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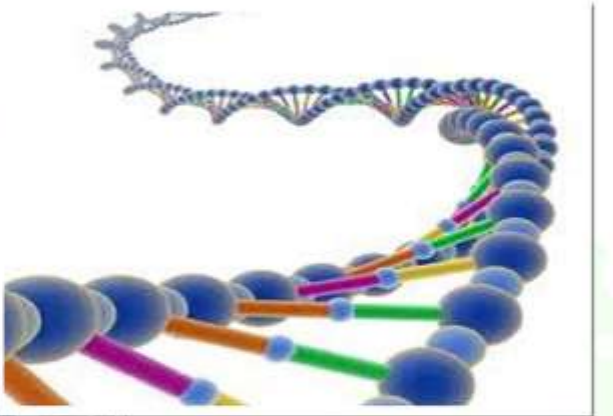

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1. Acute Rheumatic Fever among Primary School Students in Harari Region, Eastern Ethiopia

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Abstract: In many developed countries, acute rheumatic fever has been eradicated through strong health promotion and prevention activities; yet, it persists to cause serious health problems in many developing countries including Ethiopia. The main aim of this study was to assess the prevalence and factors associated with the occurrence of acute rheumatic fever among primary school students in Harari region. A cross-sectional study design was used to conduct the study on students of four primary schools during November, 2015 to March, 2016. Data were collected according to modified Jones criteria with confirmation of preceding infection by anti-streptolysin –O titre. It was analysed using SPSS. Logistic regression was used to identify the factors influencing the outcome. Odds ratios and the corresponding confidence intervals were used to identify the predictors. Out of 1739 school children, 21 were with Acute Rheumatic Fever (ARF). The mean age of students was 11.5 years (6-19 years). The two weeks prevalence of acute rheumatic fever and tonsillopharyngitis were 21/1739 (1.2%) and 231/1739 (13.2%), respectively. Regarding awareness towards causes of tonsillitis, 78% perceived consumption of cold foods and drinks. Factors associated with ARF were maternal illiteracy (AOR 5.54, 95% CI 1.07, 28.662) and urban school (AOR 0.254, 95% CI 0.084, 0.769). The prevalence of ARF among primary school children was high. School health education program focused on acute rheumatic fever and its causes and consequences are needed to increase awareness among children and their parents.

Keywords: Acute rheumatic fever; tonsillopharyngitis; School children tonsillopharyngitis; tonsillopharyngitis Ethiopia

1. Introduction

Acute rheumatic fever (ARF) is the immune-mediated sequel of an innocuous Group A streptococcal throat infection. It occurs in 0.3 – 3.0% of children between the ages of 3 and 15 who had untreated sore throat (Robertson KA, Volmink JA et al. 2005). It causes an acute, generalised inflammatory response that can affect the joints, central nervous

system and subcutaneous tissues. It is; however, the potential damage to heart that is the most concern as it can lead to permanent disability and death (Counties Manukau Health 2013).

ARF and Rheumatic Heart Disease (RHD) affect about 16 million people worldwide and leads to 250,000 deaths every year(Jonathan R and Carapetis 2007). It constitutes 25-40% of all cardiovascular disease in developing countries. More than 80% of affected children are younger than 15 years of age. These children belong to the regions of the world where RHD is endemic. Around 8 million school children require further treatment to prevent morbidity and mortality(Marijon E., Mariana Mirable et al. 2012).

There are important factors suggested for the increased prevalence and malignant course of rheumatic heart disease in sub-Saharan African nations. Factors like illiteracy, poverty, over-crowdedness are common conditions associated with the problem. As the prophylactic penicillin therapy is often inadequate, the problem got worsen (Marcus RH SP, Pocock WA et al. 2009). To identify and treat children suffering from the problem, echocardiographic screening is good method, but this is not true always in many poor countries like Ethiopia, as the device or the technicians are not existing particularly in places far from the centre (Beaton A OE, Lwabi P et al. 2012).

Addressing ARF is complex because of incomplete understanding of the disease itself in addition to the influence of upstream determinants of health (such as housing), inequitable access to primary care and limitations of health literacy among the at risk population. Further, knowledge of the current best practice for sore throat management is variable in the primary care workforce, which lead to in adequate treatment and transmission of drug resistant organisms among the vulnerable children (Counties Manukau Health 2013).

Studies showed that ARF affects mainly children between age of 6 and 15 years. Overcrowding and poor access to health care (Penm E 2008), urban residency and maternal illiteracy (Riaz BK, Selim S et al. 2013), a low level of awareness of the disease in the community(WHO 29 October - 1 November, 2001) were some of the influencing factors for the occurrence of the problem.

Few studies on children with heart diseases are available in in Ethiopia (Oli and Porteous, 1999; Oli and Asmera, 2004 ; Tadele, et al. 2013; Engel, et al. 2015; Moges , Gedlu et al. 2015; Yadeta, et al. 2016). Almost all them are on acute rheumatic fever and rheumatic heart disease while only Yadeta et.al (2016) is on Eastern Ethiopia. These studies revealed high prevalence of ARF in Addis Ababa (24.9%) (Tadele, al. 2013); asymptomatic RHD (19/1000) in six geographic regions (Yadeta, et al. 2016); high mortality rate in Gonder, Northern Ethiopia(Gunar et al. 2006); and rheumatic heart disease as a predisposing factor for infective endocarditis in Addis Ababa (Tamirat, et al. 2015). All these studies do not show the burden of acute rheumatic fever in school children. Therefore, this study is intended to fill in the research gap on the burden of acute rheumatic fever and factors associated with its occurrence among primary school children in Harari region, eastern Ethiopia.

2. Methods and Materials

Study area and design

School based cross-sectional study was conducted among primary school children (grade 1-8) in Harari region, eastern Ethiopia, from November 30, 2015 to April 29, 2016. The health service coverage is estimated to be above 100%. There are four governmenta hospitals, two private hospitals and four health centres in the town. More than half of the population in this region lives in urban places. In the year 2015/16, there were 84 primary level schools (grade 1-8) in the region among which 62 were government schools (39 rural, 23 urban), 17 were private schools, and 5 were inside religious organizations (1 in mosque and 4 inside church). All private schools were located in urban areas. In these schools, during 2015/16 academic year, there were 41,336 students (35,733 in government schools and 5,603 in private/NGO schools). The net education attendance ratio in the region was 79.8% for male and 77.6% for females (CSA 2014)

Sample size determination and sampling technique

The sample size was calculated by epi info online calculator(Ausvet 2016) using single population proportion at a precision of 1%, 95% confidence interval and p value of 0.031 While adjusting for population size and adding 10% non-response rate, the total sample size calculated was 1262.

Study participants were selected from all categories of schools; that is from government, religious and private schools; composing from urban and rural areas. Each school was randomly selected from all category and all students in the school using lottery method. These randomly selected schools were Deker Primary School (a total of 630students, Government rural), Ras Mekonin primary School (a total of 1686 students, government, urban), SOS primary school (a total of 613 students, private, urban) and Mekane Silassie Primary School (a total of 268 students, religious institution, urban).

Data collection tools

Data were collected on a-face-to-face interview using standardized questionnaire. The questionnaire has seven sections comprised of the socio-demographic characteristics of students and parents, health history and physical examination of students, parents' awareness about the disease, and environmental conditions. Students were asked about any sore throat/ tonsillopharyngitis (lesion in the tonsils and pharynges)/ experience in the preceding two weeks before data collection and confirmed by anti-streptolysin –O titre. Chest auscultation for apical pan systolic heart murmur or early diastolic murmur was conducted by trained nurses and positive cases were confirmed by internists.

Data quality control: The data collection tool was prepared in English and translated to local languages of the students (Oromiffa and Amharic). Pre-test was conducted in 5% of students in nearby school. Two-day training was given to data collectors by investigators. Close supervision was undertaken during data collection in school by supervisors (1 Paediatrics Nurse and 1 Internist) and investigators.

Statistical analysis

Data were coded, and entered in to Epi Data version 3.02 and exported to SPSS version 16 for analysis. Descriptive statistics was used to describe the frequency, mean and standard deviations. Multiple logistic regression (Bivariate and multi-variate analyses) was done to control for confounders, and odds ratios and corresponding confidence intervals were used to report the association between dependent and independent variables. P values of less than 0.05 were considered statistically significant.

Ethical considerations

Ethical clearance was obtained from Haramaya University College of Health and Medical Sciences institutional health research ethics review committee (IHRERC) and submitted to Harari region educational bureau and the schools selected selected for the study.. Letter of cooperation were written from Harari region Education bureau to respective schools. Parents, students and their class room teachers were informed about the objectives of the study risks and benefits and written and signed consent were obtained after participant information were read. After data collection, health education was given to all students and teachers to their level of understanding regarding the causes, clinical features, complications, and treatments with especial emphases on prevention according.

3. Results

Socio-demographic characteristics

Out of 1739 students, 804 male and 935 females participated with 90% response rate. The mean ages of students were 11.5 years (SD ± 2.52). The mean monthly incomes of families were 2,317 Ethiopian Birr (103.9 USD). Ethnicity of Oromo, Amhara, Adere constitute 36%, 35.8% and 3.8 of study participants, respectively. The mean and median family size was 5.6 and 5 respectively with 42.8% of households have more than 5 household members. The mean, median and mode of people per bedroom were 1.6, 1.0 and 1.0, respectively.

Table 1. Socio-demographic characteristics of parents of study participants, Harari, Ethiopia, 2015/16.

Variable s	Frequency	Percentage
Maternal education		
No education	542	31.2
Primary education (grade 1-8)	385	22.1
Secondary education and above	812	46.7
Total	1739	100%
Paternal education		
No education	374	21.5

Primary education (1-8)	290	16.7
Secondary education and above	1,075	61.8
Total	1739	100%
Maternal occupation		
House Wife	349	20
Civil servant	402	23.1
Merchant/Non-governmental Organization	486	28
Daily Labourers	155	8.9
Others	347	20
Total	1739	100%
Paternal occupation		
Unemployed	50	2.9
Civil servant	482	27.7
Merchant/Non-governmental Organization	467	26.9
Daily Labourers	153	8.8
Others	587	33.7
Total	1739	100.0

Household environment

Water supply was not adequate for domestic consumption in 677 (39%) of households. Regarding place of cooking, 614 and 840 households used main house and separate kitchen, respectively.

Table 2. Household environment of study participants in Harar, Ethiopia 2015/16.

Characteristics		Frequency	Percentage
Source of drinking water	Piped to yard	1537	88.3
	Public tap	131	7.5
	Protected well	60	3.5
	Surface water	6	0.4
	Unprotected spring	5	0.3
Household solid waste disposal	Collected by the Municipality	1534	88.2
	Garbage pit	196	11.3
	Burn	9	0.5

The 2 week prevalence of tonsillopharyngitis among school children was 231 (13.2%). According to Modified Jones criteria, 4 students had both chest pain plus migratory poly arthritis, 1 student had migratory poly arthritis plus subcutaneous nodules, 2 students had migratory poly arthritis plus Sydenham's chorea. On the other hand, 3 students were with both chest pain plus Sydenham's chorea, 2 were with both chest pain plus erythema marginatum, 3 were with chest pain plus subcutaneous nodules. Regarding minor

criteria's, 3 students had chest pain plus fever plus joint swelling, 2 students had Sydenham's chorea plus fever plus joint swelling, and 1 student had subcutaneous nodule plus fever plus joint swelling. The prevalence of ARF was 21/1739 (1.2% or 12/1000) for primary school children.

Knowledge about tonillopharyngitis and ARF

Awareness towards cause of tonsillopharyngitis was low as 180 (77.9%) of participants perceived that the cause was consumption of cold foods and drinks. Only 51 (22%) of them answered that the causes of tonsillopharyngitis was infection by bacteria and viruses. Treatment seeking of modern medications from health institutions for tonsillopharyngitis by parents was 226/ 231 (97.84%). Harmful traditional practice of tonsillectomy was practiced by 5/231(2.16%) parents.

Table: 3. Students suffering from tonsilliopharynities, treatment seeking behaviour and knowledge of parents in Harari region, Ethiopia, 2015/16.

Characteristics		Frequency	Percentage
Suffering from Tonsillopharyngitis	Yes	231	13.28
	No	1508	86.72
Treatment seeking for the problem	Modern Medication	226	97.84
	Tonsillectomy	5	2.16
Causes of Tonsillopharyngitis	Cold foods and drinks	180	77.9
	Infections	51	22.1
Tonsillopharyngitis and ARF/RHD are associated	Yes	8	3.46
	No	223	96.54

Factors associated with occurrence of acute rheumatic fever

Maternal illiteracy has significantly associated with ARF (AOR 5.54, 95% CI 1.07 to 28.662). Whereas being in urban school found to be protective from ARF (AOR 0.254, 95% CI 0.084 to 0.769). In this study, overcrowding at home and school, monthly income, father's education and occupation, other environmental and nutritional variables were not associated with ARF**.**

Table 4. Factors associated with ARF among primary school students of Harari region, 2015/16.

Characteristics		Acute Rheumatic Fever		COR	AOR
		Yes	No	(95% CI)	(95% CI)
Sex	Male	9	795	1.023 (0.4, 2.5)	0.9 (0.4, 2.4)
	Female	12	923	1	1
Residence	Urban	10	1326	0.2 (0.1, 0.6)*	0.254 (0.1, 0.8)*
	Rural	11	413	1	1
Maternal education	No education	12	530	9.2(2.1, 41.3)*	5.5 (1.1, 28.7)*
	Primary	5	380	1.7(0.6, 4.8)	4.0 (0.7, 22.7)

	Secondary +	4	808	1	1
Family size	Less or equal to 5	13	1005	1.0(0.4, 2.4)	1.9 (0.7, 5.4)
	Greater than 5	8	734	1	1
Number of person/bed room	Less or equal to 2	15	1366	0.67 (0.2, 2.9)	0.9 (0.2, 4.2)
	Greater than 2	6	373	1	1
Family monthly income	Less or to 1000	12	969	0.6(0.1, 4.6)	0.6 (0.1, 5.1)
	1001-5000	7	614	0.6(0.1, 5.3)	0.9 (0.1, 7.3)
	5001 +	2	156	1	1

**significant at p-value <0.05.*

4. Discussion

The 2 week prevalence of tonsillopharyngitis among school children in Harari region was 13.2%. This is higher than the prevalence of hyperplasia of tonsils among school children of 11% in Denizli, Turkey(Cüneyt Orhan, Hacer Ergin et al. 2002), 7.65% in Guntur(Phani Madhavi KV and Anil Kumar B 2013). In this study, many of students were unaware of tonsillopharyngitis causes rheumatic fever and this is similar with a qualitative study done in pacific people in Auckland in which most didn't realize the significance of a sore throat(Naea, Dobson et al. 2016).

The prevalence of ARF was 1.2% or 12/1000 among school children. This is lower than studies conducted in Jimma 31/1000(Engel, et al. 2015), Peru 19.7/1000 (Spitzer, et al. 2015) and country wide study in Ethiopia 19/1000 (Yadeta, et al. 2016). To the contrary, the prevalence of ARF in the study area was higher than that of 0.87/1000 children in Indian(Ragini and Rana 2013), 0.6/1000 in Bangladesh (Zaman, al. 2015), 99/10,000 by 2012 and 114/10,000 cases in 2013 in New Caledonian (Corsenac, et al. 2016) and 1 (0.37%) had a clinical history compatible with the diagnosis of acute rheumatic fever (ARF) in Belo Horizonte (Miranda, Camargos et al. 2014). This variation may be due to epidemiological variation of diseases in poor and better of countries. This study clearly indicates that acute rheumatic fever is still a problem in poor socioeconomic societies.

Being from urban school was found to be protective of ARF. This is similar with the findings of 4.42/1000 in rural verses and 0.88/1000 in urban school children in Shimla, north India(Prakash Chand Negi, Anubhav Kanwar et al. 2013). But, it contradicts with the findings of Bangladesh in which urban residence was associated with ARF(Riaz BK, Selim S et al. 2013). On the other hand a study in Sichuan province of China revealed that there is no association between residence and ARF (Chen X, Zhang M et al. 2003). These studies show that residence alone is not a driving factor for ARF, rather complex contextual factors comes into play in the occurrence of the problem. The disease can occur anywhere people lives unless tonsillopharyngitis is not managed promptly with appropriate antibiotics.

In this study, maternal illiteracy is found to be associated with the occurrence of ARF. This is similar with a case-control study in Bangladesh (Riaz BK, et al. 2013). Children's

wellbeing is highly associated with maternal education and wealth status. As the mother is better off, the possibility of getting good nutrition and proper hygiene and care during health and sickness is maintained. As the mothers are able to read and understand, they are motivated to know much about their children and seek medical care at times of sickness.

5. Conclusion and Recommendations

The prevalence of both tonsillopharyngitis and ARF was high in the study area. But awareness of parents and children towards the cause of disease were low. This needs appropriate response from concerned bodies in order to prevent serious complication of ARF (rheumatic heart disease). School based health education focusing on causes and prevention of rheumatic fever and rheumatic heart disease should be emphasized.

6. Authors' Contribution

All authors contributed their part during proposal writing, training of data collectors, data collection supervision, quality assurance, data analysis and manuscript preparations.

7. Acknowledgement

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2. Epidemiological Assessment of Mental Health Problems and Its Contributing Factors among Public University Students of Eastern Ethiopia

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Abstract: One of the primary concerns in younger populations is that mental health problems may affect human capital accumulation in particular; the amount and productivity of schooling which may in turn have lifelong consequences for employment, income, and other outcomes. Yet little is known about the mental health problem burden among university students. The aim of the study was to epidemiologically assess the mental health problems and its contributing factors among public university students of eastern Ethiopia from December 01, 2015 to February 28, 2016. A cross sectional study was conducted among the three public university students in Eastern Ethiopia (namely Haramaya, Jigjiga and Dire Dawa University). The data was collected by using patient health questionnaire (PHQ9), general anxiety (GAD-7) data collection tools and questions (about substance use, clinical, psychosocial and socio-demographic factors) prepared from reviewing important literatures. A Multistage sampling technique was employed. Ordinal logistic regression analysis was done to determine the contributing factors of mental health problems. A total of 1438 students were included in this study with an 89.9% response rate. About 57.72% of the students had anxiety disorder. More than 46% thought that they would be better off dead or hurting themselves. About 66.76% of the students had depression. Level of study year, average monthly income, presence of died relatives, financial crisis, conflict with loved ones, religious practice, presence of love partner, worry about safety in campus, previous history of depression, and family history of mental illness were among the contributing factors of anxiety disorder that showed statistically significant association from the ordinal logistic regression model. Age group, former residents, average monthly income, suffered serious illness/injury, problem with police/courts, religious practice, presence of love partner, worry about safety in campus, current khat chewing, previous history of anxiety disorder, previous history of depression, and family history of mental illness were among the contributing factors for depression. Furthermore, it was found that the students' academic

performance/achievement can be affected by the increasing level of anxiety and depression that showed statistically significant association from the ordinal logistic regression model. Anxiety disorder and depression among the public university students is significantly at a higher level, which indicated higher level of mental health problems. The Ministry of Education, University community, and concerned bodies therefore, should give more focus for students' mental health problem to minimize its highest level and by critically considering the identified contributing factors, while designing intervention strategies to minimize the mental health problem level.

Keywords: Mental Health Problem; Depression; General Anxiety Disorder; University, Eastern Ethiopia

1. Introduction

"Mental illness" refers to the collection of all diagnosable mental disorders causing severe disturbances in thinking, feeling, relating, and functional behaviors. It can result in a substantially diminished capacity to cope with the demands of daily life (Souma A., *et.al*, 2012).

A mental illness is a hidden disability; it is rarely apparent to others. However, students with mental illness may experience symptoms that interfere with their educational goals and that create a "psychiatric disability." These symptoms may include, yet are not limited to: heightened anxieties, fears, suspicions, or blaming others, marked personality change over time, confused or disorganized thinking; strange or grandiose ideas, difficulty concentrating, making decisions, or remembering things, extreme highs or lows in mood, denial of obvious problems and a strong resistance to offers of help, thinking or talking about suicide (Souma A., *et.al*, 2012).

About14% of the global burden of disease has been attributed to neuropsychiatric disorders, mostly due to the chronically disabling nature of depression and other common mental disorders (like anxiety disorders; depression), alcohol use and substance use disorders, and psychoses. Based on a report from world health organization (WHO), by 2020, mental disorder will account for nearly 15% of disability adjusted life-years lost to illness (WHA 65.4, 2012). Mental illness is common; with approximately 450 million people are affected globally. Depression is a significant contributor to the global burden of disease and affects people in all communities across the world. Today, depression is estimated to affect 350 million people (AAMH, 2008; WHO, 2012).

According to the WHO, unipolar depressive disorders were ranked as the third leading cause of the global burden of disease since 2004 will be the second in 2020(4) and will move into the first place by 2030 (AAMH, 2008; WHO, 2012). It is gradually becoming recognized that mental disorders are a public health problem throughout the world (Desjaralais R., *et.al*, 2015). In order to institute policies and strategies to control mental disorders, their prevalence must be determined (Pinheiro KA., *et.al*, 2015)

Mental health is an important part of health contributing to the overall well-being of individuals, societies and countries. Recent advances have shown that like many physical illnesses, mental and behavioral disorders are the results of complex interaction between biological, psychological, and social factors (WHO, 2001). In a study done among adolescents (age15-18 years) in urban area of Pelotas, Brazil, prevalence of mental disorder was found to be 28.8 % (Vera Lucia Dutra Facundes and Ana Bernarda Ludermir, 2005).

In Ethiopia, mental disorder is the leading non-communicable disorder in terms of burden. The average prevalence of common mental disorders in Ethiopia is 15% for adults and 11% for children. Among every five persons, one is affected by a mental disorders at some stage of his or her life (FMOH, 2012; Appunni Sathiyasusuman, 2011). Studies in our country on mental health are few and those few showed a high prevalence of mental distress in the areas they were conducted. The prevalence of mental disorders was shown to be 17% in the adult population of Butajira, South Ethiopia in 1999 while it was shown to be 11.7% in Addis Ababa in 1994 (Alem A., *et.al*, 1999; Kebede D., *et.al,* 1999).

Mental health problems are highly prevalent among college students, according to several data sources. In 2008, an American study showed that, more than one in three undergraduates reported that they were "feeling so depressed and was difficult to function" at least once per a year, and nearly one in 10 reported "seriously considering attempting suicide" (ACHA, 2008).

A Study done in Jamaica in 2009 showed that 40% of students had depression (Lowe GA., *et.al*, 2009). In another study done in 2010 among medical students of Wah Medical College in Pakistan showed that anxiety was present in 133 (47.7%) students and depression in 98 (35.1%) students (Alvi T., *et.al*, 2010). A Study done in Hawassa university students in 2009 showed that 49% of the university students had common mental disorder (Tesfaye A., 2009). Study done in 2005 among medical students of Addis Ababa showed that the prevalence of common mental disorders was 32% and over 6.0% reported that they had suicidal ideation (Alem A., *et.al*, 2005).

College students have difficulty adapting to college life, competing, and handling their new-found freedom with minimal adult supervision. As they transit from high school to college, anxiety increases as they leave behind the support of family, friends, and familiar surroundings which may place them at risk for academic, personal, and social difficulties. Moreover, some studies suggest that adolescent drinking and suicide ideation are associated with stress that transitions in relationships may be related to mental health issues that develop in young adulthood and that mood and substance disorders are linked to relationship stability and change (Hernandez NE., 2006). Depression and anxiety disorders are the two most common types of mental disorders among adolescents and young adults and significant predictor of lower GPA and higher probability of dropping out, and poor academic performance (Daniel Eisenberg, *et.al*, 2009; Afolayan JA., *et.al*, 2013). So, this study had focused on these disorders which affect the academic performances of students in different ways as described below.

Depression, anxiety, could plausibly affect non- cognitive factors, in addition to having direct effects on cognitive ability. Specifically, a number of depressive symptoms may affect the productivity of time in academic activities and/or the amount of time dedicated to academic activities. These symptoms include reduced interest or pleasure in usual activities (anhedonia), sleep disturbances (less or more than normal), reduced energy, difficulty concentrating or making decisions, restlessness or slowing of movement, and suicidal thoughts (which may impair concentration or decrease interest in investing in the future) (Kaplan HI. and Sadock BJ., 2010).

In addition, negative affect (feeling sad or hopeless) may decrease interest in the future. A common anxiety disorder, generalized anxiety, is marked by excessive worrying and difficulty controlling this worrying. At lower levels anxiety can actually be productive, but at higher levels it often impairs concentration and the ability to remain on task (Kaplan HI. and Sadock BJ., 2010).

Generalized anxiety shares many symptoms of depression (e.g., reduced energy, sleep disturbance, and reduced concentration) and therefore could affect academic outcomes for many of the same reasons that depression would. Furthermore, anxiety is associated with poor attainment in school, problems forming relationships and low socio-economic status (Russell G and Shaw, 2006).

The roles of depression, anxiety disorders in college are particularly important to examine, as the incidence of these conditions during late adolescence and young adulthood greatly exceeds that of most other mental disorders. Mental disorders frequently have first onset shortly before or during the typical college age range (18-24) (Kessler, R. C., *et.al,* 2005), yet relatively little is known about the prevalence of mental health problems and its contributing factors among university students. Therefore, the main aim of this study is to make the epidemiological assessment of the mental health problems and show its contributing factors among public university students of eastern Ethiopia (Haramaya, Dire Dawa and Jigjiga University)

2. Methods

Study Design and Setting

To meet the desired objectives, a quantitative cross-sectional study was employed. The study was conducted among students of three public universities found in Eastern Ethiopia (Namely: Haramaya University, Jigjiga University and Dire Dawa University) from December 01, 2015 to February 28, 2016. All of these public universities accommodate large number of students in different colleges/departments for about the last 10 or more years. The overall data was collected by a self-administered questionnaire prepared after reviewing important literatures and adapting the Patient Health Questionnaire-9 (PHQ-9) and General Anxiety Disorder 7 (GAD-7) study tools.

Study participants

All regular undergraduate students enrolled and continuing their education in the three public Universities on the data collection time were the source population for this study.

All full-time undergraduate students who were attending their regular education at the time of data collection were included in this study. Those departments with only first and second year students were excluded from the study. Those students who were blind (not able to see) and who were critically sick (to the extent of unable to read and write) and an already diagnosed psychiatric patient during the data collection days were excluded from the study.

Sample size determination and sampling procedures

In order to determine the number of students to be included in the study, the single population formula was used. The researchers had taken a prevalence of 49.1 % mental distress among regular students of Hawassa University, from study done on prevalence and correlates of mental distress among regular undergraduate students of Hawassa University (Tesfaye, A. 2009). This study had assumed 49.1% prevalence to obtain the maximum sample size at 95 % certainty and a maximum discrepancy of $\pm$ 3 % between the sample and the underlying population. A design effect of 1.5 was used and an additional 10 % was added to the sample size as a contingency for non-response, to increase the power. Based on the aforementioned assumptions the overall sample size was found to be 1760. A multi stage sampling procedure was employed to select a fair representative sample of students from the three Universities. First the sample size was allocated proportionally to the three universities. Then from each university two colleges were selected by simple random sampling (lottery method) by name out of the total which fulfills the inclusion criteria. The sample size was distributed proportionally to each selected college based on the student population. From each college three departments were selected randomly. The proportionally distributed sample size in each college was then distributed proportionally to the selected respective departments. Then again from each department the sample size was proportionally allocated to each class year. From each class year students were then selected by simple random sampling from the student attendance list.

Study Variables

Dependent variable

Depression, General Anxiety Disorder

Independent variable

1. Psychosocial (Religious practice, negative stressful live events, witnessing parental violence, having loving friend/have love partner, worry about their safety in the campus, conflicts with fellow students in issues of religion and race around their dormitories, engaging in sexual practice),
2. Clinical (Previous history of depression/anxiety (general anxiety disorder and social anxiety disorder), family history of depression/anxiety (general anxiety disorder and social anxiety disorder) and having general medical conditions),
3. Substance use (current substance use or ever substance use like chat, alcohol, cigarette, shisha and other related substances),

4. Socio-demographic variables (Age, sex, religion, ethnicity, marital status, college/department, class year, monthly income).

Data sources/measurement

For the purpose of data collection, a self-administered questionnaire was developed by reviewing important literatures and adapting the Patient Health Questionnaire-9 (PHQ-9) and General Anxiety Disorder 7 (GAD-7) study tools. Data regarding all the variables were collected through administering a questionnaire to be filled/completed by the students. The investigators were responsible for coordinating the assessment and identify members who will be involved in completing the instrument. The data collectors were responsible in assisting the questionnaire filling by using their professional experience. The aim of the study was cleared to the subjects.

To minimize bias and ensure quality training of data collectors were held. A pretest was conducted in order to ensure the quality of the tools/instruments. The investigators checked the collected data in order to maintain its accuracy, completeness, clarity and consistency on daily basis. Any error, related to clarity, ambiguity, incompleteness, or misunderstanding were solved on the following day before beginning data collection activities. To make the subjects respond freely, in minimizing Hawthorne effect, the data collection process was conducted confidentially and the duration of data collection was as short as possible. The overall data collection process were coordinated and supervised by the investigators.

Data processing and analysis

The collected data were coded and entered into a computer using EPIDATA statistical packages, and then 10% of the responses were randomly selected and checked for the consistency of data entry. Frequencies were then determined and printed to check outliers and to clean the data. Data were cleaned accordingly and then it was exported to STATA version 12 for further analysis. The frequency distribution of dependent and independent variables was computed. To ascertain the association between dependent and independent variables, bivariate analysis was used to calculate the crude odds ratio (OR) and a 95% confidence interval (CI). For all statistical significance tests, the cut of value set was $p<0.05$ as this is considered statistically reliable for analysis of this study. Multiple variable analyses were employed by fitting the ordinal logistic regression.

Ethical Considerations

Ethical approval and clearance was obtained from the Haramaya University, College of Health and Medical Science IHRERC (Institutional Health Research Ethics Review Committee). Official communications were made with the concerned institutions in addition to personal communications by the investigators. To collect data from participants, explanations were given on the purpose of the study, the importance of their participation and true response. It was also explained that the study had no connection with individual affairs of respondents. In addition, participant information

sheet and informed consent form was prepared for each participant. Confidentiality of all data collected was kept. All sample populations were encouraged to participate in the study while at the same time they were informed that they have the right not to participate.

3. Results

Socio-demographic Characteristics

A total of 1438 students were included in this study with an 89.9% response rate. Most of the students age range between 20 to 23 years (76.77%) and single (97.22%). Concerning religion, about 39.36% and 34.70% of the students were Muslim and Orthodox Christian, respectively. About 58.69% of the respondents were from former urban residence. About 624 (43.39%) of the students have a monthly average income ranging from 100 to 300 Ethiopian birr (Table 1).

Table 1. Characteristics of public University students of Eastern Ethiopia, 2017.

Characteristics	Number (un-weighted)	% (Weighted)
Age Group		
16 – 19	161	11.20
20 – 23	1104	76.77
24 – 27	163	11.34
28 – 30	10	0.70
Marital Status		
Single	1398	97.22
Married	35	2.43
Divorced	5	0.35
Religion		
Muslim	566	39.36
Orthodox	499	34.70
Protestant	267	18.57
Waqefeta	50	3.48
Catholic	33	2.29
No religion	23	1.60
Study year level		
1	348	24.20
2	344	23.92
3	609	42.35
4	109	7.58
5	28	1.95
Former residence		
Urban	844	58.69
Rural	594	41.31
Average monthly income (Ethiopian birr)		
No income	121	8.41
1 – 300	624	43.39
301 – 600	462	32.13

601 – 900	86	5.98
901+	145	10.08
Departments		
Chemistry	205	14.26
Biology	185	12.87
Nursing	154	10.71
Accounting	129	8.97
Mathematics	117	8.14
Veterinary	113	7.86
Midwifery	111	7.72
Management	84	5.84
Environmental Health	82	5.70
Economics	81	5.63
Logistics	71	4.94
Psychiatry	59	4.10
Physics	47	3.27
Current CGPA		
2.00 – 2.50	345	23.99
2.51 – 2.99	458	31.85
3.00 – 3.50	522	36.30
3.51 – 4.00	113	7.86

Psycho-Social Factors of Mental Health Problems

About 80.18% of the students had not suffered from any injury while 81.15% responded that their close relatives had not suffered from injury. About 8.62% of the respondents lost their loved ones while 18.08% lost their close family member. About 28.37% faced serious financial crisis while 21.42% reported for losing anything important. About 19.12% broken off steady relationship and 22.95% reported to have serious problem with close friends, neighbor or relative. About 16.55% reported to have problem with policeman or courts and 43.05% reported to have religious practice always. More than half (57.02%) of the students worry about their safety in campus and 16.62% reported to get engaged in sexual practice (Table 2).

Table 2. Psycho-social factors of mental health problems among public University students of Eastern Ethiopia, 2017.

Variables	Number (un-weighted)	% (Weighted)
Suffered injury		
Yes	285	19.82
No	1153	80.18
Close relative suffered injury		
Yes	271	18.85
No	1167	81.15
Lost loved ones		
Yes	124	8.62
No	1314	91.38
Lost close family member		

Yes	260	18.08
No	1178	81.92
Faced financial crisis		
Yes	408	28.37
No	1030	71.63
Lost anything important		
Yes	308	21.42
No	1130	78.58
Separated due to marital difficulties		
Yes	163	11.34
No	1275	88.66
Broken off steady relationship		
Yes	275	19.12
No	1163	80.88
Had serious problem with close friend, neighbor or relative		
Yes	330	22.95
No	1108	77.05
Had serious problem with instructor		
Yes	213	14.81
No	1225	85.19
Any violence against		
Yes	198	13.77
No	1240	86.23
Any problem with police or courts		
Yes	238	16.55
No	1200	83.45
Had religious practice		
Yes Sometimes	584	40.61
Always	619	43.05
No	235	16.34
Had love partner		
Yes	855	59.46
No	583	40.54
Worry about safety in campus		
Yes	820	57.02
No	618	42.98
Conflict with students in the issue of race		
Yes	225	15.65
No	1213	84.35
Engaged in sexual practice		
Yes	239	16.62
No	1199	83.38

Around 48.89% of the students reported not to have nervous, anxious or on edge feelings. Around 45.13% reported for being able to stop or control worrying while 10.29% worry everyday too much about different things. More than 55% feel afraid as if something awful might happen (Table 3).

Table 3. Responses to questions showing level of general anxiety disorder among public Universities students of Eastern Ethiopia, 2017

Over the last two weeks how often have you been bothered by the following problem:	Not at all		Several days		More than half the days		Every day	
	N	%	N	%	N	%	N	%
Feeling nervous, anxious or on edge	703	48.89	416	28.93	259	18.01	60	4.17
Not being able to stop or control worrying	649	45.13	415	28.86	249	17.32	125	8.69
Worrying too much about different things	591	41.10	399	27.75	300	20.86	148	10.29
Trouble relaxing	578	40.19	410	28.51	299	20.79	151	10.50
Being so restless that is hard to sit still	666	46.31	343	23.85	293	20.38	136	9.46
Become easily annoyed or irritable	710	49.37	342	23.78	315	21.91	71	4.94
Feeling afraid as if something awful might happen	641	44.58	367	25.52	294	20.45	136	9.46

About 650 (45.20%) of the students reported that GAD related problems made it difficult for them to accomplish tasks or get along with other people (Figure 1).

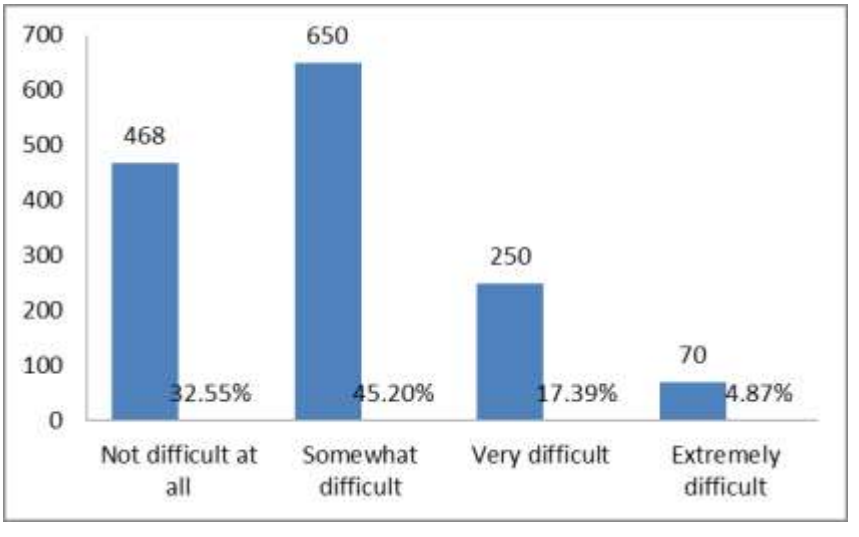

Figure1. Response about how difficult have the GAD related problems made it accomplish tasks or get along with other people among the students of public Universities of Eastern Ethiopia, 2017.

The study found out that about 57.72% of the students had anxiety disorder (Figure 2).

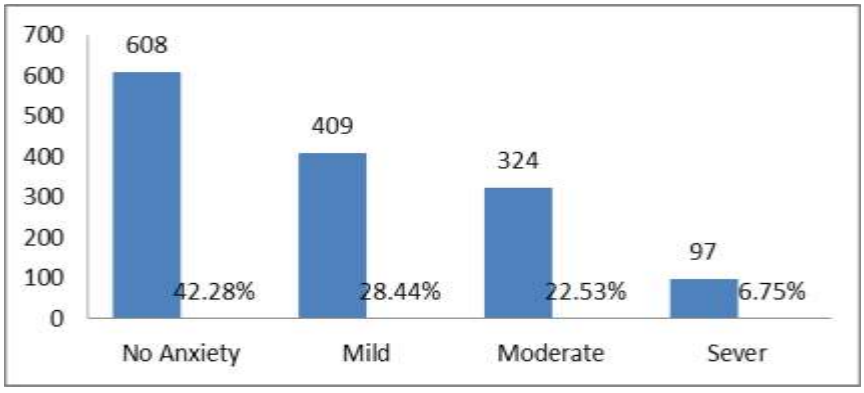

Figure 2. Level of anxiety disorder among the students of public Universities of Eastern Ethiopia, 2017.

Level of general anxiety disorder

More than 62% of the students had little interest or pleasure in doing things and more than half have a down, depressed or hopeless feelings. More than 60% had trouble of failing or staying asleep or sleeping too much. More than 48% had bad feeling about themselves or that they were a failure or have let themselves or their family down. More than 46% thought that they would be better off dead or hurting themselves (Table 4).

Table 4. Responses to questions showing level of general anxiety disorder among public Universities students of Eastern Ethiopia, 2017.

Over the last two weeks how often have you been bothered by any of the following problems:	Not at all		Several days		More than half the days		Every day	
	N	%	N	%	N	%	N	%
Little interest or pleasure in doing things	533	37.07	377	26.22	371	25.80	157	10.92
Feeling down, depressed ,or hopeless	703	48.89	347	24.13	266	18.50	122	8.48
Trouble failing or staying asleep or sleeping too much	573	39.85	304	21.14	365	25.38	196	13.63
Feeling tired or having little energy	500	34.77	414	28.79	346	24.06	178	12.38
Poor appetite or over eating	699	48.61	315	21.91	265	18.43	159	11.06
Feeling bad about yourself or that you are a failure or have let yourself or your family down	741	51.53	255	17.73	302	21.00	140	9.74
Trouble concentrating on things as reading the newspaper or watching television	682	47.43	314	21.84	329	22.88	113	7.86
Moving or speaking so slowly that other people could have noticed or the opposite being so fidgety or restless that you	654	45.48	374	26.01	279	19.40	131	9.11

have been moving around a lot more than usual								
Thought that you would be better off dead or hurting yourself	765	53.20	285	19.82	269	18.71	119	8.28

About 529 (36.79%) of the students reported that depression related problems made it made it difficult for them to accomplish tasks or get along with other people (Figure 3).

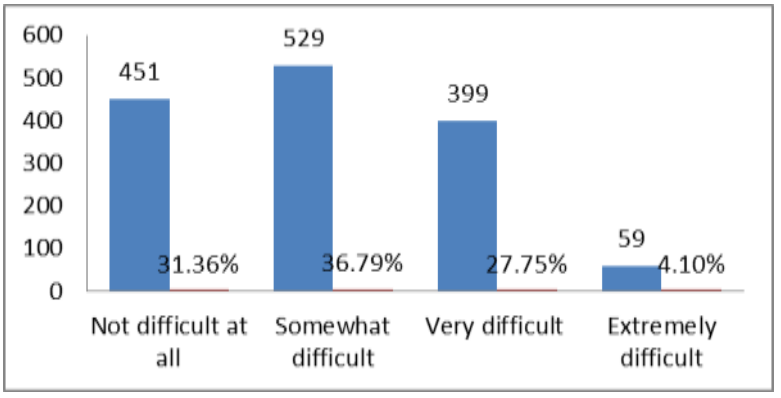

Figure 3. Response about how difficult have the depression related problems made it accomplish tasks or get along with other people among the students of public Universities of Eastern Ethiopia, 2017.

Level of depression

About 66.76% of the students had depression (Figure 4).

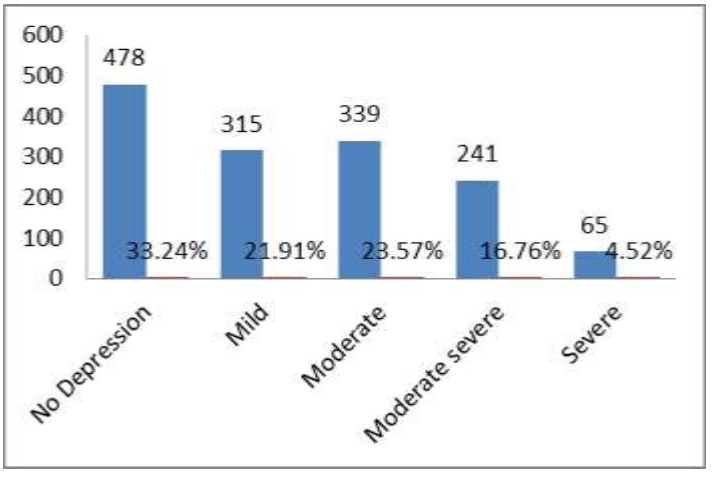

Figure 4. Level of depression among the students of public Universities of Eastern Ethiopia, 2017.

About 33.10% students reported for having functional impairments related with reported anxiety disorder and depression and 40.47% used to miss their classes. From those effects, about 26.63% and 17.73% students used to miss exam and drop courses, respectively. Additionally, 43.39% and 40.40% reported to score low grade and made to be less than others, respectively (Table 5).

Table 5. Response related with effects of anxiety disorder and depression among public University students of Eastern Ethiopia, 2017.

Variables	Number (un-weighted)	% (Weighted)
Functional impairments		
Yes	476	33.10
No	962	66.90
Class missing		
Yes	582	40.47
No	856	59.53
Exam missing		
Yes	383	26.63
No	1055	73.37
Course dropping/academic withdrawal		
Yes	255	17.73
No	1183	82.27
Repeat Class		
Yes	316	21.97
No	1122	78.03
Absent from group work participation		
Yes	471	32.75
No	967	67.25
Scoring low grade		
Yes	624	43.39
No	814	56.61
Perception of being less than others		
Yes	581	40.40
No	857	59.60

Substance use of students

Regarding substance use, about 36.51% students were ever user of the psycho active substances. About 24.13% students were current khat users (Table 6).

Table 6. Response related substance use among public University students of Eastern Ethiopia, 2017.

Variables	Number (un-weighted)	% (Weighted)
Ever used psycho active substances		
Yes	525	36.51
No	913	63.49

Current Khat users		
Yes	347	24.13
No	1091	75.87

About 347 and 117 students reported to use Khat and alcohol, respectively (Figure 5).

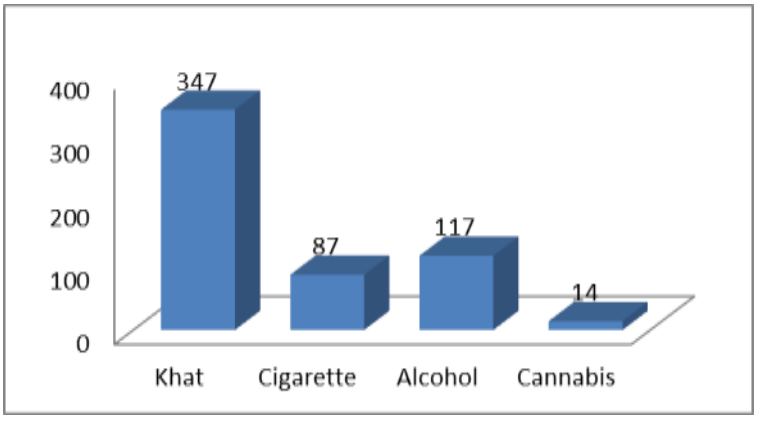

Figure 5. Response about types of substance used among the students of public Universities of Eastern Ethiopia, 2017.

About 242 and 172 students reported to increase performance and to get relief from tension as a reason of substance use, respectively (Figure 6).

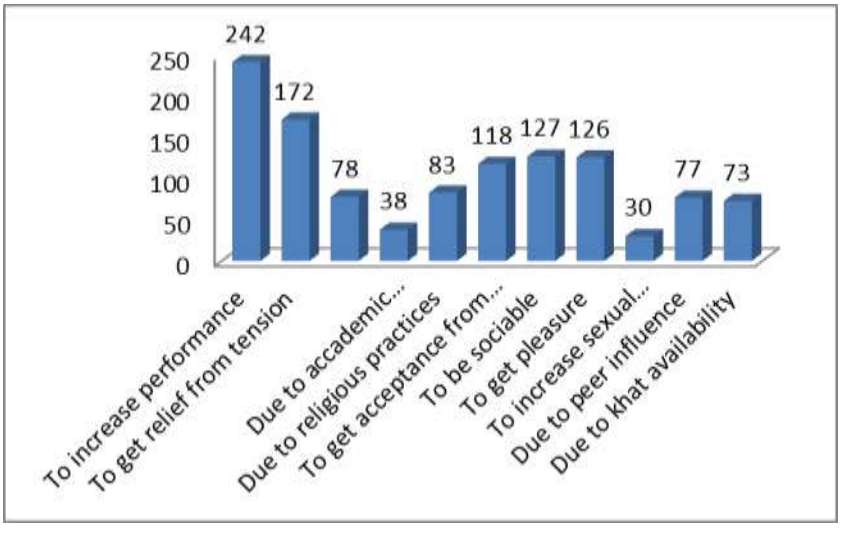

Figure 6. Response about perceived reasons to use substances among the students of public Universities of Eastern Ethiopia, 2017.

History of mental health problems

About 17.45% and 21.49% of the students reported a previous history of anxiety disorder and depression, respectively (Table 7).

Table 7. Response about previous history of mental health problems among public University students of Eastern Ethiopia, 2017.

Variables	Number (un-weighted)	% (Weighted)
Previous history of anxiety disorder		
Yes	251	17.45
No	1187	82.55
Previous history of depression		
Yes	309	21.49
No	1129	78.51
Comorbid general medical medication		
Yes	139	9.67
No	1299	90.33

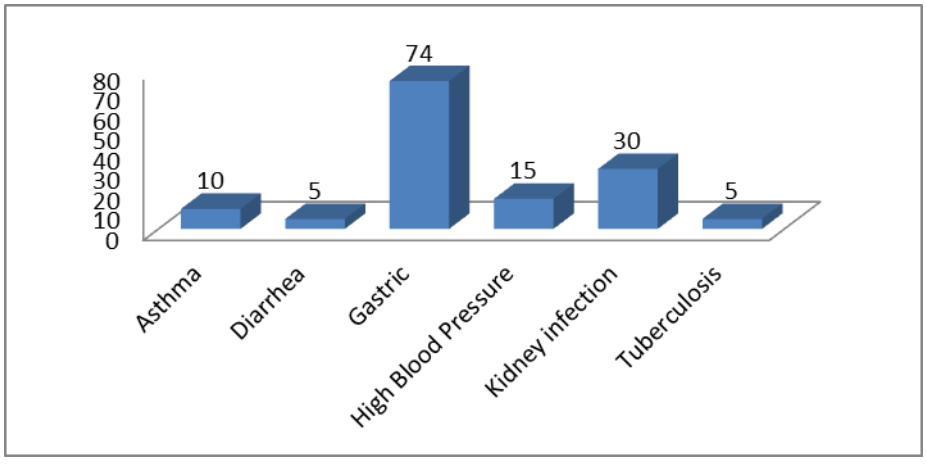

Figure 7. Response about comorbid general medical condition among the students of public Universities of Eastern Ethiopia, 2017.

Family history of mental health problems

About 18.01% and 15.79% had family history of anxiety disorder and depression, respectively (Table 8).

Table 8. Response about family history of mental health problems among public University students of Eastern Ethiopia, 2017.

Variables	Number (un-weighted)	% (Weighted)
Family history of anxiety disorder		
Yes	259	18.01
No	1179	81.99
Family history of depression		

Yes	227	15.79
No	1211	84.21
Family history of mental illness		
Yes	218	15.16
No	1220	84.84

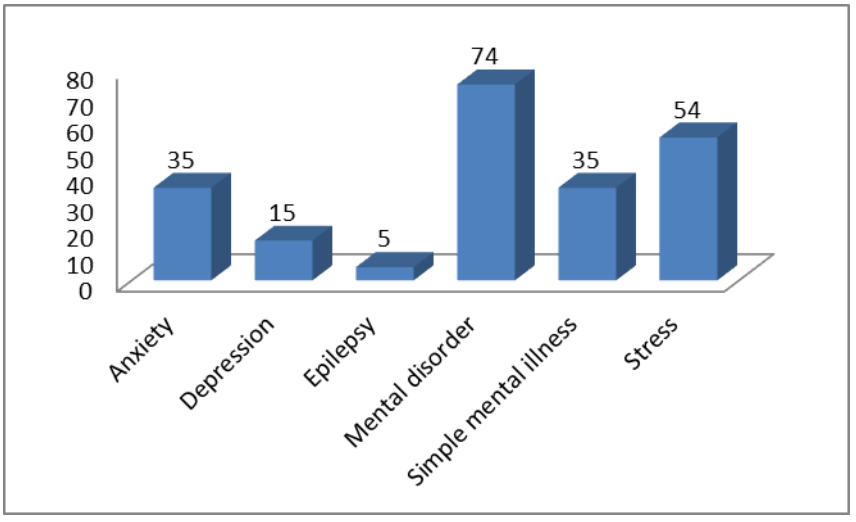

Figure 8. Response about family history of mental illness among the students of public Universities of Eastern Ethiopia, 2017.

Factors Associated with Mental Health Problems

Ordinal logistic regression analysis for anxiety disorder

An ordered logistic regression model analysis was performed to explore the relations between the predictor variables with the anxiety disorder while simultaneously adjusting for all other variables included in the model.

The regression analysis showed, while keeping the other predictor variables constant, for being second year student, the odds of sever anxiety disorder versus the combined from moderate to none are 1.5 times more than first year students.

In keeping the other predictor variables in the model constant, for having an average monthly income of Ethiopian birr 001 to 300, 301 to 600, and 601 to 900, the odds of sever anxiety disorder versus the combined from moderate to none are 0.61, 0.53 and 0.22 times lower than those with no income, respectively. While keeping the other predictor variables in the model constant, for not having died spouse, parent or child in the last 6 months, the odds of sever anxiety disorder versus the combined from moderate to none are 0.50 times lower that those with died spouse, parent or child. For not having major financial crisis in the last 6 months, the odds of sever anxiety disorder versus the combined from moderate to none are 0.57 times lower than those had major financial crisis, given the other variables are held constant in the model. While keeping the other predictor variables in the model constant, for not having serious problem with close friend, neighbor or relative in the last 6 months, the odds of sever anxiety disorder

versus the combined from moderate to none are 0.47 times lower that those with serious problem with close friend, neighbor or relative.

While keeping the other predictor variables in the model constant, for no religion practicing, the odds of sever anxiety disorder versus the combined from moderate to none are 1.70 times higher than those practicing religion.

While keeping the other predictor variables in the model constant, for not having love partner, the odds of severe anxiety disorder versus the combined from moderate to none are 0.70 times lower that those who had love partner. For not worried about safety in campus, the odds of severe anxiety disorder versus the combined from moderate to none are 0.75 times lower than those worried about safety in campus, given the other variables are held constant in the model.

While keeping the other predictor variables in the model constant, for not having previous history of depression, the odds of sever anxiety disorder versus the combined from moderate to none are 0.48 times lower than those who had previous history of depression. While keeping the other predictor variables in the model constant, for not having family history of mental illness, the odds of sever anxiety disorder versus the combined from moderate to none are 0.43 times lower than those who had family history of mental illness (Table 9).

Table 9. Predictors of anxiety disorder among the students of public Universities of Eastern Ethiopia, 2017.

Variables	OR	P-value	95% Confidence Interval	
Level of study year				
First	1.00			
Second	1.50	0.007	1.12	2.01
Third	1.15	0.282	0.89	1.49
Fourth	1.09	0.698	0.70	1.72
Fifth	1.54	0.219	0.77	3.11
Average monthly income				
No income	1.00			
001 – 300	0.61	0.009	0.43	0.88
301 – 600	0.53	0.001	0.37	0.77
601 – 900	0.22	<0.0001	0.12	0.38
900+	0.67	0.081	0.43	1.05
In last 6 months, died spouse, parent or child				
Yes	1.00			
No	0.50	<0.0001	0.38	0.65
In last 6 months, had major financial crisis				
Yes	1.00			
No	0.57	<0.0001	0.45	0.72
In last 6 months, had serious				

problem with close friend, neighbor or relative				
Yes	1.00			
No	0.47	<0.0001	0.37	0.60
Religious Practicing				
Yes	1.00			
No	1.70	<0.0001	1.28	2.26
Had love partner				
Yes	1.00			
No	0.70	0.001	0.57	0.87
Worried about safety in campus				
Yes	1.00			
No	0.75	0.009	0.61	0.93
Previous history of depression				
Yes	1.00			
No	0.48	<0.0001	0.37	0.62
Family history of mental illness				
Yes	1.00			
No	0.43	<0.0001	0.32	0.58

Ordinal Logistic Regression Analysis for Depression

An ordered logistic regression model analysis was performed to explore the relations between the predictor variables with the depression while simultaneously adjusting for all other variables included in the model.

The regression analysis showed, while keeping the other predictor variables constant, for being in 20 to 23 and 24 to 27 age group, the odds of severe depression versus the combined from moderate severe to none are 0.60 and 0.38 times lower than those in 16 to 19 age group, respectively. While keeping the other predictor variables constant, for former rural residents, the odds of severe depression versus the combined from moderate severe to none are 0.70 times lower than for urban residents.

In keeping the other predictor variables in the model constant, for having an average monthly income of Ethiopian Birr 301 to 600, 601 to 900 and greater than 900, the odds of severe depression versus the combined from moderate severe to none are 0.42, 0.30 and 0.50 times lower than those with no income, respectively. While keeping the other predictor variables in the model constant, for not suffered serious illness/injury in the last 6 months, the odds of severe depression versus the combined from moderate severe to none are 0.76 times lower that those suffered from it. For not having problem with police/courts in the last 6 months, the odds of severe depression versus the combined from moderate severe to none are 0.53 times lower that those had problem with police/courts, given the other variables are held constant in the model.

While keeping the other predictor variables in the model constant, for no religion practicing, the odds of severe depression versus the combined from moderate severe to none are 1.69 times higher than those practicing religion.

While keeping the other predictor variables in the model constant, for not having love partner, the odds of severe depression versus the combined from moderate severe to none are 0.64 times lower than those who had love partner. For not worried about safety in campus, the odds of severe depression versus the combined from moderate severe to none are 0.67 times lower than those who worried about safety in campus, given the other variables are held constant in the model. For non-current khat chewers, the odds of severe depression versus the combined from moderate severe to none are 0.77 times lower that those current khat chewers, given the other variables are held constant in the model.

While keeping the other predictor variables in the model constant, for not having previous history of anxiety disorder, the odds of severe depression versus the combined from moderate severe to none are 0.57 times lower that those had previous history of anxiety. While keeping the other predictor variables in the model constant, for not having previous history of depression, the odds of severe depression versus the combined from moderate severe to none are 0.34 times lower than those who had previous history of depression. While keeping the other predictor variables in the model constant, for not having family history of mental illness, the odds of sever depression versus the combined from moderate severe to none are 0.59 times lower than those who had family history of mental illness (Table 10).

Table 10. Predictors of depression among the students of public Universities of Eastern Ethiopia, 2017.

Variables	OR	P-value	95% Confidence Interval	
Age				
16 – 19	1.00			
20 – 23	0.60	0.001	0.45	0.82
24 – 27	0.38	<0.0001	0.25	0.59
28 – 31	1.58	0.469	0.46	5.43
Former residence				
Urban	1.00			
Rural	0.70	0.001	0.57	0.86
Average monthly income				
No income	1.00			
001 – 300	0.70	0.062	0.49	1.02
301 – 600	0.42	<0.0001	0.29	0.61
601 – 900	0.30	<0.0001	0.18	0.52
900+	0.50	0.003	0.32	0.78
In last 6 months, Suffered serious illness or injury				
Yes	1.00			
No	0.76	0.035	0.59	0.98
In last 6 months, had problem with police or courts				

Yes	1.00			
No	0.53	<0.0001	0.39	0.72
Religious Practicing				
Yes	1.00			
No	1.69	<0.0001	1.27	2.26
Had love partner				
Yes	1.00			
No	0.64	<0.0001	0.52	0.79
Worried about safety in campus				
Yes	1.00			
No	0.67	<0.0001	0.54	0.82
Current khat chewer				
Yes	1.00			
No	0.77	0.043	0.60	0.99
Previous history of anxiety disorder				
Yes	1.00			
No	0.57	<0.0001	0.41	0.77
Previous history of depression				
Yes	1.00			
No	0.34	<0.0001	0.26	0.44
Family history of mental illness				
Yes	1.00			
No	0.59	0.001	0.43	0.80

Linear Regression Analysis

Furthermore, a linear regression analysis was performed to understand the effects of anxiety disorder on student academic achievement (current CGPA) and found out a coefficient of -0.015 (95% CI: -0.020, -0.011); which indicates that a one-unit increase in the GAD scale results 0.015 decrease in students CGPA. Similarly, the effects of depression on student academic achievement (current CGPA) was analyzed and found out a coefficient of -0.007 (95% CI: -0.011, -0.004); which indicateed that a one-unit increase in the GAD scale resulted 0.015 decrease in students CGPA.

Disc

Epidemiological assessment of mental health problem was tried to be assessed by using a quantitative study on anxiety disorder and depression. The limitation for the quantitative data could be the findings are totally dependent on the true response of the students. However, the optimum sample size, and cross questioning can provide reliable evidence in the epidemiological assessment of mental health problems and its contributing factors.

This study indicated that anxiety disorder is higher than a study done in Pakistan, Hawassa and Addis Ababa. The increase behind may be due to the public demonstration

catastrophe taken place in the country/university environment in the duration of data collection. However, this should not mask that this is a recent study and the level of anxiety is increasing with time (Alvi *et.al*, 2010; Tesfaye , 2009; Alem *et.al*, 2005).

This study found a depression that is higher than the level of depression investigated in Jamaica, Pakistan, Hawassa and Addis Ababa. This may be due to the public demonstration catastrophe taken place in the country/university environment in the duration of data collection. However, this should not mask that this is a recent study and the level of anxiety is increasing with time. (Lowe *et.al*, 2009; Alvi *et.al*, 2010; Tesfaye , 2009; Alem *et.al*, 2005).

This study showed the prevalence of suicidal ideation way more than that of the study done in Addis Ababa University, Ethiopia. This may be due to the fact that the time gap between the two studies, in which the life style/living environment has changing with time that may contribute to the increment in suicidal ideation among the students (Alem *et.al*, 2005; Tesfaye , 2009).

The ordinal regression analysis showed that second year studenst have an increased probability of suffering from anxiety disorder than first year students. This may be due to the known fact that the first year of campus life is new and full of support from family side; however, when time goes, the level of independence increase thereby exerting an effect on the students which may contribute to the suffering from anxiety disorder (Hernandez , 2006; Jadoon *et.al*, 2010; Alem *et.al*, 2005).

Students with no average monthly income showed a high probability of suffering from anxiety disorder than those who have an average monthly income. This could be due to the known fact that lack of income can affects one's personality in many ways which at the end could result in anxiety disorder. In line with this, it was found that students having major financial crisis have an increased probability of suffering from anxiety disorder than those who had not faced the financial crisis (Tesfaye , 2009; Russell and Shaw, 2006; Mojs *et.al*, 2012; Sayadi and Shabani , 2012; Hysenbegasi *et.al*, 2005; Lupo *et.al*, 2011).

Those students who had died spouse, parent or child found to have a high probability of suffering from anxiety disorder than those with no died spouse, parent, or child. This goes in line with other studies and may be due to the fact that losing someone important, particularly a relative, would definitely affect the students from different angles including their mental stability thereby increase the probability of suffering from anxiety disorder. It was also found that having serious problem with close friend, neighbor or relative resulted in increased probability of suffering from anxiety disorder. This is obviously due to the fact that problems with loved ones/people around would definitely result in mental distress from anxiety disorder (Khan *et.al*, 2006; Dyrbye , *et.al*, 2006; Lotfi , *et.al*, 2010; Sayadi and Shabani , 2012; Hysenbegasi , *et.al*, 2005; Mae *et.al*, 2013).

Having religious practice was found to decrease the probability of suffering from anxiety disorder. This could show the fact that religious practicing may keep the spiritual health component of an individual, which in turn believed to decrease the probability of suffering from anxiety disorder. Students who had love partners showed a less like

probability of suffering from anxiety disorder. This can be due to the reason that love partners could play a vital role in sharing ideas/burdens which believed to cause anxiety, thereby reducing the probability of suffering from anxiety disorder among the students with love partners (Tesfaye , 2009; Lupo , *et.al*, 2011; Mae , *et.al*, 2013; Lotfi , *et.al*, 2010; Sayadi and Shabani , 2012; Hysenbegasi , *et.al*, 2005).

Those students who used to worry about their safety in the campus were found to have a high probability of suffering from anxiety. This could happen since the worrying feeling if stayed for extended period of time would definitely grows to a level of anxiety disorder among the students (Tesfaye , 2009; Kaplan and Sadock , 2010; Sayadi and Shabani , 2012).

Having previous history of depression was found to increase the probability of suffering from anxiety disorder. This could be due to the reason behind that depression and anxiety disorder are two inter-related mental health problem which one could be the predictor for the other. It was also found that having family history of mental illness could increase the probability of suffering from anxiety disorder. This could be due to the fact that having a family with mental illness would result in many stressors on the particular family members including the students, which thereby increased the probability of suffering from anxiety disorder among the students (Khan, *et.al*, 2006; Sayadi and Shabani , 2012; Hysenbegasi , *et.al*, 2005).

The probability of suffering from depression found to increase at the earlier adolescent period. This goes in line with other studies and it could directly be linked with the level of maturity versus the increased ability of controlling feelings/things surrounding. An increased age is directly proportional to increased level of maturity, thereby enables the students to manage their feelings and decreases the probability of suffering from depression (Vera Lucia Dutra Facundes and Ana Bernarda Ludermir, 2005; Kessler, *et.al,* 2005; Sayadi and Shabani , 2012; Hysenbegasi , *et.al*, 2005; Alem , *et.al*, 2005).

It was also found that for students from previous rural residence, the probability of suffering from depression is lower than those from urban residents. The reason may be due to the fact that students from urban residents were exposed to many encounters that may contribute to an increased probability of suffering from depression when compared with those from rural residents. Students with no average monthly income showed a high probability of suffering from depression than those who have an average monthly income. This could be due to the known fact that lack of income can affect ones personality in many ways which at the end could result in depression (Russell G and Shaw, 2006; Mojs *et.al*, 2012; Sayadi and Shabani , 2012; Hysenbegasi *et.al*, 2005; Lupo *et.al*, 2011; Tesfaye , 2009).

Those students who suffered from serious injury/illness in the last 6 months found to have an increased probability of suffering from depression than those who have not suffered from it. This could be related with the post injury/illness impacts on the individual from different angles including a stress on the mental health thereby increased the probability of suffering from depression. Similarly, having problem with police/courts in the last 6 months was found to have an increased probability of

suffering from depression than those who do not have problem. This could be due to the related stresses from the process and external influences, which in turn facilitates the depression occurrence (Dyrbye *et.al*, 2006; Khan *et.al*, 2006; Jadoon *et.al*, 2010; Lotfi *et.al*, 2010; Sayadi and Shabani 2012; Mae Lynn Reyes-Rodríguez, *et.al*, 2013).

Having religious practice was also found to decrease the probability of suffering from depression. This could show the fact that religious practicing may keep the spiritual health component of an individual, which in turn believed to decrease the probability of suffering from depression. Students who had love partners showed a less like probability of suffering from depression. This can be due to the reason that love partners could play a vital role in sharing ideas/burdens which believed to cause depression, thereby reducing the probability of suffering from depression among the students with love partners (Tesfaye , 2009; Lupo *et.al*, 2011; Mae *et.al*, 2013; Sayadi and Shabani , 2012; Hysenbegasi *et.al*, 2005).

Those students who used to worry about their safety in the campus were found to have a high probability of suffering from depression. This could happen since the feeling if stayed for extended period of time would definitely grow to a level of depression among the students(Kaplan and Sadock , 2010; Sayadi and Shabani , 2012; Tesfaye , 2009).

Current *khat* chewing practice was found to increase the probability of suffering from depression. This could strengthen the fact about the effects/impacts of *khat* chewing practice on mental health problems including depression, which in turn increased the probability of suffering from depression among the students (Alem *et.al*, 2005; Khan *et.al*, 2006).

Having previous history of anxiety disorder was found to increase the probability of suffering from depression. This could be due to the reason behind that depression and anxiety disorder are two inter-related mental health problem which one could be the predictor for the other. Similarly, having previous history of depression was found to increase the probability of suffering from depression. It was also found that having family history of mental illness could increase the probability of suffering from depression. This could be due to the fact that having a family with mental illness would result in many stressors on the particular family members including the students, which thereby increased the probability of suffering from depression among the students (Khan *et.al*, 2006; Sayadi and Shabani , 2012; Hysenbegasi *et.al*, 2005).

The linear regression analysis identified that as each of the anxiety and depression level increases, the students CGPA score decrease. This goes in line with other studies and strengthened the known fact that mental health problems like anxiety and depression decreases the academic performance/achievements of students (Daniel *et.al*, 2009; Afolayan *et.al*, 2013; Hysenbegasi *et.al*, 2005).

4. Conclusion

Based on the findings of this study, it can be concluded that anxiety disorder and depression among the public university students is significantly at a higher level. This indicated the existence of higher level of mental health problems among the students.

Level of study year, average monthly income, presence of died relatives, financial crisis, conflict with loved ones, religious practice, presence of love partner, worry about safety in campus, previous history of depression, and family history of mental illness were among the contributing factors of anxiety disorder. Age group, former residents, average monthly income, suffered serious illness/injury, problem with police/courts, religious practice, presence of love partner, worry about safety in campus, current *khat* chewing, previous history of anxiety disorder, previous history of depression, and family history of mental illness were among the contributing factors for depression.

Furthermore, it was found that the students' academic performance/achievement can be affected by the increasing level of anxiety and depression.

The Ministry of Education, University community, and concerned bodies therefore, should give more focus for students' mental health problem to minimize its highest level and by critically considering the identified contributing factors, while designing intervention strategies to minimize the mental health problem level. In addition, parents should consider all the contributing factors identified to play their share in the intervention towards minimizing the mental health problem prevalence.

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3. Perinatal HIV Positive Status Disclosure and Associated Factors in Dire Dawa and Harar, Eastern Ethiopia: A Health Facility Based Cross Sectional Study

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Abstract: The aim of this study was to assess the level and factors associated with caregiver's disclosure of perinatally HIV infected children's sero-positive status. A cross-sectional study was conducted in five public health facilities which provide HIV treatment and care services in Dire Dawa and Harar. It was done among 310 caregivers from February to April, 2016. The data were collected through face- to-face interview and record review and analyzed using STATA Version 14. Statistical tests were declared significant at P-value<0.05. The level of perinatal HIV positive status disclosure was 49.4% (95% CI, (43.79, 54.94)). Children's mean age at disclosure was 11.21 years. The caregivers were more likely to disclose children's HIV positive status if children frequently asked questions about their own health status, aOR=2.04, 95% CI (1.04, 4.03), and if caregivers know someone else who did perinatal HIV positive status disclosure (aOR= 2.49, 95% CI (1.17, 5.32)). Whereas, disclosure was less likely occurred when children were 12 years of age or below (aOR=0.04, 95% CI (0.02, 0.09)), the caregivers had deceived children's HIV positive status (aOR=0.38, 95% CI (0.19, 0.74)), and caregivers perceived older age as an appropriate time for disclosure (child age,10-12 years, aOR=0.30, 95% CI (0.11, 0.84); ≥13 years, aOR=0.06, 95% CI (0.02, 0.18)). Only about half of the care givers disclosed their children's perinatal HIV sero-positive status. Therefore, to facilitate disclosure, caregivers should receive health education on the recommended age of children by which they can do full disclosure. It is also important to help caregivers provide their children with age appropriate and correct information about children's frequent questions. Furthermore, experience sharing of disclosed caregivers may also be helpful to facilitate disclosure.

Keywords: perinatal HIV infection; HIV positive status disclosure; Eastern Ethiopia

1. Introduction

The increasing survival of perinatally HIV-infected children into adolescence and adulthood has brought important challenges relating to adherence to long-term treatment, as well as development issues including, among many, peer relationships, puberty, and sexuality [Judd A et.al, 2007; Morstan M et.al, 2005]. Another important challenge as more of these children reach adolescence and adulthood is disclosure of their HIV status [WHO, 2006; AAPCP, 1999]. HIV diagnosis disclosure entails communication about a potentially life threatening, stigmatized and transmissible illness and many caregivers fear that such communication may create distress for children [Wiener L et.al, 2007].

In resource limited settings, only a few of the perinatally HIV infected children knew their HIV positive status [Biadgilign S et.al, 2011; Vreeman RC et.al, 2014] despite several studies reported benefits of disclosure both to the care giver and the child as well. Previous studies reported improved adherence, providing answers to child's question, fulfilling child's right to know and child being able to protect him/her or others as advantage of disclosure [Bikaako-Kajura W et.al, 2007; Bhattacharya M et.al, 2010]. Researches also suggested that HIV-infected children who knew their status may be better able to seek social support and have improved coping skills [Gerson AC et.al, 2001; Sopena S et.al, 2010].

Child factors identified to affect disclosure include child age, child's level of maturity/awareness, death of family member, child's level of education, duration since HIV diagnosis and child put on ART [Biadgilign S et.al, 2011; Vreeman RC et.al, 2014; Bhattacharya M et.al, Kallem S et.al, 2011]. Similarly, caregiver related factors include fear of negative effects of disclosure and feel worried about or unprepared to disclosure [Biadgilign S et.al, 2011; Bhattacharya M et.al; Demmer C, 2011].

Despite several studies conducted elsewhere, there is a dearth of information on the magnitude of disclosure and associated factors in Ethiopia. In Ethiopia, when this study was conducted, there were only three published studies on perinatal HIV positive status disclosure. In these studies children studied were at younger age compared to our study and not all children did start on ART [Biadgilign S et.al, 2011; Negese D et.al, 2012; Tadesse BT et.al, 2015]. Therefore, the aim of this study was to assess the level of perinatal HIV positive sero-status disclosure and its associated factors among caregivers.

Findings of the study provide evidence on factors that hindered or facilitated caregiver's disclosure of perinatal HIV positive status. This, in turn, will be an input to health care providers, caregivers and others working in the area of HIV/AIDS care and treatment services as to where to focus to improve perinatal HIV positive status disclosure for improved HIV care and treatment services.

2. Materials and Methods

Study Setting and Design

A cross-sectional study was conducted from February 1/2016 to April 30/2016 in five public health facilities in the Eastern part of Ethiopia: in two hospitals in Harar - the capital city of the Harari Regional State - and in two hospitals and one health center in Dire Dawa city of the Dire Dawa city administration council. Many of the people (68.2%) in Dire Dawa City Administration, which is 1559 km^2, and in Harari Regional State (54.2%), which is 334 km^2, were urban inhabitants [The population of regions of Ethiopia, 2017; Wikipedia, HIV/AIDS projections and estimates for Ethiopia, 2017].

The prevalence of HIV in Dire Dawa City Administration Council and Harari Regional State was 4.0%(4.3 for female, 3.7 for male) and 2.8% (3.8 for female, 1.7 for male), respectively [CSA, 2012]. According to a projection estimate for the year 2016, there were 456 and 1,029 HIV positive population of children between the ages of 0-14 years in urban areas of Harar and Dire Dawa, respectively [EHNRI, FMOH, 2012].

Study Participants

Caregivers who had perinatally HIV positive children between 6 and 18 years of age and who were registered in the surveyed health facilities were included. For a caregiver who had more than one perinatally HIV positive child in the specified age range, only one was randomly selected. In this study, a caregiver was defined as a person who is responsible for all needs of the child, takes care of the child, and lives with the child. When this study was conducted, all children for whom information was collected had started on ART.

Sample Size

Of the 12 public health centers (4 in Harar and 8 in Dire Dawa) and 4 public hospitals (2 in Harar and 2 in Dire Dawa), those urban governmental health facilities which had at least 10 eligible caregivers--one health center and four hospitals—were selected. All the caregivers in the selected facilities who had perinatally HIV positive children in the age range of 6-18 years were included. Accordingly, a total of 325 eligible caregivers from the 5 health facilities and 310 caregivers consented to participate: 210 from three public health facilities in Dire Dawa (144 participants from Dilchora Referal Hospital, 41 from Sabian Primary Hospital and 25 from Legahare Health Center) and 100 from two public health facilities in Harar (58 from Hiwot Fana Specialized University Hospital and 42 from Jugel General Hospital).

Data Collection

Data were collected through face-to-face interview using a structured questionnaire and from the children's and caregiver's medical record card in the ART units. The data collectors, who were nurses and had been working in the ART units of the respective health facilities for at least three years, were oriented on objectives of the study, data collection techniques, and how to avoid interviewer bias during data collection. Onsite

supervisors both in Dire Dawa and Harar study sites checked questionnaires for completeness and consistency.

Measurement

Data on both the caregivers' (applicable only if caregiver is HIV positive) and the children's age, sex, education, religion, ethnicity, caregiver- child relation, and HIV status were collected from patient card using patient medical record number and unique ART number. We assessed whether a child asked questions regarding his/her health status, using a 'yes/no' response question. The caregivers' deception to children's question was also measured using a 'yes/no' response question.

In this study deception was defined as a caregiver's intentional false answer to a child's question regarding his/her health status or intentionally attributing a child's health problem to other unrelated health related condition. Caregiver's disclosure of the children's perinatal HIV positive status was an outcome variable. This study measured disclosure as a dichotomous outcome with a 'yes/no' response question. Disclosure was said to happen when the caregivers told their children that he/she had HIV/AIDS, by naming the disease. Children's age at disclosure, caregiver's perceived appropriate age for disclosure and duration since disclosure were also collected. The caregivers who told children of their perinatal HIV positive status were asked a 'yes/no' question if they had prepared them before the actual disclosure. They were also asked with whom they made disclosure. Furthermore, the need for a third person's involvement to help them with the disclosure process was assessed using a 'yes/no' response question. A binary response 'yes/no' question was used to assess whether the caregivers had told the children about the source where they got infected. Finally, self-reported post disclosure caregiver-child relationship was assessed using one question with five Likert scales. Positive scales were used to assess the current post disclosure caregiver-child relation which included 'very good=5, good=4, neither god nor bad= 3, poor=2, very poor=1' where higher values represented more positive relationship.

Data Analysis

Data were entered in to EpiData Version 3.1. Data cleaning and analysis was done using STATA Version 14.0. The outcome variable was disclosure and defined in dichotomy (disclosure "yes" and disclosure "no"). Multivariable logistic regression was used to control confounding and identify independent predictors associated with disclosure. Multicollinearity was tested using the VIF (Variance Inflation Factor). We dropped 'children's educational statuses from the final model as it had a VIF as high as 6.37. The Hosmer-Lemeshow goodness-of-fit test was used to assess model calibration. Statistical significance was declared at P-value <0.05 for 95% confidence interval.

Ethical Issues

Ethical approval was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University, College of Health and Medical Sciences. Letter of cooperation for data collection was written to health institutions in Dire Dawa

Administrative Council and Harari Regional State. Written informed consent was obtained from each eligible caregiver before the data collection from each eligible participant included in the study. No personal identifiers were collected, and data confidentiality was strictly maintained.

3. Result

Caregivers' and Children's Socio-demographic Characteristics

Of the total 325 eligible caregivers, 15 caregivers did not come on their appointment date and during the study period, making the response rate 95.4% (310/325). Most of the caregivers 81.9% (254/310) were female, and 67.4% (209/310) were biological parents. Seventy four percent (229/310) of the caregivers were HIV positive. The caregivers' median age was 38 (Table 1).

More than half of the perinatally HIV infected children were female 52.9% (164/310) and their mean age was 12 years, and 12.6% (39/310) had lost both biological parents (Table 1).

Table 1. Basic socio demographic characteristics of caregivers and perinatally HIV infected children

Variables	Response category	N=310, (%)
Caregiver's characteristics		
HIV sero status	Positive	229 (73.9)
	Negative	76 (24.5)
	Don't know	5 (1.6)
Age, median (IQR)	38 (15)	
Sex	Male	56 (18.1)
	Female	254 (81.9)
Educational status	No formal education	85 (27.4)
	Primary education	111 (35.8)
	Secondary and above	114 (36.8)
Variables	Response category	N (%)
Religion	Christian	226 (72.9)
	Muslim	84 (27.1)
Ethnicity	Amhara	172 (55.5)
	Oromo	88 (28.5)
	Other*	50 (16.2)
Relation to child	Biological caregiver	209 (67.4)
	Non-biological caregiver	101 (32.6)
Children's characteristic		
Age, mean (SD)	12.07 (±3.06)	
Sex	Male	146 (47.1)
	Female	164 (52.9)

Table 1. cont'd

Educational status	not school going	8 (2.6)
	Primary, below grade 5	144 (46.5)
	Primary, grade 5 to 8	126 (40.6)
	secondary and above	32(10.3)
Parent/s alive	Both parents alive	145 (46.8)
	Only mother alive	75 (24.2)
	Only father alive	51 (16.5)
	Both parents not alive	39 (12.6)

*SD=standard deviation *Guraghe, Somali, Tigray and Harari*

Perinatal HIV positive status disclosure and socio-demographic characteristics

Perinatal HIV positive status disclosure was significantly different by child age, caregiver's religion, children's educational status and the presence or absence of biological parents (Table 2). Disclosure increased as the children's age increased. For example, whereas 80.69% (95% CI, (73.35, 86.38)) of the children 13 years of age and above knew their HIV positive status, only 31.8% (95% CI, (22.80, 42.44)) of the children between 10 to 12 years of age did so. More female children 57.52% (88/153) than male 42.48% (65/153) were told they are HIV positive, though this difference was not statistically significant, chi2(df)=2.58 (1), P-value=0.11 (Table 2).

Table 2. Level of Perinatal HIV positive status disclosure by caregiver and child socio-demographic characteristics.

Variables	Response category	Disclosure		Pearson chi2 (df)
		Yes=153, n (%)	No=157, n (%)	
Caregiver's characteristics				
Age	Below 30 years of age	19 (12.42)	29 (18.47)	3.54 (2)
	30 to 44 years of age	84 (54.90)	89 (56.69)	
	≥ 45 years of age	50 (32.68)	39 (24.84)	
Sex	Male	27 (17.65)	29 (18.47)	0.04 (1)
	Female	126 (82.35)	128 (81.53)	
Educational status	No formal education	38 (24.84)	47 (29.94)	1.13 (2)
	Primary education	58 (37.91)	53 (33.76)	
	Secondary and above	57 (37.25)	57 (36.31)	
Religion	Christian	127 (83.01)	99 (63.06)	15.61* (1)
	Muslim	26 (16.99)	58 (36.94)	

Table 2. cont'd

Ethnicity	Amhara	91 (59.48)	81 (51.59)	2.22 (2)
	Oromo	41 (26.80)	47 (29.94)	
	Other¥	21 (13.73)	29 (18.47)	
Relation to child	Biological caregiver	104 (67.97)	105 (66.88)	0.04 (1)
	Non-biological caregiver	49 (32.03)	52 (33.12)	
Children's characteristic				
Sex	Male	65 (42.48)	81 (51.59)	2.58 (1)
	Female	88 (57.52)	76 (48.41)	
Age	6 to 9 years of age	8 (5.23)	69 (43.95)	127.16* (3)
	10 to 12 years of age	28 (18.3)	60 (38.22)	
	13 to 14 years of age	45 (29.41)	24 (15.29)	
	15 to 18 years of age	72 (47.06)	4 (2.55)	
Educational status	Did not start education	3 (1.96)	31 (19.75)	71.96* (2)
	Below grade 5	36 (23.53)	82 (52.23)	
	Grade 5 and above	114 (74.51)	44 (28,03)	
Parent/s alive	Both parents alive	58 (37.91)	87 (55.41)	10.47 (3) §
	Only mother alive	41 (26.80)	34 (21.66)	
	Only father alive	29 (18.95)	22 (14.01)	
	Both parents not alive	25 (16.34)	14 (8.92)	

**P-value <0.001, §P-value<0.05 ¥Guraghe, Somali, Tigray and Harari.*

The level of perinatal HIV positive status disclosure and the disclosure process

Overall, 49.4% (95% CI, (43.79, 54.94)) of the caregivers did perinatal HIV positive status disclosure. The median duration since children were told they are HIV positive was 24 months and their mean age at disclosure was 11.21 (SD= ±2.42) (Table 3).

Of the caregivers who disclosed their children's HIV positive status, 86.3% (132/153) reported that they had prepared children for the actual disclosure. Forty five percent (69/153) of them told their children in the absence of third person, but 54.9% (84/153) did so in the presence of one. Only 66% (101/153) of caregivers reported that they told the children the source of infection. Regarding post disclosure caregiver-child relationship, 44.4 % (68/153) reported 'good' and39.9% (61/153) reported 'very good' (Table 3).

Table 3. Caregivers' disclosure process and post disclosure caregiver-child relation of disclosed caregivers.

Variables	Response category	Frequency
Disclosure	Yes	153 (49.4)
(N¥=310)	No	147 (50.6)
Prepared children before actual disclosure	Yes	132 (86.3)
(n*=153)	No	21 (13.7)
Child age at disclosure, mean (SD)	11.21 (±2.42)	
Disclosed with whom	Alone	69 (45.1)
(n=153)	with third person	84 (54.9)
Third person necessity during disclosure	Yes	78 (51.0)
(n=153)	No	75 (49.7)
Told source of infection to the child	Yes	101 (66.01)
(n=153)	No	52 (33.99)
Duration since HIV positive status, median (IQR)	24 (36) months	
Self-reported caregiver-child post-disclosure relationship	Very good	61 (39.87)
	Good	68 (44.44)
(n=153)	Neither good nor bad	10 (6.54)
	poor	9 (5.88)
	Very poor	5 (3.27)

*Where¥total population studied; * disclosed caregivers sub-sample.*

Factors associated with perinatal HIV infection positive sero-status disclosure

The variables with P-value < 0.2in the bivariate logistic regression (Table 4) were entered into the multivariable logistic regression model.

Table 4**:** Factors associated with perinatal HIV infection sero-status disclosure in the bivariate logistic regression.

Variables		Disclosure		cOR, (95% CI)
		Yes	No	
Caregiver's age	<30	19	29	0. 51 (0.25, 1.04)
	30-44	84	89	0. 74 (0.44, 1.23)
	>= 45	50	39	1
Caregiver's religion	Christian	127	99	2.86 (1.68, 4.87)‡
	Muslim	26	58	1
Ethnicity	Amhara	91	81	1.55 (0.82, 2.93)
	Oromo	41	47	1.20 (0.60, 2.43)
	Other♦	21	29	1
Caregiver's educational status	No formal education	38	47	0.81 (0.46, 1.42)
	Primary education	58	53	1.09 (0.65, 1.85)
	Secondary and above	57	57	1

Table 4. cont'd

Relation to child	Biological parent	104	105	1.05 (0.65, 1.69)
	non-biological caregiver	49	52	1
Biological parents alive	Bothe parents were alive	58	87	0.37 (0.18, 0.78) §
	Mother was alive	41	34	0.68 (0.30, 1.50)
	Father was alive	29	22	0.74 (0.31, 1.74)
	Both parents were not alive	25	14	1
Child age in years (N=310)	≤12	36	129	0.07 (0.04, 0.12) ‡
	>12	117	28	1
Child questions about his/her health status	Yes	87	74	1.48(0.94, 2.31)
	No	66	83	1
Child educational status	Did not start formal education	3	31	1
	Below grade five	36	82	4.54 (1.30, 15.81) §
	Grade five and above	114	44	26.77 (7.79, 92.06) ‡
Deception	Yes	53	88	0.42 (0.26, 0.66) ‡
	No	100	69	1
Caregiver's perceived age for disclosure in years	<10	35	10	1
	10-12	71	65	0.31 (0.14, 0.68)
	≥13	47	82	0.16 (0.07, 0.36)
Caregiver Knew someone who did disclosure	Yes	47	23	2.58 (1.48, 4.52) §
	No	106	134	1
Sex of child	Male	65	81	1
	Female	88	76	1.44 (0.92, 2.26)

‡ P-value < 0.001, § P-value <0.05, ♦Guraghe, Somali, Tigray and Harari; cOR= Crude Odds Ratio.

The independent factors that favor disclosure in the final model were the caregiver's knowledge of someone else who did disclose (aOR= 2.49, 95% CI (1.17, 5.32)) and the children inquire about their health (aOR=2.04, 95% CI (1.04, 4.03) (Table 5).

The children who were less than or equal to 12 years were less likely to be told their HIV positive status, (aOR=0.04, 95% CI (0.02, 0.09). The caregivers who deceived children (aOR=0.38, 95% CI (0.19, 0.74) and those who perceived later age as appropriate time for disclosure (10-12 years, aOR= 0.30, 95% CI (0.11, 0.84); ≥13 years, aOR=0.06, 95% CI (0.02, 0.18)) were less likely to disclose children's HIV positive status (Table 5).

Table 5. Factors associated with child HIV infection status disclosure in the multivariable logistic regression.

Variables		cOR (95% CI)	aOR (95% CI)
Caregiver's age	<30	0. 51 (0.25, 1.04)	0.92 (0.33, 2.58)
	30-44	0. 74 (0.44, 1.23)	1.56 (0.67, 3.64)
	≥45	1	1
Religion	Christian	2.86 (1.68, 4.87)	1.75 (0.85, 3.61)
	Muslim	1	1
Biological parents' survival	Both parents alive	0.37 (0.18, 0.78)	0.74 (0.26, 2.13)
	Only mother alive	0.68 (0.30, 1.50)	1.84 (0.56, 6.06)
	Only father alive	0.74 (0.31, 1.74)	1.42 (0.42, 4.77)
	Both parents not alive	1	1
Child age in years	≤12	0.07 (0.04, 0.12)	0.04 (0.02, 0.09)†
	>12	1	1
Child asked questions about their health status	Yes	1.48(0.95, 2.31)	2.04 (1.04, 4.03) §
	No	1	1
Deception	Yes	0.42 (0.26, 0.66)	0.38 (0.19, 0.74)§
	No	1	1
Caregiver's Perceived appropriate age for disclosure	<10	1	1
	10-12	0.31 (0.14, 0.68)	0.30 (0.11, 0.84) §
	≥13	0.16 (0.07, 0.36)	0.06 (0.02, 0.18) †
Child sex	Male	1	1
	Female	1.44 (0.92, 2.26)	1.13 (0.60, 2.15)
Caregiver Knew someone who did disclosure	Yes	2.58 (1.48, 4.52)	2.49 (1.17, 5.32) §
	No	1	1

† P-value <0.001, § P-value <0.05; aOR= Adjusted Odds Ratio, cOR= Crude odds ratio

4. Discussion

The level of perinatal HIV positive status disclosure in the study setting was 49.4%. The age of the children and their questions about their health; the caregivers' deception about their children's HIV positive status, the caregivers' perceived old age for disclosure, and their access to someone else who disclosed were factors significantly associated with the disclosure.

In this study, the magnitude of perinatally HIV infected children who knew their HIV positive status was higher than the levels reported from different settings in Ethiopia (17.4% to 39.5%) [Biadgilign S et.al, 2011; Negese D et,al 2012; Tadesse BT et.al, 2015]. The difference might be attributed to the difference in the age of the children studied: the mean age of the children in our study, 12 years, is older than that of the children in those studies, 8.52 years [Biadgilign S et.al, 2011], 9.96 years [Negese D et,al 2012], 10.1 years [Tadesse BT et.al, 2015]. Consistent with our study, 43.1% of children 5-18 years

of age had received complete disclosure in Uganda and in Zambia 56.7% caregivers disclosed the perinatal HIV positive status to their children [Namasopo-Oleja S et.al, 2015; Mweemba M et.al, 2015]. A study by Vreeman RC et.al in Western Kenya reported disclosure level as high as 62% among children aged 14 years and above [Vreeman RC et.al, 2014]. Similarly, 54% of children above the age of 10 years knew their HIV positive status in southern Ethiopia [Tadesse BT et.al, 2015]. In this study, however, 62.2% of children 10 years of age and above and 88.7% of children 14 years of age and above were disclosed their HIV positive status. Despite the higher level of disclosure in our study compared to the report of Vreeman RC et.al and Tadesse et.al, 38% of children 10 years of age and above including 11.03% of children 14 years and above were undisclosed.

Regardless of the HIV disclosure counseling guideline of World Health Organization, which recommends that children of school age (6-12 years) should be told their HIV positive status [WHO, 2011], and that of Ethiopia [FMOH, 2014], only 21.8% of school age children knew their HIV positive status in the study setting. In this study, we assessed caregiver's perceived appropriate age for disclosure and 41.6% suggested 13 years and above as an appropriate age to make disclosure. This might explain the significant number of children in the study settings who were not disclosed of their HIV positive status at an age they should. In this regard, caregivers should receive support on what to tell and how to pass age appropriate HIV related information to children rather than waiting for until children get too old for disclosure

Disclosure of perinatal HIV infection after the age of 12 years has important public health implication in the transmission of HIV as it coincides with age for sexual debut. Researches have indicated that adolescents in some developed countries enter into sexual relationships as early as 14 years and 15 years in countries like Ethiopia [Mavhandu-Mudzusi AH et.al, 2016; Tassiopoulos K et.al, 2013]. A qualitative study in Kenya reported that HIV positive teenagers had been influenced by their HIV negative peers to engage in sex [Gachaja G, 2015]. Other study also reported that adolescents who knew their HIV positive status had responsibly practiced safer sex through the use of condoms [Marhefka SL et.al, 2011]. Therefore, it is important that adolescents know their HIV positive status to decide on their health needs and protect themselves and others from HIV infection.

Deception of children's HIV positive status among caregivers in the study settings was common. Caregivers who deceived children's HIV positive status were less likely to disclose. Similar findings were discussed elsewhere [Biadgilign S et.al, 2011; Tadesse BT et.al, 2015; Namasopo-Oleja S et.al, 2015]. Studies reported deception as caregivers' coping mechanism to lack of self-efficacy to manage disclosure and fear of negative outcomes [Tadesse BT et.al, 2015; Mweemba M et.al, 2015; Kiwanuka J et.al, 2014]. Deception was also reported as caregiver's being out of concern for children's psychological wellbeing [Wiener L et.al, 2007].

This study confirmed the finding of other studies that reported caregivers' need of third person for assistance in the disclosure process [Tadesse BT et.al, 2015; Kiwanuka J et.al, 2014; Nzota MS et.al, 2015], as more than half of the caregivers who disclosed children's perinatal HIV positive status believed in the importance of the presence of a

third person during disclosure, which is also an opportunity for trained health care workers to help caregivers on the matter. Caregivers collaboration with health care providers in the disclosure process will produce a better outcome as disclosure will more probably be individualized to the child's context as discussed elsewhere [Nzota MS et.al, 2015].

Regarding caregiver-child post disclosure relation, 85% of the caregivers reported good to very good. Consistent with our finding, Santamaria EK et.al reported that HIV positive youth who had been told their HIV status did not show an increase of psychological problems [Santamaria EK et.al, 2011]. A post disclosure qualitative study in Kenya reported that HIV positive children with full disclosure returned to normal anywhere from a few weeks up to 4 months later [Gachanja et.al, 2015].

In our study the children less than or equal to 12 years and below were less likely to be disclosed their HIV positive status, and this finding was consistent with findings from Ethiopia and other settings including Tanzania and Western Kenya [Biadgilign S et.al, 2011; Vreeman RC et.al, 2014; Negese D et.al, 2012; Tadesse BT et.al, 2015; Nzota MS et.al, 2015]. Children's frequent questioning about their health condition was positively associated with disclosure. A similar finding was also reported that child questioning triggers disclosure [Tadesse BT et.al, 2015].

The strength of this study includes that it is conducted in multiple centres covering wide geographic areas. The health facilities included in this study were major HIV care and treatment centres in the studied area where all eligible caregivers are represented and hence generalizable. The study assessed an important but overlooked public health issue in the care of HIV/AIDS in the study setting. However, limitations inherent to this study include that data collectors were health care providers and whose knowledge of participant's information might have affected exposure and outcome assessment despite efforts to reduce it. The other limitation is related to the study design where the outcome and exposure variables assessed at the same time, and as a result, the reported associations may not show temporality. Moreover, the study did not assess health care related factors which might have affected caregiver's disclosure and tendency to seek counselling for disclosure.

5. Conclusion

Only about half of the care givers disclose their children's perinatal HIV sero-positive status. Therefore, to facilitate disclosure, caregivers should receive health education on the recommended age of children by which they can do full disclosure. It is also important to help caregivers provide their children with age appropriate and correct information about children's frequent questions. Furthermore, experience sharing of disclosed caregivers may also be helpful to facilitate disclosure.

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4. Prevalence of Salmonella, Shigella and their Antimicrobial Susceptibility Pattern, Intestinal Parasites and Associated Factors among Asymptomatic Food Handlers Working in Haramaya University, Eastern Ethiopia

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Abstract: Salmonella, Shigella and intestinal parasites are global public health problems, particularly in developing countries like Ethiopia. The emergence of antimicrobial resistance of Salmonella and Shigella is another growing problem. Asymptomatic food handlers and poor hygienic practices during food preparation and handling play an important role in the transmission of food-borne diseases. The objective of the study was to assess the prevalence of Salmonella, Shigella their antimicrobial susceptibility pattern, intestinal parasites and associated risk factors among asymptomatic food handlers working in Haramaya University, Eastern Ethiopia from August, 2015 to January, 2016. A quantitative cross sectional study was conducted among 417 randomly selected asymptomatic food handlers. Data was collected by using questionnaire, microscopic examination of the stool for the presence of intestinal parasites, and culture isolation of Salmonella, Shigella and antimicrobial susceptibility pattern. Logistic regression and Odds ratio were used to analysis the data. The prevalence of Salmonella, Shigella and intestinal parasites were 4.1%, 1.2% and 25.2%, respectively. Salmonella typhi (64.7%) is the leading bacteria isolated. Salmonella and Shigella species showed varying degrees of sensitivity and resistance to antimicrobial agents used for susceptibility testing. More than 88% of Salmonella and 40% of Shigella species were multidrug resistant. Almost all Salmonella and Shigella isolates were sensitive to Ceftriaxone, Ceftazidime, Norfloxacin and Gentamicin. The most frequently isolated intestinal parasites was Entamoeba coli (46.7%). The age group of more than 40 years, no formal education, more than 5 years of service, monthly income of less than 500 Birr, hand washing after the use of the toilet with water only/ not at all and untrimmed fingernails were the independent predictors of the outcome. Several factors are involved in the occurrence of high intestinal parasites and antimicrobial resistant Salmonella and Shigella. Therefore, combined measures like educating food handlers about food hygiene practice, periodic medical screening and continuous supervision should be in place to prevent their

transmission.

Keywords: Salmonella; Shigella; intestinal parasite; antimicrobial susceptibility; associated risk factors; asymptomatic food handlers

1. Introduction

The consumption of contaminated foods may result in foodborne diseases. Such diseases remain a major public health problem globally, but particularly in developing countries due to difficulties in securing optimal hygienic food handling practices (WHO, 2008). About 70% of diarrheal disease are associated with the consumption of contaminated food and up to 20% of food-borne disease outbreaks are due to contamination by the food handlers (WHO, 2008; Maizun & Nyi, 2012).

Food handlers who harbour *Salmonella*, *Shigella* and intestinal parasites can contaminate food while preparing and serving via their fingers, which in turn lead to the contamination of food and finally reach the consumers (Gashaw et al. 2008), if basic sanitary practices are not well maintained. Particularly, food prepared and served at establishments in a higher learning institution is implicated for food borne disease outbreaks caused by pathogenic bacteria and parasites (Conradie, 2007).

Salmonella is the most common cause of food and water borne gastroenteritis in humans and remains an important health problem worldwide (WHO, 2008). *Shigella* also continues to play a major role in the aetiology of inflammatory diarrhoea and dysentery, thus presenting a serious public health problem worldwide (Kansakar et al. 2007).

Antimicrobial resistance of *Salmonella* and *Shigella* species are an emerging global challenges (Bayeh et al. 2010; Ecker et al. 2011). Resistance to first line antibiotics such as Ampicillin, Tetracycline and Chloramphenicol are reported from different parts of Ethiopia (Yismaw et al. 2007; Tiruneh, 2009). Misuse of antibiotics by patients and negligence antimicrobial prescription in health facilities in many developing countries, including Ethiopia has led to an increased antimicrobial resistance (Asrat, 2008; Ecker et al. 2011).

Intestinal parasites are also the major public health problems in developing countries. Ethiopia has ranked the second highest burden of ascariasis, the third highest burden of hookworm and the fourth highest burden of trichuriasis in Sub-Saharan Africa (Tadesse et al. 2008; Hotez & Kamath, 2009) .

In Ethiopia, limited studies are available regarding the extent of *Salmonella*, *Shigella* and intestinal parasites among food handlers working in higher learning institutions (Moges, 2010; Daniel & Abera, 2012; Fentabil et al. 2014). Therefore, this study was aimed to generate current information on the prevalence of *Salmonella*, *Shigella* their antimicrobial susceptibility pattern, intestinal parasites and associated risk factors, which will provide conclusive evidence to designing intervention protocols to safeguard the health and wellbeing of the young scholars.

2. Material and Methods

Study Area and Period

The study was conducted from August, 2015 to January, 2016 among asymptomatic food handlers working in Haramaya University (HU), Eastern Ethiopia. It is located in East Hararghe zone of Oromia Regional State at a distance of 510kms from Addis Ababa, 17kms from Harar town, 40kms from Dire Dawa town and almost 5kms off the main road from the nearby town of Haramaya. It has three campuses: the main campus is the centre for both campuses. The second campus is found in Harar town where the College of Health and Medical Sciences (CHMS) is located. The third campus, which is 200kms far from the main campus, is found in Chiro town. There are fifteen food establishments in Haramaya University (9 in main campus, 4 in CHMS and 2 in Chiro campus). A total of 1,274 food handlers were employed in these food establishments.

Study Design

The study design is an institutional based quantitative cross sectional study.

Population

Source population: All food handlers working in HU.

Study population: All randomly selected asymptomatic food handlers working in HU.

Exclusion criteria

All food handlers with clinical sign and symptoms of gastrointestinal diseases or taking either antibiotics or anti-parasitic drugs in the last two weeks and during the study period was excluded from the study.

Sample Size Determination

A sample size (422) was determined by using single population proportion formula considering 5% margin of error and 95% confidence interval. It was calculated by taking the prevalence of *Salmonella* (1.3%), *Shigella* (2.7%) and antimicrobial resistance patterns of *Shigella* species (67%) from the study done in University of Gonder (Mulat et al. 2013), the prevalence of intestinal parasites (52%) and antimicrobial resistance patterns of *Salmonella* species (75%) from a study conducted in Mekelle University (Araya et al. 2014) and (50%) for associated risk factors. Finally, 10% non-response rate was added to the calculated sample size.

Sampling technique

A total sample size was proportionally allocated to a total number of food handlers working in main campus (928), CHMS (148) and Chiro campus (144) food establishments. Study participants were selected by lottery method followed by systematic random sampling technique. A complete list of food handlers was obtained from each food establishment.

Data collection and sample processing

A structured questionnaire was used to collect data such as sociodemographic characteristics and predisposing factors by interview. About 2-3gms of faeces was collected in a sterile, suitable size and leak-proof plastic container. The specimens were inoculated into Cary-Blair transporting medium and transported in cold chain to the Medical Microbiology Laboratory for the analysis. The isolation of *Salmonella* and *Shigella* was performed by a series of cultural characteristics and their antimicrobial susceptibility testing using disc diffusion method. And a direct wet mount was run for detection and isolation of intestinal parasites.

Isolation of *Salmonella* and *Shigella* spps

Stool specimen were inoculated into Selenite F broth (Oxoid, England) and incubated for 18 hours to enrich the *Salmonella* and *Shigella* prior to subculture onto Xylose lysine deoxycholate agar (XLD) and Salmonella-Shigella agar (Oxoid, England) for isolation. Biochemical reaction such as motility, indole, lysine deoxychocolate (LDC), Simmon's citrate agar, Urea and Kligler iron agar (KIA) were also performed to differentiate the isolate to species level after incubation at 37°C for 24 hours (Perilla, 2003; Cheesbrough, 2006).

Antimicrobial susceptibility testing

Antimicrobial susceptibility testing was performed by the Kirby-Bauer disk diffusion technique. After a suspension equivalent to 0.5 McFarland was swabbed uniformly onto Mueller Hinton agar plate, antimicrobial discs were placed over the agar and left for 30 minutes for the diffusion of antimicrobials impregnated in the disc. Then, the plates invested upside down and incubated aerobically at 37°C for 18-24 hours. The zone of inhibition was measured and the results recorded as sensitive (s), Intermediate (I) or resistance (R) based on the cut-off value recommended by the Clinical and Laboratory Standards Institute (CLSI) guideline (CLSI, 2015). The antimicrobial used were Ampicillin (10mg), Tetracycline (30mg), Chloramphenicol (30mg), Gentamycin (10mg), Ciprofloxacin (10mg), Cotrimoxazole (1.25/23.75µg), Ceftazidime (30µg), Norfloxacin (10mg) and Ceftriaxone (30µg) (Oxoid, UK). Multidrug resistance (MDR) is defined when either *Salmonella* or *Shigella* species is resistant against 2 or more of the antimicrobial agents belonging to different structural classes (Yismaw et al. 2007, Getenet & Haimanot, 2014).

Stool examination for egg and cyst

About 1gm of stool was emulsified in a drop of physiological saline (0.85% N) and Lugol's iodine on either side of the microscope slide. After a cover slide was applied to each wet-mount, the slide was scanned under 10X and 40X objectives of light microscope. A floatation and formal ether concentration technique was also used to enhance the probability of detection of egg and cyst stages of intestinal parasites (Cheesbrough, 2006).

Study Variables

Dependent variable

Depended variables are prevalence of *Salmonella* species*, Shigella* species, intestinal parasites and antimicrobial susceptibility pattern.

Independent variables

Independent variables include: Sociodemographic characteristics (sex, age, religion, ethnicity, marital status, educational status, year of service, and income), a place of food establishment, wearing apron/ hair tie practice, hand washing practices, medical checkup, fingernail status, food safety training and type of job.

Data quality control

A questionnaire was pretested on 5% food handlers working in Dire Dawa University. Based on the information obtained, the questionnaire was modified.

Each batch of the culture medium was checked for performance and sterility using the American Type Culture Collection (ATCC) reference strains such as *E. coli* (ATCC 25922), *S. aureus* (ATCC 25923) and *P. aeruginosa* (ATCC 27853) (CLSI, 2015). All the standard strains were obtained from the Armauer Hansen Research Institute of Ethiopia.

Data processing and analysis

The data were entered into Epidata software version 3.3.2 and cleaned before transporting to the Statistical Package for Social Sciences (SPSS) version 20 for data analysis.

Quantitative variables were expressed by using proportion, arithmetic mean and standard deviation (SD). Bivariate logistic regression analysis was used to explore the effect of individual dependent variables. Variables with $P \leq 0.25$ in a bivariate analysis were considered for multivariate analysis. Odds ratio (OR) was also computed to determine the strength of association. A *P*-value < 0.05 was used as a cut-off point to indicate a statistically significant association.

Ethical considerations

The study was ethically approved by the Institutional Health Research Ethics Review Committee (IHRERC) of the CHMS, Haramaya University. Written informed consent was obtained before data collection from the head of each food establishment and the study participants. Infected study participants received free treatment based on their laboratory findings.

3. Result

Socio-demographic Characteristic of the Study Participants

Four hundred twenty two food handlers were planned to include in this study. Out of these, 417 food handlers were enrolled, making a response rate of 98.8%. Seven food handlers were excluded from the study based on exclusion criteria. Of the total study participants, 79.9% were females; with male to female ratio of 0.3:1. The age of the majority was more than 40 years (40.5%) with the mean age of 38.6 (SD $\pm$ 9.4) years. The majority of participants (42.4%) had a primary level education (1-8th grade), currently married (58.5%) and served as a food handler in their respective food establishment for more than 5 years (52.8%) (Table 1).

Table 1. Socio-demographic characteristics of asymptomatic food handlers working in Haramaya University, Eastern Ethiopia from August, 2015 to January, 2016.

Socio-demographic characteristics		Total patients (N=417)	
		No	%
Location of food establishments			
	Main campus	321	77
	CHMS	59	14.1
	Chiro	37	8.9
Sex			
	Female	333	79.9
	Male	84	20.1
Age group (in years)			
	> 40	169	40.5
	31-40	142	34.1
	21-30	58	13.9
	≤ 20	48	11.5
Educational status			
	No formal education	101	24.2
	Grade 1-8th	177	42.4
	Grade 9-12th	93	22.3
	More than 12th grade	46	11
Current marital status			
	Currently married	244	58.5
	Divorced	61	14.6
	Widowed	38	9.1
	Unmarried	74	17.7
Year of service			
	More than 5 years	220	52.8
	1-5 years	112	26.9
	Less than 1 year	85	20.4

Frequency of *Salmonella* and *Shigella* species

The overall prevalence of *Salmonella* species was 4.1%. The most frequently isolated was *S. typhi* (64.7%) followed by *S. paratyphi* (23.5%) (Figure 1). Five *Shigella* species were isolated, which make the overall prevalence of 1.2%. Multiple infections were detected only in two food handler.

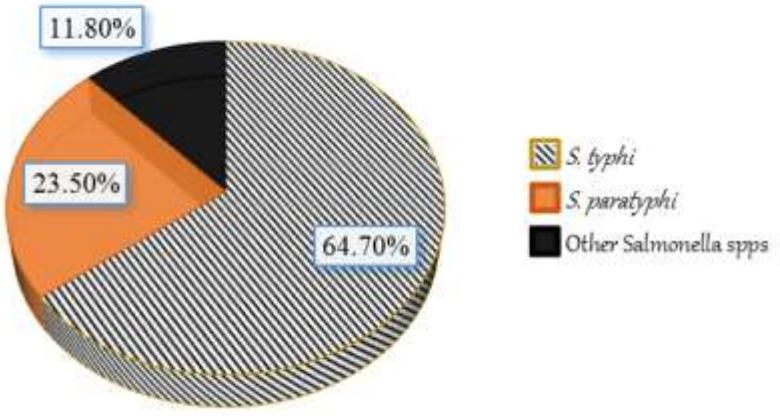

Figure 1. Frequency of Salmonella species isolated from stool specimens of asymptomatic food handlers working in Haramaya University, Eastern Ethiopia from August, 2015 to January, 2016.

Antimicrobial susceptibility pattern of *Salmonella* and *Shigella* species

The results of the antimicrobial susceptibility pattern of *Salmonella* and *Shigella* were presented in Table 2. In general, *Salmonella* and *Shigella* species were sensitive to Ceftriaxone (81.2%), Ceftazidime (81.2%), Norfloxacin (77.3%), Ciprofloxacin (72.7%) and Gentamycin (68.2%). While the higher rate of resistance was observed to Tetracycline (77.3%), Amoxicillin (72.7%), Chloramphenicol (68.2%) and Cotrimoxazole (68.2%).

Salmonella typhi were highly sensitive to Ceftazidime (90.9%), Ceftriaxone (81.8%) and Norfloxacin (80.8%), and 72.7% for each of Ciprofloxacin and Gentamicin; whereas resistance to Tetracycline (90.9%), Chloramphenicol (81.8%), Amoxicillin (72.7%) and Cotrimoxazole (72.7%). On the other hand, 75% of *S. paratyphi* were sensitive for each of Ceftriaxone, Ceftazidime and Gentamicin; while resistance to Amoxicillin (100%), and 75% for each of Ciprofloxacin, Cotrimoxazole and Tetracycline.

Shigella species were 80% sensitive for each of Ceftriaxone, Ceftazidime, Ciprofloxacin and Norfloxacin; while 80% resistance to Tetracycline, and 60% for each of Chloramphenicol and Cotrimoxazole.

Table 2. Antimicrobial susceptibility pattern of *Salmonella* and *Shigella* Species isolated from stool specimens of asymptomatic food handlers working in Haramaya University, Eastern Ethiopia from August, 2015 to January, 2016.

Bacterial Isolates	Total No	Antimicrobial susceptibility N (%)								
		Pattern	AM	CRO	CAZ	CHL	CIP	COT	GN	NOR	TE
S. typhi		S	3(27.3)	9(81.8)	10(90.9)	2(18.2)	8(72.7)	3(27.3)	8(72.7)	9(80.8)	1(9.1)
	11	I	0	0	0	0	0	0	0	0	0
		R	8(72.7)	2(18.2)	1(9.1)	9(81.8)	3(27.3)	8(72.7)	3(27.3)	2(18.2)	10(90.9)
S. paratyphi		S	0	3(75)	3(75)	0	1(25)	1(25)	3(75)	2(20)	0
	4	I	0	0	1(25)	2(50)	0	0	0	0	1(25)
		R	4(100)	1(25)	0	2(50)	3(75)	3(75)	1(25)	2(20)	3(75)
Other *Salmonella*		S	0	2(100)	2(100)	0	4(100)	1(50)	2(100)	2(100)	1(50)
spps	2	I	0	0	0	1(50)	0	0	0	0	0
		R	2(100)	0	0	1(50)	0	1(50)	0	0	1(50)
		S	3(60)	4(80)	4(80)	1(20)	4(80)	2(40)	3(60)	4(80)	1(20)
Shigella spps	5	I	0	0	0	1(20)	0	0	0	0	0
		R	2(40)	1(20)	1(20)	3(60)	1(20)	3(60)	2(40)	1(20)	4(80)
Total											
		S	6(27.3)	18(81.2)	18(81.2)	3(13.6)	16(72.7)	7(31.8)	15(68.2)	17(77.3)	3(13.6)
	22	I	0	0	2(0.9)	4(18.2)	0	0	0	0	2(0.9)
		R	16(72.7)	4(18.2)	2(0.9)	15(68.2)	8(36.4)	15(68.2)	7(31.8)	5(22.7)	17(77.3)

S: sensitive; I: intermediate; R: resistance; AM: Ampicillin; CRO: Ceftriaxone; CAZ: Ceftazidime; CHL: Chloramphenicol; CIP: Ciprofloxacin; COT: Cotrimoxazole; CN: Gentamicin; NOR: Norfloxacin; TE: Tetracycline

Multidrug resistance of *Salmonella* and *Shigella* species

The overall multidrug resistance (resistant against two or more antimicrobials) of *Salmonella* and *Shigella* spps was 77.3%. The most MDR resistance was recorded among *Salmonella* spps (88.2%), particularly by *S. typhi* (64.7%) followed by *S. paratyphi* (23.5%). 40% of *Shigella* spps were also MDR (Table 3).

Table 3. Multidrug resistance pattern of *Salmonella* and *Shigella* species isolated from stool specimens of asymptomatic food handlers working in Haramaya University, Eastern Ethiopia from August, 2015 to January, 2016.

	Salmonella spps (N=17)			*Shigella*
MDR pattern	*S. typhi*	*S. paratyphi*	Other spps	spps (N=5)
AM, COT	2(11.8)	1(5.9)	0	2(40)
CHL, TE	4(23.5)	2(11.8)	0	0
AM, CHL, COT	2(11.8)	0	0	0
CHL, COT, TE	2(11.8)	1(5.9)	1(5.9)	0
AM, CHL, COT, TE	1(5.9)	0	0	0
MDR by spps	11(64.7)	3(23.5)	1(4.5)	2(40)
Total MDR isolates	15(88.2)			2(40)

Frequency of intestinal parasites

The overall prevalence of intestinal parasites was 25.2%. The commonest isolates were *E. histolytica/dispar* (46.7%) followed by *G. lamblia* (14.3%), *Taenia* species (13.3%), *A. lumbricoides* and (10.5%). About 2.2% of the total participants were infected with two or more types of intestinal parasites (Table 4).

Table 4. Frequency of intestinal parasites isolated from stool specimens of asymptomatic food handlers working in Haramaya University, Eastern Ethiopia from August, 2015 to January, 2016.

Types of parasitic isolates	Frequency	%
A. lumbricoides	11	10.5
E. histolytica/ dispar	49	46.7
G. lamblia	15	14.3
H. nana	8	7.6
Hookworms	5	4.8
Taenia species	14	13.3
Others (*E. coli*, *T. trichuria, S. mansoni*)	3	0.7
Total	105	100

Factors associated with the occurrence of enteric pathogens

The risk factors associated with the occurrence of enteric pathogens (the isolation of *Salmonella, Shigella*, or intestinal parasites) were depicted in Table 5. The age group of more than 40 years [AOR: 5.144, at 96% CI: 1.932, 13.695], no formal education [Adjusted Odds Ratio (AOR0: 3.376, at 96% CI: 1.276, 8.928], more than 5 years of services [AOR: 2.341, at 96% CI: 1.147, 4.779], monthly income of less than 500 Birr [AOR: 3.346, 95% CI: 1.406, 7.963], hand washing after the use of the toilet with water only/ not at all [AOR: 2.6, at 96% CI: 1.307, 5.302] and untrimmed fingernails [AOR: 4.951, at 96% CI: 2.879, 8.516] were the major risk factors for the occurrence of enteric pathogens.

Table 5. Factors associated with the occurrence of enteric pathogens among asymptomatic food handlers working in Haramaya University, Eastern Ethiopia from August, 2015 to January, 2016.

Risk factors	Enteric pathogens		Crude	Adjusted	*P-value*
	No (%)	Yes (%)	OR (95% CI)	OR (95% CI)	
Gender					
Female	242(72.7)	91(27.3)	1.060[0.616, 1.824]		
Male	62(73.8)	22(26.2)	1		
Age group (in years)					
> 40	100(58.8)	70(41.2)	4.041[1.713, 9.534]	5.144[1.932, 13.695]	0.001*
31-40	116(81.7)	26(18.3)	1.313[0.530, 3.253]	1.267[0.460, 3.487]	0.647
21-30	47(81)	11(19)	1.371[0.486, 3.862]	1.300[0.413, 4.093]	0.654
≤ 20	41(85.4)	7(14.6)	1	1	
Educational Status					
No formal education	62(61.4)	39(38.6)	2.586[1.126, 5.938]	3.376[1.276, 8.928]	0.014*
Grade 1-8th	129(72.9)	48(27.1)	1.530[0.687, 3.405]	2.200[0.868, 5.575]	0.097
Grade 9-12th	76(81.7)	17(18.3)	0.920[0.374, 2.258]	1.032[0.372, 2.864]	0.952
≥ 12th grade	37(80.4)	7(19.6)	1	1	
Current marital status					
Married	173(70.9)	71(29.1)	1.277[0.702, 2.323]		
Divorced	46(75.4)	15(24.6)	1.014[0.461, 2.232]		
Widowed	29(76.3)	9(23.7)	0.966[0.386, 2.416]		
Unmarried	56(75.7)	18(24.3)	1		

Table 5. Continued

Risk factors		Enteric pathogens		Crude	Adjusted	
		No (%)	Yes (%)	OR (95% CI)	OR (95% CI)	*P-value*
Place of food establishment						
	Main campus	233(72)	88(27.4)	0.697[0.340, 1.430]		
	CHMS	47(79.7)	12(20.3)	0.471[0.187, 1.190]		
	Chiro	24(64.9)	13(35.1)	1		
Year of service (in year)						
	More than 5 years	174(66.8)	73(33.2)	2.142[1.161, 3.949]	2.341[1.147, 4.779]	0.019*
	1-5 years	88(78.6)	24(21.4)	1.176[0.580, 2.384]	1.421[0.627, 3.218]	0.400
	Less than 1	69(81.2)	16(18.8)	1	1	
Average monthly income in Birr						
	Less than 500	199(68.4)	92(31.6)	3.583[1.648, 8.790]	3.346[1.406, 7.963]	0.006*
	501-1000	20(74.1)	7(25.9)	2.712[0.874, 8.420]	1.558[0.416, 5.835]	0.511
	1001-1500	23(79.3)	6(20.7)	2.022[0.633, 6.460]	2.062[0.535, 7.956]	0.293
	More than 1500	62(88.6)	8(11.4)	1	1	
Hand washing practice before food preparing with soap						
	No	78(70.3)	33(29.7)	1.195[0.739, 1.932]		
	Yes	226(73.9)	80(26.1)	1		
Hand washing after touching body parts/ dirty materials						
	No	144(67.6)	69(32.4)	1.742[1.122, 2.706]	1.187[0.703, 2.004]	0.522
	Yes	160(78.4)	44(21.6)	1	1	
Use of apron/hair tie when cooking/ serving food						
	No	105(67.3)	51(32.7)	1.559[1.005, 2.419]	1.404[0.826, 2.385]	0.210
	Yes	199(76.2)	62(23.8)	1	1	

Table 5. Continued

Risk factors	Enteric pathogens		Crude	Adjusted	
	No (%)	Yes (%)	OR (95% CI)	OR (95% CI)	*P-value*
Hand washing practice after toilet regularly with					
Water only/ not at all	225(72.4)	96(37.6)	2.294[1.258, 4.183]	2.632[1.307, 5.302]	0.007*
Water and soap	79(84)	15(16)	1	1	
keeping short fingernails					
Untrimmed	74(53.6)	64(46.4)	4.06[2.576, 6.399]	4.951[2.879, 8.516]	0.001*
Trimmed	230(82.4)	49(17.6)	1	1	
Hand washing before and after eating food with a soap					
No	67(65)	36(35)	1.654[1.024, 2.672]	1.579[0.880, 2.835]	0.126
Yes	237(75.5)	77(24.5)	1	1	
Medical check-up in the last 6 months					
No	215(70)	92(30)	1.814[1.063, 3.095]	1.710[0.923, 3.168]	0.088
Yes	89(80.9)	21(19.1)	1	1	
Food safety training					
No	213(72.7)	80(27.3)	1.036[0.645, 1.664]		
Yes	91(91)	33(26.6)	1		
Type of job					
Assistance food handler	69(77.5)	20(22.5)	0.676[0.268, 1.707]		
Food handler	214(71.8)	84(28.2)	0.916[0.403, 2.081]		
Waiter	21(80.8)	9(30)	1		

Note:*Statistically significant; OR: Odd ratio; CI: Confidence interval

4. Discussion

To our knowledge, this is the first report in its kind on the prevalence of *Salmonella*, *Shigella* their antimicrobial susceptibility pattern, intestinal parasites and associated factors in Eastern Ethiopia. The prevalence of *Salmonella*, *Shigella* and intestinal parasites is high. The antimicrobial susceptibility pattern of *Salmonella and Shigella* are varied to commonly prescribed antimicrobials in the testing panel. The age, educational status, year of service, monthly income, hand washing practice after the use of the toilet and fingernail status are independent predictors of the occurrence of enteric pathogens.

In this study, the overall prevalence of *S. typhi* was 4.1%. This is comparable to a study conducted in Addis Ababa University, Ethiopia (3.4%) (Fentabil et al. 2014); but, is relatively higher than reports from other part of Ethiopia, such as Debub University Dilla campus (0.93%) (Misganaw & David, 2013), Mekelle University (1%) (Araya et al. 2014) and (3.1%) (Legesse et al. 2014). However, it is lower compared to a study conducted in Arba Minch University, South Ethiopia (6.9%) (Mama & Getaneh, 2016) and Bahir Dar town, Ethiopia (80%) (Bayeh et al. 2010). On the other hand, 1.2% prevalence of *Shigella* species was recorded in this study. This is more than an expected for the occurrence of bacillary dysentery outbreak among the consumers. The prevalence is comparable to report from Sudan (1.3%) (Saeed et al. 2010). But, lower compared to reports elsewhere from Ethiopia such as in University of Gondar (2.7%) (Mulat et al. 2013), Arba Minch University (3%) (Mama & Getaneh, 2016) and Gonder town (3.1%) (Gashaw et al. 2008). The possible explanation for this variation might be due to differences in the sample size (small sample size might overestimate the proportion), geographical variation, socioeconomic condition and the isolation technique.

S. typhi showed high sensitivity to Norfloxacin (80.8%), 72.7% for each of Ciprofloxacin and Gentamicin; whereas resistance to Tetracycline (90.9%), Chloramphenicol (81.8%), Ampicillin (72.7%) and Cotrimoxazole (72.7%). This is comparable to a study conducted in other part of Ethiopia such as in Mekelle University, in which *S. typhi* was 100% sensitive for Gentamicin, Ciprofloxacin and Norfloxacin; whereas, 75% resistance for each of Ampicillin and Tetracycline, and 100% to Chloramphenicol (Araya et al. 2014) and in University of Gonder in which 100% sensitive for each of Ciprofloxacin and Norfloxacin; whereas 50% resistance for each of Tetracycline and Cotrimoxazole (Mulat et al. 2013) indicated that antimicrobial resistance of *S. typhi* is an increasing concern. Antimicrobials that are sensitive against the *S. typhi* can be used for the treatment and management of Salmonellosis. The disagreement among reports might be due to the difference in the technique of isolation and the sample size.

In the current study, *Shigella* species were 80% sensitive for each of Norfloxacin and 80% Ciprofloxacin and 60% to Ampicillin; while 80% resistance to Tetracycline, 60% for each of Chloramphenicol and Cotrimoxazole. This is consistent with a study report in the University of Gonder, Ethiopia, in which *Shigella* species demonstrated high level of sensitivity to Ciprofloxacin (100%) and Norfloxacin (87.5%); while 75% resistance to Tetracycline and Cotrimoxazole (Mulat et al. 2013). But, contradict with a study done in

Arba Minch University, Ethiopia, in which high rate of sensitivity observed to Cotrimoxazole (100%), Chloramphenicol (100%) and Ceftriaxone (100%) (Mama & Getaneh, 2016); whereas, resistance to Ampicillin (61.5%) and Tetracycline (46.2%) in University of Gonder, Ethiopia (Legesse et al. 2014). The variation in the antimicrobial susceptibility pattern might be due to availability and unrestricted use of the antimicrobials without prescription (Asrat, 2008).

The proportion of MDR *Salmonella* spps was 88.2%. This is low compared to the report from Addis Ababa University, Ethiopia (100%) (Addis et al., 2015); but higher compared to a study conducted in Arba Minch University (66.6%) and University of Gonder (46.2%) (Legesse et al. 2014). The rate of MDR of *Shigella* spps was also high (40%). This is low compared to a study conducted in other part of Ethiopia such as Butajira town (53%) (Getachew et al. 2014), Addis Ababa University (100%) (Addis et al. 2015) and Arba Minch University (100%) (Getenet & Haimanot, 2014). The variations in the prevalence of MDR can be explained in two ways. One might be due to the distribution of sensitive or resistant strains of *Salmonella* and *Shigella* species across the county and the other might be due to inappropriate empirical antimicrobial treatment, easy availability and indiscriminate use of common antimicrobials by health professionals and patients.

In this study, the overall prevalence of intestinal parasites was 25.2%. This is in line with a study conducted in Gonder University, Ethiopia (25%) (Mulat et al. 2012). But, it is low compared to previous studies conducted in different part of Ethiopia like in Bahir Dar town (41.1%) (Bayeh et al. 2010), Yebu town (44.1%) (Tefera & Mebrie, 2014), Addis Ababa (45.3%) (Addis et al. 2015) and Mekelle University (52.4%) (Araya et al. 2014). The variation in the prevalence of intestinal parasites might be due to the difference in personal hygiene, environmental sanitation and ignorance of health promotion practices (Moges, 2010).

The most frequently isolated intestinal parasites was *E. histolytica/dispar* (46.7%). This is particularly significant since infected food handlers might be at risk of developing gastrointestinal infections and serve as a sources of pathogens for the students and customers. The finding is consistent with two studies done in Mekelle University, Ethiopia (32.3%) (Araya et al. 2014) and (36.6%) (Daniel & Abera, 2012). But, contradict with other studies done in Ethiopia such as in University of Gonder (Mulat et al. 2012) and Gonder town (Gashaw et al. 2008), in which *G. lamblia* (11%) and *A. lumbricoides* (18.11%) isolated predominantly. The variation in the type of intestinal parasites might be due to differences in sample size, geographical location, environmental and poor food handling practices.

In this study, food handlers infected with enteric pathogens were adults aged more than 40 years (41.2%). The odd of getting an infection is also high among this group (AOR: 5.144, at 95%, CI: 1.932, 13.695). This is almost in line with a study conducted in Mekelle University (Araya et al., 2014), in which a higher proportion reported in the age group of more than 40 years (64%). But, contradict with a study conducted at the University of Gonder, Ethiopia, in which age group 29-39 years (26%) (Mulat et al. 2012) was more infected. This might be attributed to the immune status of the individuals as being the major predisposing risk factor.

In the current study, a higher proportion of enteric pathogens were recorded among food handlers who had no formal education (38.6%). The odd of enteric pathogen isolate also high among those who learned grade 12 and above (AOR: 3.376, 95% CI: 1.276, 8.928). This is lower compared to a study done in Mekelle University, Ethiopia (Araya et al. 2014), in which a high prevalence recorded among food handler learned from grade 11-12 (75%); but lower compared to other studies conducted elsewhere in Ethiopia: in University of Gonder, in which large proportion of enteric pathogens recorded among food handler who learned grade 1-8 (25%) (Mulat et al. 2012) and primary school (35.3%) in Arba Minch (Mama & Getaneh 2016). This might be due to low sample size in each category of educational status.

The proportion of enteric pathogens participants who had more than 5 years' work experience was higher (33.2%) compared to those who served for $\leq$ 1 year (18.8%) [AOR: 2.341, at 96% CI: 1.147, 4.779]. This is in line with a study conducted in Arba Minch University in which food handlers who served for 1-5 years and 6-10 years (32.4%) were more infected (Mama & Getaneh, 2016). But lower compared to a study done in Mekelle University, Ethiopia in which 60% of food handlers served for 1-5 years were infected. The absence of regular medical check-up, food safety training, inadequate supervision and low monthly income of food handlers might contribute to this difference.

Food handlers who earned a monthly income of less than 500 Ethiopian Birr were 3.3 times more likely to be infected with enteric pathogens (AOR: 3.346 at 95%, CI: 1.406, 7.963) compared to those who earned more than 1500 Birr. This is in line with a study conducted in Dangila town, Northwest Ethiopia (Ayehu et al. 2014). The possible reason for this similarity might be those who had monthly income of less than 500 Birr might have low levels of education, poor personal hygiene, poor food handling practice and poor knowledge towards prevention of food borne diseases.

Food handlers who were washing their hands regularly with water only or not at all were 2.6 times more likely to have enteric pathogens (37.6%) compared to those who were washing their hands after the use of toilet regularly with water and soap (16%) (AOR: 2.632 at 95%, CI: 1.307, 5.302). This finding is comparable to a study conducted in Arba Minch University, Ethiopia (30%) (Mama & Getaneh, 2016). In addition, more than half of the food handlers in this study did not wash their hands after touching their body parts and between handling of uncooked food items. This might indicate a lack of awareness about food contamination. This might be explained in terms of low educational status, limited or no sanitary monitoring by responsible body, availability of the facilities used for hand washing and the nature of the working environment (Daniel & Abera, 2012).

Food handlers who had untrimmed fingernails (46.4%) were more likely to have enteric pathogens compared to those who had trimmed fingernails (AOR: 4.951 at 95%, CI: 2.879, 8.516). This might serve as a vehicle to transmit pathogenic organisms from the untrimmed fingernail contents to the foods to be served and then to the customers. This is consistent with a study conducted in Arba Minch University, Ethiopia (Mama & Getaneh, 2016); but contradict with a study conducted in Addis Ababa University, Ethiopia (Fentabil et al. 2014), in which untrimmed fingernails had no association with

the occurrence of *Salmonella*. The probable reason for the variation among reports might be due to differences in socioeconomic status, poor working environment and poor food handling practice.

One of the limitations of this study was that serological grouping on *Salmonella* and *Shigella* spps, which would provide further insight into the distribution of strains was not done. Fingernail content examination, which might increase the prevalence as well as supporting the idea of contamination due to poor food handling practices, was also not performed. Social desirability bias, particularly in hand washing practice assessment is another concern. In spite of all these limitations, the methods used in this study were comprehensive in that it used a series of culture, biochemical tests and concentration techniques for the isolation of *Salmonella*, *Shigella* and intestinal parasites.

4. Conclusion and Recommendations

The isolation of high frequency of intestinal parasites as well as antimicrobial resistant *Salmonella* and *Shigella* in this study is a growing problem and is a major concern. The commonest enteric pathogens isolated are *S. typhi* and *E. histolytica/dispar*. A large number of *Salmonella* and *Shigella* species are resistant to Tetracycline, Ampicillin, Chloramphenicol and Cotrimoxazole. Especially, the occurrence of high MDR *Salmonella* and *Shigella* in the study area is an alarming for the current situation of emerging antimicrobial resistance. Ceftriaxone, Ceftazidime, Norfloxacin, Ciprofloxacin and Gentamicin are the most effective antimicrobials against *Salmonella* and *Shigella* species. Age, education status, year of service, monthly income, hand washing after the use of the toilet and fingernail status are the most independent predictors of the occurrence of *Salmonella*, *Shigella* and intestinal parasites.

Based on the findings of the present study, the following recommendations are made:

- Health education intervention on hand washing and food safety training should be strengthened to ensure food safety during processing, storing and serving for the customers.
- Food handlers should wash their hands after the use of the toilet with a soap and keep short their fingernails.
- Ceftriaxone, Ceftazidime, Norfloxacin, Ciprofloxacin and Gentamycin should be used to treat Salmonellosis and Shigellosis in the study area, and where there are no culture and antimicrobial susceptibility test.
- Antimicrobials such as Tetracycline, Ampicillin, Chloramphenicol and Cotrimoxazole should not be used for empirical treatment of *Salmonellosis* and *Shigellosis* infections.
- Further study is recommended to check the presence of other enteric organisms, serotyping of *Salmonella* and *Shigella* by using a fingernail contents and stool samples simultaneously.

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5. Magnitude, Characterization and consequence of Road Traffic Accidents on the Road between Harar and Dire Dawa, Eastern Ethiopia

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Abstract: A Road Traffic Accident (RTA) is a rampant public health and development challenge in Ethiopia. There is little evidence in regards to the different characteristics of road traffic accidents that has occurred. This study was aimed to characterize the RTA on the way between Harar to Dire Dawa, Eastern Ethiopia. We conducted a cross-sectional study which runs over four months on the way from Harar to Dire Dawa and every road traffic accident that occurred were included. We collected the data in collaboration with traffic police accident investigating team and face-to-face interviews with drivers who survived the accident. Further data were collected by asking eyewitnesses and reviewing medico-legal reports of the accidents occurred. We presented a descriptive analysis to characterize the road traffic accidents that had occurred in the specified period. The study revealed that within a four weeks period, a total of 166 RTAs had occurred on the way between Harar and Dire Dawa. From these, 69 (41.6%) resulted in severe accidents, 56(33.7%) resulted in property damage only, and 41(24.7%) resulted in property damage and minor injury to human being. Majority of the accidents 107(64.5%) occurred on undivided two way road, whilst 38(22.9%) and 21(12.7%) occurred on a divided two way and one way road, respectively. A majority of the accidents 139(83.7%) were collision which involved two or more vehicles. Eighty three (50%) of the drivers reported never used seatbelt whereas (38.6%) and 19(11.4%) of them use it always and only sometimes, respectively. Commercial vehicles contribute the largest (40.4%) to the accidents. Most of the accidents 134(80.7%) occurred in foggy weather condition and surprisingly, most of the accident 110(66.3%) occurred on non-congested road. Road traffic accident is causing a huge damage to properties and loss of human life in eastern Ethiopia. Most of the reasons for the cause of the accidents are really and easily preventable. Interventions that focuses on driver risky behavior, speeding and road safety improvement are essential to avert many of the problems.

1. Introduction

Road traffic accidents (RTAs) are accident that occurred on a street open to public traffic that results in one or more persons being killed or injured, as a result of collisions between vehicles; between vehicles and pedestrians; between vehicles and animals; or between vehicles and fixed obstacles (Amol T 2008). Data from 180 countries, indicates that deaths from road accidents has plateaued at 1.25 million per year, with the highest road traffic fatality rates in low-income countries carrying about 94% of the burden of road traffic injury (WHO 2015). Over 3400 people die on the world's roads every day and tens of millions of people are injured or disabled every year (Alice Nganwa B 2004).

Children, pedestrians, cyclists and older people are among the most vulnerable of road users (WHO 2015, WHO 2002). In order to curb these problems, 17 countries have aligned at least one of their laws in the last three years with best practice on seat-belts, drink–driving, speed, motorcycle helmets or child restraints. Though there has been progress towards improving road safety legislation and in making vehicles safer, the report shows that the pace of change is too slow for what the 2030 Agenda for Sustainable Development launched of halting the global number of deaths and injuries from road traffic crashes (WHO 2015).

In fact, road traffic injuries alone ranked as the number one cause of disease burden among children between 5 and 14 years, and as the number three cause among those in the age group 15 to 29 years (Jha N, Srinivasa DK et al. 2004). Official road accident statistics make a distinction between three levels of injury severity: fatal, serious and slight. In most countries, fatal injuries include all those who die within 30 days of the accident as a result of injuries sustained in the accident. Safety studies depending on data from only police reports to establish injury or crash severity therefore could produce erroneous results (Bryant B, Mayou R et al. 2004).

In Ethiopia, the situation has been worsened as the number of vehicles increased and traffic flow increased. Evidence indicates that the underlying reason for accident in Ethiopia are; improper driver or low skill driver resulting not respecting pedestrian priority, absence of knowledge on road traffic safety, pedestrian not taking proper precaution, mixed traffic flow system, poor vehicle technical condition, poor traffic law enforcement. Poor road network and safety consideration not sufficiently given in roads development including absence of road side warning signs/objects and maintenance (Abebe A 2010). Poor road network; absence of knowledge on road traffic safety; mixed traffic flow system; poor legislation and failure of enforcement; poor conditions of vehicles; poor emergency medical services; and absence of traffic accident compulsory insurance law have been identified as key determinants of the problem (Amol T 2008). Pedestrians and passengers of commercial vehicles are the most vulnerable (Tsegazeab Kebede, Tesfaye Mekonen et al. 2007, Mensour Ousman, Yigzaw Kebede et al. 2003). In addition to the immeasurable personal and social price paid by the victims of road crashes and their relatives, traffic injury has a significant economic impact where the direct and **economic cost of injury and disability result from** **levels of injury severity (Mensour Ousman, Yigzaw Kebede et al. 2003).**

Road traffic accidents are a huge public health and development problem in Ethiopia. Despite this prevailing phenomenon, limited attention has been given to RTA as public health problems. as well; there is a little recognition of the health and economic burden of this problem in our setting. Its current situation requires a high level political commitment, immediate decisions and actions in order to curb the growing problem. The objective of this study was to characterize the road traffic accident in Eastern Ethiopia on the road from Harar to Dire Dawa. So, the finding of this study may be used to alleviate RTA burden as the finding can be utilized by Ethiopian transport and roads authorities.

2. Method and Procedures

2.1. Setting the Study

This study was conducted on one of the main roads of Ethiopia which extends from Harar to Dire-Dawa crossing Awaday, Haramaya, Adelle and Dangago which are small town. This mainly two-way and one lane road has an average width of 6 meters asphalt and covers a total distance of 57 km. It is part of the main route of the country which takes to Jigjiga and Somali land. Moreover, the road has a significant economic importance as the area is known for its popular *Khat* product. The road is used by Isuzu carriage vehicles which travel at high speed to arrive for *Khat* market on time at Dire Dawa, Awaday, Jigjiga and Togo chale towns. Most parts of the road is curvy with trees on road side from Harar, Awaday to Haramaya. Compared to other road networks in the country, the Harar Dire-Dawa road has very curvy, mountainous features (down Dangago) with regard to its alignment. The traffic mix on this road is very diverse, shared by high speed vehicles (Khat carriage Isuzu vehicles), heavy trucks, animal drowns two-and three-wheelers and pedestrians (ERA 2012). Map of Harar Dire Dawa road and Ethiopia was illustrated in Figure 1 below.

Figure 1. Map of Ethiopia and Harar-Dire Dawa Road.

2.2. Study Design and Population

This is a cross-sectional study conducted over four months period (January 2016- April 2016). All RTAs that occurred on the way between Harar Dire Dawa road were included. Drivers who were died and severely injured and had no one else who know about them to provide us data were excluded from the study.

2.3. Data Collection and Measurements

Relevant data on crash related information, road characteristics, vehicle type, weather and light conditions were gathered on the way to Harar, Awaday, Haramaya, Dangago and Dire Dawa by five trained data collectors and professional road traffic crash investigators. The data collectors were stationed at five sites on the road from Harar to Dire Dawa (Harar, Awaday, Haramaya, Dangago and Dire Dawa) with road traffic police. The road traffic accidents occurred on the road were characterized with road conditions, vehicle conditions, weather and time conditions. During the data collection, detailed incident investigations were carried out immediately at the time of the crash, and then additional information were collected through interviewing the drivers. Each road traffic accident occurred on the way was recorded in partnership with road traffic and more data were collected through face-to face-interview with drivers and furthermore observation was undertaken. Then, further information was collected by reviewing medico-legal reports.

Drivers socio-demographic characteristics were collected through face-to-face interview with drivers who survived the road traffic accident. Driver characteristics like alcohol, *Khat* and use of other substances were recorded through interview. Data on alcohol consumption were assessed with verbal aberration of drivers as alcohol breath test was not available for use. For those drivers, severely injured and unable to talk/died proxy interview was used. Vehicle and road characteristics were recorded through observation in collaboration with road traffic police accident investigators. Then, RTA severity was classified into three categories: severe injury (death at the scene or up to one month following an incident); minor injury and property damage (victim hospitalized at least for 24 hr) with damage to property; and property damage only (crash without any human injury).

Data collection tool was adapted from road traffic accident event registry. The study tool contained four parts (driver characteristics, vehicle conditions, weather and time conditions, road conditions). To maintain the quality of data, data collectors were trained for two days and assessed for their understanding on interviewing process and content of the questionnaire. Pre-test was done on the road from Harar to Babile. Daily check-up was made for the completed questionnaire at the submission time. Each completed questionnaire was checked for completeness and consistency during submission at the end of every data collection day. After data collection, study variables were identified.

2.4. Data Analysis

Data cleaning and checking of completed questionnaires were made to check accuracy, consistency and any error identified was corrected. Data entry template was prepared using Epidata version 3.0. The data were entered by trained data clerks and was checked for completeness and consistency and finally exported to SPSS version 16 for analysis. Then result of the study was presented using comparative table, graph and figure. Univariate analyses such as proportion, percentage, ratio, frequency distribution and appropriate graphic presentations besides measure of central tendency were used for describing data.

2.5. Ethical Considerations

The study was ethically approved by Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University, College of Health and Medical Sciences (CHMS). Respondents were informed about the purpose, risk and benefits of the study ahead of data collection. The right of the participants to withdraw from the study at any stage was kept and the name of subjects was not registered on the questionnaire to maintain confidentiality.

3. Results

3.1. Socio-demographic and Drivers' Characteristics

A total of 166 RTA occurred on the road connecting the main cities (Harar and Dire Dawa) in eastern Ethiopia within four months period. Drivers who have survived the accident were interviewed and about 43(25.9%) of them were less than 23 years and a great majority (98.2%) of them were males. More than half of the drivers 87(52.5) attended less than grade eight education level. The mean age of the drivers was 29 years with standard deviation of 8 (Table 1).

Table 1. Socio-demographic and behavioral characteristics of drivers incurred RTA on the road Harar-Dire Dawa, 2016.

Variable	Category	Frequency	Percentage	Mean ±SD
Age of Drivers	<23	43	25.9%	29 ± 8
	24-35	98	59.0%	
	36-50	23	13.9%	
	>51	2	1.2%	
	Total	166	100%	
Sex	Male	163	98.2%	
	Female	3	1.8%	
	Total	166	100%	
Educational Status	Less than grade 8	87	52.5%	
	Secondary school completed	62	37.3%	
	Diploma and above	17	10.2%	
	Total	166	100%	
Alcohol	Yes	8	4.8%	

	No	158	95.2%
Khat chewing	Yes	29	17.5%
	No	137	82.5%
Cigarette	Yes	18	10.8%
smoking	No	148	89.2%
Hashish use	Yes	6	3.6%
	No	160	96.4%

3.2. Seatbelt Use and Driving Related Conditions

From the interview made with the drivers we identified that half 83(50%) of the drivers self- reported they never use seatbelt or use only to escape traffic police and 64(38.6%) of them use always and 19(11.4%) use only sometimes. Most of the road traffic accidents 145(87.3%) occurred on familiar road while 21(12.3%) occurred on unfamiliar road. Twenty two (13.3%) of the drivers self-reported they have used cell phone while driving and 144(86.7%) of them claimed that they didn't used cell phone while driving. More than half 89(53.6%) of the drivers had less than five years driving experiences 59(35.5%) had 5-10 years experiences and 18(10.8%) had more than ten years of driving experiences.

3.3. Severity Status of the Accidents

RTA severity was assessed in collaboration with road traffic accident investigators and classified into three categories as severe injury, minor injury with property damage and property damage only (crash without any human injury). From the total of 166 RTA cases recorded over four months period over 57km road, 56(33.7%) were only property damage, 41(24.7%) were property damage plus minor injury and unfortunately, 69(41.6%) were severe accidents (Figure 2).

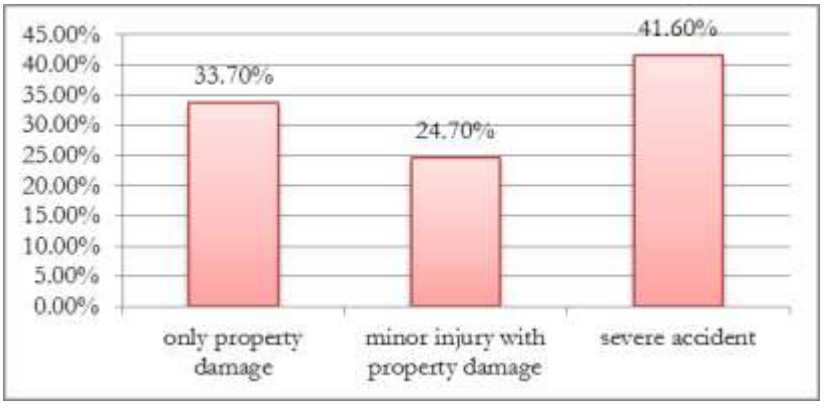

Figure 2. Road traffic accident severity on Harar to Dire Dawa road, 2016.

3.4. Vehicle Characteristics

As indicated in Figure 3 below, 71(42.8%) of the vehicles involved in crash were two and three wheelers (Bajaj taxi, bicycle and motor cycle) and 36(21.7%) minibus and van,

15(9%) medium truck, 12(7.2%) heavy truck, 12(7.2%) pickup, 9(5.4%) medium and large bus and 4(2.4%) were others.

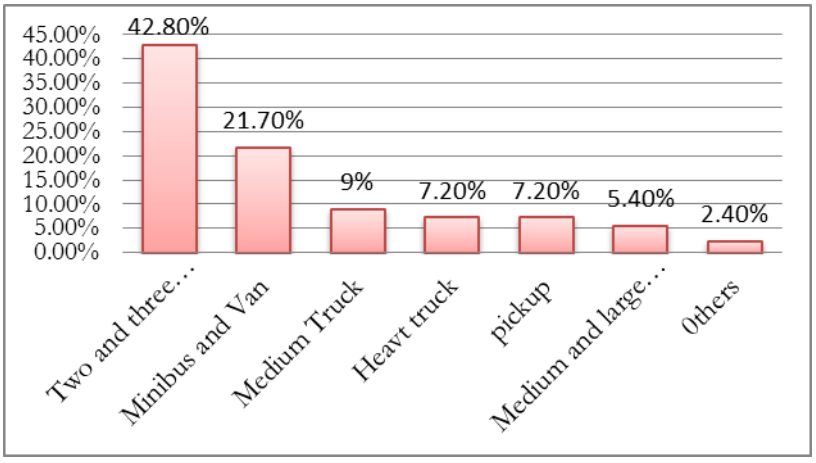

Figure 3. Types of vehicles involved/incurred accident on Harar to Dire Dawa, 2016.

Of the 166 vehicles involved in accident, only 13(7.8%) of them were found to have technical defect and 153(92.2%) were found to have no technical defect. As portrayed in Table 2 below, vast majority of the accidents 139(83.7%) were collision/ at least two or more vehicles were involved and the remaining 27(16.3%) were noncollision/ involved only single vehicle. One hundred one (60.8%) of the accidents occurred while the vehicle was going street ahead. Vast majority of the collision 107(64.5%) occurred heads-on and the remaining 29(17.5%) and 2(1.2%) occurred front-rear and front-side respectively. In regards to the mode of accident, majority 139(83.7%) of it was collision mode. Most of the vehicles accounted for RTA were commercial vehicles 67(40.4%) followed by taxi which constitute 66(39.8%). It was observed that 79(47.6%) of the vehicles were found posted above 60km/hr and the remaining 87(52.4%) found posted speed less than 60km/hr.

Table 2. Vehicle characteristics, incurred RTA on the Harar-Dire Dawa road, 2016.

Variable	Category	Frequency	Percentage
Mode of accident	Collision	139	83.7%
	Falling of vehicle	12	7.2%
	Run over	5	3%
	Over turning	5	3%
	Being knocked down	3	1.8%
	Vehicle hitting stationery object	2	1.2%
	Total	166	100%
Vehicle maneuver	Going street ahead	101	60.8%
	Crossing Road	57	34.3%
	Others	8	4.8%
	Total	166	100.0%
Vehicle Load	Over loaded	50	30.1%
	Not over loaded	116	69.9%

	Total	166	100%
Vehicle Category	Taxi	66	39.8%
	Van	18	10.8%
	Commercial	67	40.4%
	government owned	15	9.0%
	Total	166	100%
Speed	Above limit	79	47.6
	In a limit	87	52.4%
	Total	166	100%

3.5 Road characteristics

Huge number of accidents 107(64.5%) occurred on undivided two way narrow road whilst 38(22.9%) and 21(12.7%) occurred on divided two way and one way road respectively (Figure 4). As of road alignment is concerned 101(60.8%) of the accident occurred on straight road and the remaining 65(39.2%) occurred on curvy road. Vast majority 138(83.1%) of the accident occurred on 'asphalt' road and 22(13.3%) occurred on 'pista' road and 6(3.6%) occurred on 'coble' road. Huge number 143(86.1%) of accidents occurred on damaged road and only 23(13.9%) occurred on non-damaged road.

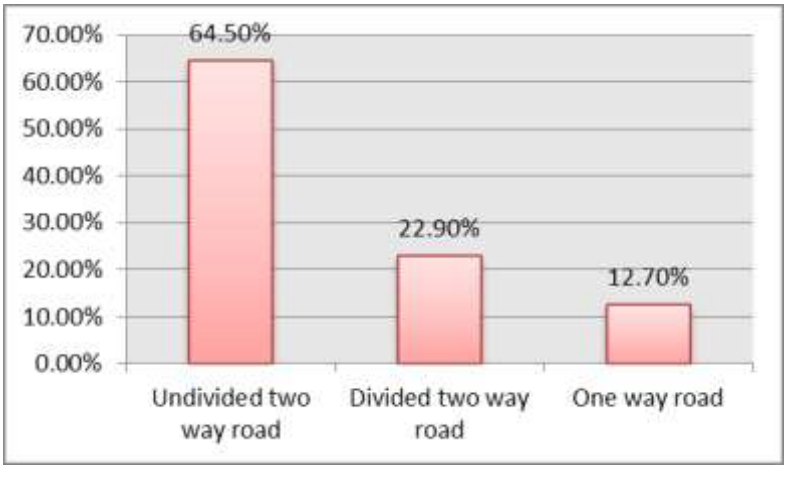

Figure 4. Road characteristics and RTA on Harar to Dire-Dawa road, 2016.

3.6. Weather and Timing Conditions

Most of the accidents 134(80.7%) occurred in foggy weather condition whilst 25(15.1%) and 7(4.2%) occurred in rainy and clear weather condition, respectively. In regards to the light condition, amazingly 122(73.5%) of the incident occurred in day light while only 35(21.1%) and 9(5.4%) occurred in night with street light and night without street light respectively. Surprisingly most of the accident 110(66.3%) occurred on non-congested road while 56(33.7%) occurred on congested road. As time condition is concerned 87(52.4%) of the accident occurred after 1:30PM and the remaining 79(47.6%) occurred before 1:30PM. The highest number of accident 45(27.1%) occurred on weekend day

(Saturday) and 22(13.3%) of RTA occurred on Monday, 33(19.9%) on Tuesday, 18(10.8%) on Wednesday, 14(8.4%) on Thursday,13(7.8%) on Friday and 21(12.7%) occurred on Sunday.

4. Discussions

A total of 166 RTA cases which occurred on the road between Harar and Dire Dawa over four months period were characterized in this study. A vast majority, 98.2%, of the drivers incurred accident were males which similar to what was reported from India where 82.5% of the victims were males and the rest accounts females (Khare Neeraj, Gupta Sanjay K et al. 2012). More than half 59% of the drivers were in the age range of 24 to 35 years which is similar with study reported from India. This could be due to reduced concentration from *khat* and other substance addiction in this age group (Maj S, Pathak m et al. 2 0 1 4).

From the total of 166 accidents occurred, 69(41.6%) were severe accident. This is in line with study conducted on the way Addis Ababa to Hawassa (Teferi Abegaz, Yemane Berhane et al. 2014). Study from Tanzania and Ethiopian Road Transport Authority, National Road Safety Coordination Office report were also in support of this finding where the vast proportions of crash injuries were severe (NRSCO 2006, Phillipo L Chalya, Joseph B Mabula et al. 2012).

Our study revealed that half of the drivers incurred RTA self-reported that they never use seatbelt. Study conducted on Hawassa to Addis Ababa road also reported that severe kind of accidents are associated with non- use of seatbelt and this is in support of our finding (Teferi Abegaz, Yemane Berhane et al. 2014). Time and day factors are important in occurrence of RTA. Our study revealed that more than half of the accident occurred after 1:30Pm and the remaining occurred before 1:30 P.M. Maximum number of accident was recorded during weekend. This is due to high traffic flow and less driver concentration in the afternoon. Studies from India indicate that maximum number of accidents occurred in between 3 and 7 P.M (44.16%) followed by between 7 and 11 A.M (24.16%) and Weekends 3 to 7 P.M recorded the maximum RTA cases. This is in line with what our study revealed (Badrinarayan Mishra and Nidhi D Sinha 2010, Nilambar Jha, Srinivasa DK et al. 2004).

Most of the accident 80.7% occurred in foggy weather condition whilst 15.1% and 4.2% occurred in rainy and clear weather condition, respectively. With respect to light condition, 73.5% of the incident occurred in day light while 21.1% and 5.4% occurred in night with street light and night without street light, respectively. From study conducted in India, it was observed that 269(81.66%) RTA occurred in rainy and cloudy conditions which is in support of this finding (Badrinarayan Mishra and Nidhi D Sinha 2010). Ethiopian based study also identified environmental related conditions, rainfall and driving at night time in the absence of street light as determinants of crash and crash severity (Teferi Abegaz, Yemane Berhane et al. 2014).

Vast majority of the accidents, 139(83.7%) were collision/involved two or more vehicles and the remaining 27 (16.3%) were non-collision type. One hundred forty-three (86.1%) and 23(13.9%) of the incidents occurred over damaged and non-damaged road

respectively. According to Indian and Ethiopian study, majority of accidents were collision type and this is in support of our finding. (Mensour Ousman, Yigzaw Kebede et al. 2003, Badrinarayan Mishra and Nidhi D Sinha 2010). Another Indian based study reported that being knocked down was the common mode of RTA followed by falling off vehicles (Nilambar Jha, Srinivasa DK et al. 2004). This discrepancy could be explained by difference in road design and land topography.

The study finding revealed that two and three wheeler vehicles were mainly involved in RTA followed by minibus. Trucks and buses were less commonly seen encountering RTA. Indian based study revealed that bicycles, trucks and buses accounted more in the road accidents. This is in support of our finding. But, the proportion of truck and buses involved in RTA were less in our finding and this is probably due to the difference in vehicle proportion (Nilambar Jha, Srinivasa DK et al. 2004).

Social desirability bias and fear of legal consequences may have been affected the research finding. Research methodologies involving self-reported measures depend largely on individuals' memory and recall bias may exist. Self-reported assessment of driver alcohol use may have introduced bias and alcohol test which was already in use at the capital Addis Ababa need to be implemented. The study could have not included those RTA cases which have escaped investigation due to fear of medico-legal consequences.

5. Conclusions and Recommendations

The burden of road of traffic accidents is high which is largely associated with narrow defective road and mixed traffic flow. High proportion of the accident was severe/fatal. Commercial vehicles mainly experienced the road traffic accidents. Intervention which targets the driver risky behaviours, speeding and road safety improvement is vital. Enforcement of traffic rule and regulations need to be focused with road safety improvement at large and national level.

6. Acknowledgement

We would like to thank Haramaya University for financing this study. We also extend our gratitude to traffic police officers involved in the study.

7. Authors' Contributions

LN led the proposal development, data collection, data analysis and write up. YD also actively participated in proposal development, data collection, analysis and write up of the paper.

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6. GIS Based Malaria Risk Analysis, Characterization and Mapping In Erer District Eastern Ethiopia

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Abstract: Malaria is one of the major public health problems in Ethiopia. Despite much research in the identification of areas with malaria, it is urgent to further investigate mapping techniques to achieve better approaches to prevent and eradicate the mosquito and the illness eventually. The research was aimed at characterizing and deriving a predictive model for malaria risk in Erer district Eastern Ethiopia. Malaria hazard, elements at risk and vulnerability were the three risk factors used in the model to create the malaria geo database. Malaria hazard was approached from temperature, rainfall, elevation, slope, proximity to road and distance to water body variables. The hazard factors were then weighted using a pair wise comparison matrix in the analytical hierarchy process module. The element at risk was analyzed from land cover perspective while the vulnerability was assessed taking health facility distribution in to consideration. Each factor in the hazard, vulnerability and elements at risk were classified and reclassified in accordance to their effect on malaria incidence. The malaria prediction model was then prepared by combining the three risk factors (Hazard, Elements at risk and vulnerability/Accessibility index) using raster calculator in ArcGIS10.5. Results showed that 19.92%, 27.96%, 32.35%, 18.93% and

0.82% of the district were very high, high, moderate, low and very low malaria risk areas respectively. The temporal and spatial malaria trend of the area was found to be variable. More over villages which are found along the major streams in the district were at high risk to malaria incidence.

Keywords: GIS; Malaria risk factors; Multi criteria evaluation; spatial modelling

1. Introduction

Malaria caused by plasmodium parasite infection is one of the vector born diseases in the world. Globally, 300–500 million episodes of malaria illness occur each year, resulting in over one million deaths WHO (2015). More than 90% of the worldwide deaths from malaria occur in sub-Saharan Africa. It is one of the most serious diseases to affect people in developing countries with tropical and subtropical climates. It is endemic in 109 countries and more than three billion of the world's population lives in malaria risk regions. Approximately 80% of malaria deaths are concentrated in just 15 countries, mainly in Africa WHO (2013).

According to sources from the Ethiopian Ministry of Health (2009), 75% of the country is malarious with about 68% of the total population living in areas at risk of malaria. Malaria is a risk in the western and eastern lowlands and central midlands. The document further indicates that millions of people get sick and tens of thousands of people die due to malaria every year, and that rates of mortality and morbidity dramatically increase during epidemics. Spatially, there are areas where the risk of malaria is high and there are areas where the risk is low.

It was found that Erer is one of the districts in Ethiopia where the first malaria transmission season occurs. Malaria is a reason for high morbidity and mortality in the district. Impact of different water bodies resulted from seasonal rainfall, and the low lying terrain of the area were considered to be the reasons for the breeding of mosquito and prevalence of malaria. The malaria prevention and control system in the area is based on number of malaria cases reported from different kebels, procedure which is time taking and lacks early response in times epidemics happen which would result in damage of life. Therefore, integrative approaches that take the environmental, socioeconomic, demographic, physical factors into account are needed to effectively reduce malaria burden. Although the focus on malaria risk has increasingly gained ground, little emphasis has been given to develop quantitative methods for assessing malaria risk and vulnerability in a temporal and spatial perspective. The general objective of the study was therefore to characterize and spatially model malaria risk using GIS.

Specifically, it is aimed to identify the physical, environmental and socio economic factors which contribute for malaria hazard and risk, to characterize the temporal & spatial malaria trend of the district, to identify malaria copying mechanisms of the community in the area and to map/model potentially malaria risk areas for preventative intervention. GIS based multi criteria decision methodology was employed to map the potential malaria hazard and risk of the area as used by Abbas *et al,* (2015). Risk factors

were grouped in to three namely hazard, elements at risk and vulnerability. Simple additive weighting and their derived weights in raster calculator was used to drive the risk model. In addition, the malaria copying strategies of the community was analysed using descriptive analysis whereas malaria trend was analysed through time series analysis methods. Results showed that 20% of the total coverage of the area was under very high risk of malaria.

2. Research Methodology

2.1. Description of the Study Area

2.1.1. Location

Erer is one of the districts in the Somali National Regional State of Ethiopia. It is bordered on the south by Dire Dawa administration and the Oromia national regional state, on the southwest by Afdem, on the northwest by the Afar National regional state and on the east by Shinile. It is found between 10^0 15'N and 41^0 30'E. The average elevation of the district is 824 meters above sea level. The track of the Addis Ababa - Djibouti Railway crosses the southern part of this woreda along the lower slopes of the Amhar Mountains.

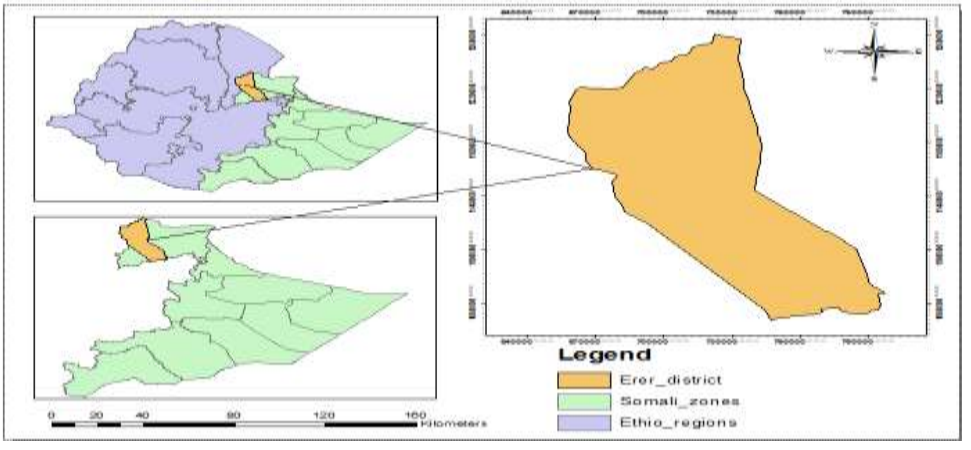

Figure.1. Location map of the study area.

Source: CSA, 1997.

2.2.2. Physical Characteristics of the area

Topography: Altitude (elevation above sea level) is one of the most important factors that determine the pattern of malaria transmission in Ethiopia. In the study area, it varies from 2057 to 343 m. Altitude influences the distribution and transmission of malaria indirectly, through its effect on temperature. As it increases, temperature decreases, so highlands are colder and lowlands are warmer. Slope is also an important habitat characteristic for many species because steeper slope does not favor plant and animal dwelling relative to gentle slopes.

Climate: Climatic factors greatly influence the pattern and level of malaria transmission in Ethiopia, in Africa and the world. The most important climatic factors that directly affect malaria transmission are temperature, rainfall and humidity. The right amount of rainfall is often important for mosquitoes to breed. In the study area, water collections that support vector breeding appear mainly after the rains, and, therefore, malaria transmission is highest following the rainy season.

Soil: Based on the Food and Agricultural Organization (2006) soil classification system, the study area consists of five soil types namely Fluvisols, Regosols, Andosls, Lithosols, and Rock surface.

Water body: Big and small water-related development projects, such as irrigation channels, dams and ponds, can increase the incidence of malaria in villages that are located near such projects. Agricultural development, particularly the use of irrigation, creates breeding sites for malaria mosquitoes, leading to increased malaria transmission.

2.2.3. Demographic and socio-economic characteristics

Based on the 2007 national census conducted by the Central Statistical Agency (CSA), Erer Woreda has a total population of 118,381 with an increase of 9.97% from the 1994 census, of the total population, 60,934 are men and 57,447 women that comprise 51% and 49% of the total population, respectively. About 17,575, (14.85%) of the population of the woreda live in urban area. It has a population density of 150.64 persons per square kilometer. Growth of population is another factor in the determination of health events such as epidemics of malaria. When population rapidly increases, it opens doors to new habitats for the malaria vector.

Health facility distribution

There are about 20 health facilities in the study area from which 4 are health centers and the remaining 16 are health extension posts. To identify the spatial distribution of health centers within the study area, point data were collected using GPS on field survey. The existence of health center/post does have an influence on the spread and management of malaria in case of epidemics.

Economic activities

Agro-pastoralism is the frequently practiced means of livelihood in the district. The rural households are being engaged in pastoralism and irrigation for the production of cash fruits such as lemon, orange, and Chat through irrigation. Orange is the most common cash fruit which is produced in the district. Irrigation is practiced along Erer, Tebe and Idora which are the three major rivers in the district. Petty trade, labor wages and off farm activities is also some of the means livelihoods in the district.

3. Methodology

3.1. Sources and Methods of Data Collection

Both primary and secondary data were used in the study. Primary data were collected from the key informants and sample respondents. The primary data were supplemented by secondary data sources such as documents from Erer woreda health office, satellite imageries. Climatic data which constitute temperature and rain fall of the study area were taken from National Metrological Service Agency (NMSA). Topographic data such as elevation and slope were taken from Aster DEM. Other input data were collected from different government offices, field survey, observations, and focus group discussions were undertaken with health experts.

Questionnaires were distributed to the selected 136 respondents so as to gather all relevant information about the outbreak of malaria and the coping mechanisms in the woreda. Key informant interviews were also conducted so as to get detailed information about the characteristics of malaria and its coping mechanisms as well as its severity. Garmin GPS 62 was used to collect locations and conditions of health centers and posts in the study area. It was also used in land use land cover classification validation.

3.2. Sample Size and Sampling Technique

In this study, a multi-stage sampling method was used to select respondents. Erer district is purposively selected based on its low lying nature, suitability to mosquito breeding and frequency of extreme climatic conditions. Based on the existence of high malaria cases and their proximity to water bodies Erer, Dimtu, Kentras, and Bella kebeles were purposively selected. Therefore, as per the data which is obtained from Erer district health center, Erer, Dimtu, kentras and Bella kebeles have 2150, 1234, 1362 and 1457 households, respectively.

The sample size determination from the study kebeles was based on the simplified formula given by Jeff (2001).

$$n = \frac{X2NP(1-P)}{d2(N-1)+X2P(1-P)} = \frac{3.841x6203x0.1(1-0.1)}{(0.05)2(6203-1)+3.841x0.1(1-0.1)} = 136 \text{ hhs}$$

Where:

n = required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size

P = the population variability (assumed to be 0.10 since the population is homogeneous in terms of elevation, similar social class and similar economic activity (cash economy).

d^2= the degree of accuracy expressed as a proportion (0.05).

On the other hand, in order to determine the number of sample (respondents) from Erer (S1), Dimtu (S2), Kentras (S3) and Bella (S4), the following formula was used.

$Sn = (N_s / N) * n$

Where Sn is the sample size for kebele S, N_h is the population size for kebele h, N is total population size, and n is total sample size.

Hence, S1= (N1/ N) * n = (2150/6203)136 = 47 hhs

S2= (N2/ N) * n = (1234/6203)136 = 27 hhs

S3= (N3/ N) * n = (1362/6203)136 = 30 hhs

S4= (N4/ N) * n = (1457/6203)136 = 32 hhs

Finally, the study population is found to be homogenous in in terms of geography, social class and economic activity (cash economy) so that a simple random sampling method was employed to select the sample households

3.3. Data Analysis Methods

Descriptive analysis was used for characterizing the prevalence of malaria in the district. The household survey data was descriptively analyzed to identify the malaria outbreak conditions and examine the copying mechanisms of the local community. Time series analysis methods were employed to understand the malaria trend of the area. Ten (10) years malaria cases report was obtained and the trend was determined.

GIS-based multi-criteria decision analysis which involves the utilization of geographical data, the decision maker's preferences and the combination of the data and preferences according to specified decision rules was used in this study as described by Malczewski (2006). The first step in multi criteria decision making is setting the goal/define the problem. Then follows determine the criteria (factors/constraints). After setting the criteria factor standardizing setting the suitability values of the factors to a common scale to make comparisons possible. The next stage used in MCA was to determine the weight of each factor using Analytic Hierarchy Process. The analytic hierarchy process is a decision-making method for prioritizing alternatives when multiple criteria must be considered. A matrix is constructed, where each criterion is compared with the other criteria, relative to its importance, on a scale from 1 to 9. Where 1 = equal preference between two factors; 9 = a particular factor is extremely favored over the other as given by Hong *et. al*, (2000).

Simple additive weighting which is based on the concept of a weighted average in which continuous criteria are standardized to a common numeric range, then combined by means of a weighted average was used to aggregate all the criteria to give the overall malaria hazard and risk mapping. The total score for each alternative was obtained by multiplying the weight assigned to each attribute by the scaled value given for that attribute and then summing the products over all attributes. Both Malaria Hazard and risk were computed by weighted linear combination using the following formula $\sum wixi$ and $R= \sum wixi$, respectively, Where, H- the composite hazard score, R – is the composite risk score, xi –is factor scores (cells),wi is weights assigned to each factor and $\sum$ -- is sum

of weighted factors. Malaria risk of the district was analyzed from the following general risk equation.

Risk = (Elements at risk)*(Hazard)*(Vulnerability)

To run MCE, the selected factors of elevation, slope, temperature, rainfall, distance to water body and distance to road, land cover (elements at risk) and health facility distribution (Vulnerability index) were developed. They were classified and reclassified to give them common scale. Next, weighted overlay technique using AHP extension in IDRISI and ArcGIS was used to generate malaria hazard model. For vulnerability analysis, health facilities were taken to generate distance to health center factor. Land cover map was used to generate element at risk factor map. Finally, malaria risk model of the district was generated in ArcGIS 10.5 using spatial analyst/ raster calculator tools. The risk map produced from the overlay analysis of the district was subjected to very high, high, moderate and low and very low malaria risk areas.

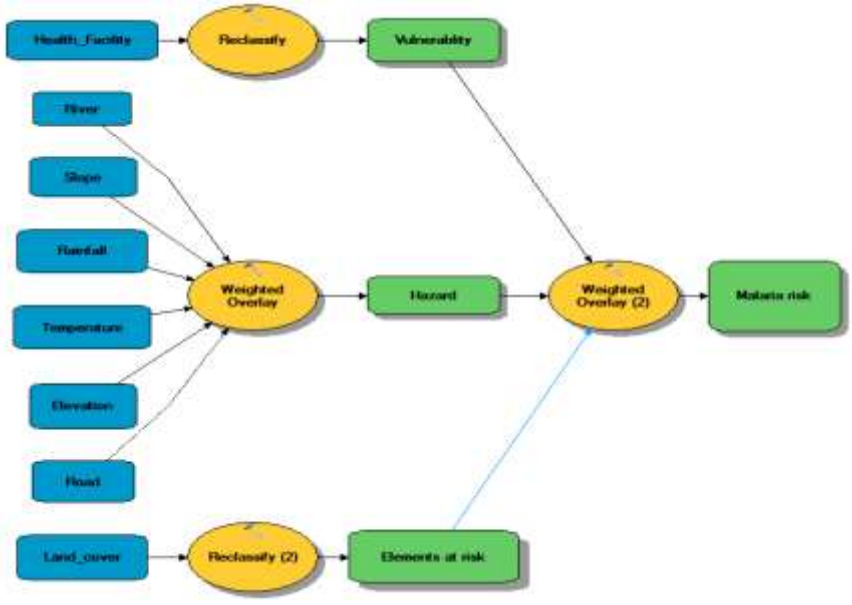

Figure 2. Malaria risk model framework.

4. Results and Discussions

4.1. Socio Demographic Characteristics of Respondents

This sub-section provides a baseline socio-economic data of the area understudy in which the some of the findings should be viewed.

Table 1. Socio demographic characteristics of respondents.

Socio-demographic variables	Variable classification	Frequency	Percentage
Sex of households	Male	116	85.3
	Female	20	14.7
	Total	136	100
Age group	15 -30	39	28.7
	31 -65	86	63.2
	Above 65	11	8.1
	Total	136	100
Educational status	Illiterate	35	25.7
	Able to read and write	61	44.9
	Primary education	29	21.3
	Secondary education	11	8.1
	Total	136	100

Source: Own Survey (2016).

As illustrated in the above table, 85.5% of the sample respondents were male whereas the remaining 14.7% were female headed households. The distribution of respondents according to their age group shows that majority of the sample respondents (63.2%) were found between 31 and 65 years of age. As far as their education level was concerned, 44.9% of them can read and write, a quite small proportion of them (8.1%) attended secondary school, 25.7% hardly got an education opportunity, and 21.3% of them had access to primary schools.

4.2. Malaria Outbreak and Coping Strategies of the Communities

As per the data which is obtained from the district health bureau, malaria is an endemic but periodic disease in the district. The period of severity of the disease is between May and September every year. However, an epidemic is also rarely observed in some parts of the district. It is also found that plasmodium phalciparum is the dominant malaria type which accounts 99% of the malaria type in the area. Plasmodium vivax which accounts the remaining 1% is also the very rarely observed malaria type in the area. The major cause of the disease is seasonal rainfall and standing waters resulted from the frequently practiced irrigation activity in the area. Kebeles which are found along the major rivers in the district are the highly vulnerable areas to malaria. All age groups are affected by the malaria incident in the district. However, the ones which are highly vulnerable to and affected by malaria are pregnant women, old age and children under 5 years old. The severity of malaria in the district is rated as medium.

Though this problem is prevalent in the study areas, all households are not taking the same measure to overcome it. The above data showed that mixtures of the aforementioned coping strategies are being practiced in the woreda. However, according to the order of importance, majority of them (88.7%) reflected that distribution of mosquito net is the most widely practiced coping strategy in times of the outbreak then followed by Environmental sanitation campaigns (by 85% of households) such as

removing grasses and filling of water ponds or avoiding standing water. According to the officials of the district health bureau, priority is always given to children under 5 and pregnant women whenever mosquito net is distributed. This is due to the fact these two groups of population are the highly vulnerable groups to malaria in the woreda. Another preventive measure which is frequently practiced in the woreda is spraying of buildings with anti-mosquito chemicals (67%).

Key informants interview results further indicated that the anti-mosquito spray of buildings is also conducted twice a year. The mosquito net is also soaked or dipped every six months in the woreda. According to the woreda health experts, mobile health cares are also other immediate but important strategies to overcome the outbreak of malaria.

It is also further elaborated that early treatments such as soaking or dipping of mosquito net in a liquid to kill the mosquitoes, treating standing water with larvicides, avoiding standing water, cutting long grasses and mass awareness creation activities are found to be the most important measures in the woreda. However, some households are found to be practicing nothing and not taking any measure for the reason that they are never infected by the disease.

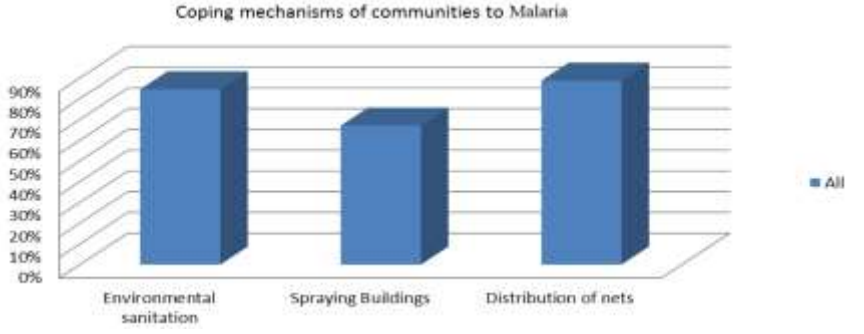

Figure.3. Copying mechanism of households to malaria.

4.3. Trends of Malaria Cases in Erer

As per the data which is obtained from Erer district (2017) Health bureau, malaria cases are currently being declining with some irregularities relative to the past. This is partly due to the frequently taken preventive measures such as spraying buildings with anti-mosquito chemicals, environmental sanitation campaigns, such as removing grasses and filling of water ponds, distribution of mosquito nets and providing mobile health services.

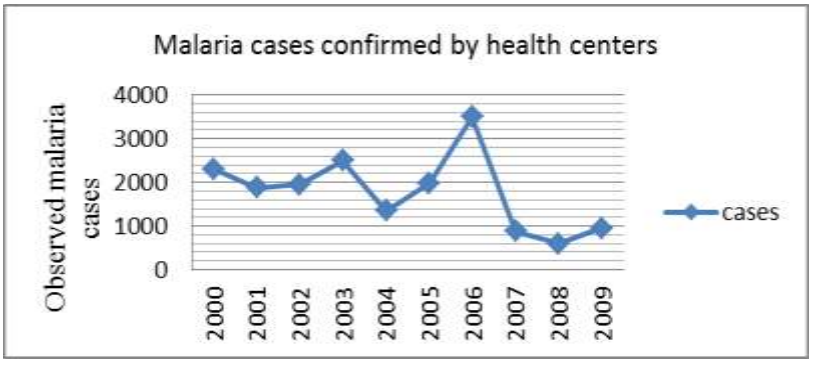

Figure 4. Trends of malaria disease of Erer district.

The same source further indicated that the peak malaria transmission and severe season in the woreda is from May to September. Hence, the higher malaria cases are usually observed during the lowest rainfall months. In the last ten years, the maximum malaria case was recorded during 2006 E.C whereas the minimum case was observed during 2008 E.C.

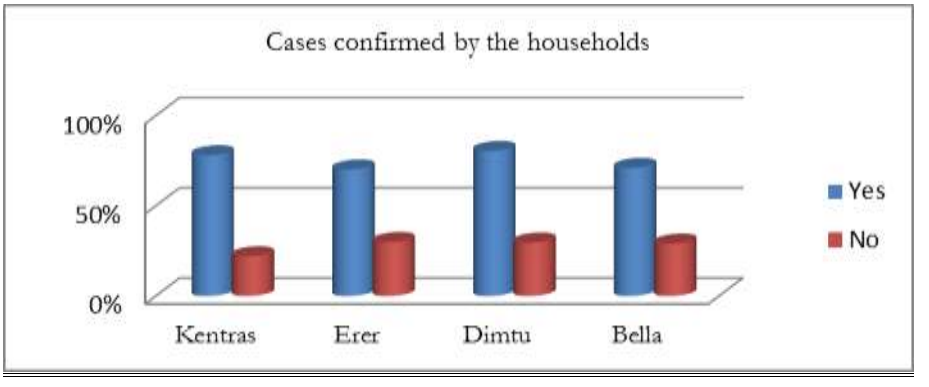

Figure 5. Malaria cases confirmed by households.

As clearly illustrated in Figure 1, malaria knocked majority of the sample respondents across all surveyed study kebeles. About 78%, 70.1%, 80.4% and 71% of the sample respondents of Kentras, Erer, Dimtu and Bella kebeles, respectively confirmed that their families were affected by malaria and the remaining proportion of the surveyed households indicated that they were not affected by malaria. This might be as a result of the proper usage of the mosquito nets and some of the actions by the government to prevent the outbreak of the incident. It is also found that almost all of the surveyed respondents reflected that malaria is the major problem and the most prevalent disease in the district.

4.4. Malaria Hazard Analysis and Discussion

Hazard is the probability of the occurrence of mosquitoes infective with malaria in a certain area. It was approached by assessing the suitability of environmental and physical

conditions for malaria transmission. The following variables of elevation, slope, distance to water body, distance to road, temperature and rainfall were considered to develop the hazard.

4.5. Eelevation Hazard Analysis and Discussion

Elevation is an important factor when determining the overall risk for malaria transmission because it determines the amount of temperature, which in turn affects mosquito breeding. In Ethiopia, areas which are found below 2,200 m are highly affected by various type of vector born disease like malaria. UNICEF, (2008) states that areas found above 2,200 m are considered to be malaria free. But other researcher agreed that the areas located between 1000-2000 m are mostly vulnerable for malaria. Currently, the area up to 2,500 m which were previously malaria free, are included under malarious (Zewge, 2016). Low elevations pose a higher risk because temperatures are generally warmer at lower elevations, resulting in a quicker life cycle and more breading for mosquitos. High elevations are often colder, resulting in fewer mosquitos.

Table 2. Elevation Hazard.

Elevation Values	Value	Area(Km²)	Per Area (%)	Hazard
343-651 m	3	3121.220	23.45	Very high
651 -996 m	2	6047.500	45.43	High
996 – 2050 m	1	4140.340	31.10	Moderate

As can be seen from the above table (Table 2) elevation of Erer district spans from 343 m to 2050 m above mean sea level. This altitude was reclassified based on malaria prevalence at different altitudes as given by UNICEF (2008). It is reclassified in to three classes and values were assigned to each class. Based on this classification, 3, 2 and 1 values were given to elevation ranges of 343 -651 m, 651-996 m, and 996-2,050 m, respectively. These values were associated with malaria risk levels of Very high, high and moderate respectively. It was found that 3121.220 km² or 23.34% of the district fall under very high malaria hazard taking elevation as parameter/variable.6047.500 km² or 45.43% of the area was found to be at high malaria hazard while the remaining 4140.340 km² or 31.10% was at moderate elevation to malaria incidence.

4.6. Slope Hazard Analysis and Discussion

According to Moss *et al.* (2011), slope is an important habitat characteristic for many species. Steeper slope does not favor plant and animal dwelling relative to gentle slopes. Since stagnant water is a great breeding ground for mosquitos, low slopes were more likely to have higher risk of malaria because it allows water to pool. Areas on flat ground are most likely to accumulate and dam rain water thereby increasing the risk of malaria. The slope of the area was derived from the elevation of the district. It was generated using surface tool box in the spatial analyst extension of ArcGIS 10.3. As can be seen

from the table below much of the area is found in low lying area that insignificant score was given to that slope.

Table 3. Hazard analysis to slope.

Slope Values	Value	Area(Km²)	Per Area (%)	Hazard
< 13%	1	960	7	High
13 – 26 %	2	3292	24	Moderate
26 – 69%	3	9456	68	Low

The above table shows slope suitability for mosquito breeding. 9456 km² or 68% of the area was found to be low, 3292 km² or 24% moderate and 960 km² or 7% high hazard areas for malaria incidence with respect to slope of the area. This is because gentle slopes could a source of water collections.

4.7. Distance to Water Body

Distance to water sources such as rivers, is a very important part of the analysis since malaria is a water related disease. This is because it is transmitted via mosquitos which tend to breed near water bodies. Therefore, according to (Worku, 2016) the closer one is to water bodies, the higher the risk for malaria transmission. As the table below indicates areas less than 1.5km were considered to be at high risk, 1.5-5 km moderate risk and areas with >5km are with low risk of malaria hazard.

Table 1.Distance to water body.

Distance Values	Value	Area(Km²)	Percent Area (%)	Hazard
< 1.5km	3	3020.61	22.15	High
1.5 - 5km	2	8128.03	59.62	Moderate
>5km	1	2485.80	18.23	low

Proximity to water body was generated by using Euclidean distance calculation in spatial analyst tools, and new values were assigned as 3, 2, 1 as can be observed from the above table. Then reclassified raster was subjected to be high, moderate, and low malaria hazard levels, respectively. Table 3 also identifies 22.15% or 3,020.61 km² of the district is located under high risk 59.62 % or 8,128.03 km² under moderate risk to hazard and 18.23% or 2,485.80 under low risk to malaria incidence.

4.8. Distance to Roads

The Euclidian distance of a place from roads determines its accessibility and the effectiveness of intervention measures against malaria. In the study places, over 20 km from the roads were deemed to be at highest risks to malaria, those between 6 km and 20 km from roads were deemed to be of moderate risk and those less than 5km from the roads were classified as having the lowest risk of malaria infections.

Table 2. Distance to roads.

Range (Values)	Value	Area(km²)	Per Area (%)	Hazard
>20 km	3	6,628	50.16	High
6-20 km	2	4,086	30.92	Moderate
<5 km	1	2,498	18.90	Low

Table 4 above shows the relationship between road distance and malaria incidence. Large part of the district i.e. about 50.16% or 6,628 km² was found to be inaccessible for health centers and health post workers using tracks. It also identifies 30.92% or 4,086 km² of the total area was under moderate hazard and the remaining 18.90% or 2,498 km² under low hazard to malaria incidence.

4.9. Temperature Hazard Analysis and Discussion

Development of the mosquito larva also depends on temperature – it develops more quickly at higher temperatures. Higher temperatures also increase the number of blood meals taken and the number of eggs laid by the mosquitoes, which increases the number of mosquitoes in a given area. The development of the parasite within the mosquito depends on temperature (Truneh, 2010). Temperature of the study area was developed from consecutive ten (10) year's annual mean temperature data and kriging interpolation method from the spatial analyst tools was used to interpolate and create raster temperature surface and the following tabular values.

Table 3. Hazard Analysis to temperature.

Range (Values)	Value	Area(km²)	Per Area (%)	Hazard
283- 268	3	6,139	45.77	High
268-240	2	4,058	30.25	Moderate
240-213	1	3,215	23.97	Low

The reclass tool with in the spatial analyst tools of ArcGIS10.5 was used to reclassify the temperature in to three classes (Table 5 above) based on its suitability for mosquito breeding. New values 3, 2, 1, were assigned to temperature class 283- 268, 268-240, and 240-213, respectively. Then, the classes were labeled as high, moderate and low malaria risk level respectively. The table also illustrated that 45.77% or 6,139 km² area of the district was found to be under high hazard of malaria incidence whereas 30.25% or 4,059 km² was on a moderate level of incidence. The remaining 23.97% or 3,215 km² of the area was found to be under low level of impact to malaria hazard.

4.10. Rainfall Hazard Analysis and Discussion

Rainfall increases the breeding habitats for mosquitoes leading to increased population sizes and the rate of malaria transmission. According Paaijmans *et. al.* (2014), the right amount of rainfall is often important for the anopheles mosquitoes to breed. Water

collections that support vector breeding appear mainly after the rains, and therefore malaria transmission is highest following the rainy season. The rainfall map of the study area was produced from ten (10) years (2006-2016) annual rainfall data of nearby stations. Average annual rainfall was computed for each station. Finally, kriging interpolation technique was employed to create raster surface of rainfall. The rainfall values were then reclassified to three classes based on its suitability to malaria incidence. New values 3, 2 and 1 were assigned to rainfall class 213-501mm, 501-603 mm and 653-923 mm respectively as given below (Table 6).

Table 4. Hazard Analysis to rainfall.

Range (Values)	Value	Area km²	Per Area (%)	Hazard
213-501	3	5,000	45.97	High
501-603	2	4,000	31.25	Moderate
653-923	1	3,000	23.77	Low

Table 6 above shows classes of rainfall based on their degree of influence for malaria transmission. New scale values were given as 3, 2 and 1 for high, moderate and low classes respectively. The scale value '3' given for low rain which means that this amount of rainfall is favorable for malaria breeding so that this is more vulnerable for breeding site where as the scale value '1' given for high rain. This means that previous findings indicated that as rainfall is higher, it has probability of washing down the breeding sites so that it has no chance for malaria breeding. That is why the lowest scale value was given to those areas which are less vulnerable to malaria breeding sites.

4.11. Assigning Weights for Hazard Factor

Malaria hazard level was determined by taking the environmental and physical variables discussed above. The factors/variables were classified and reclassified to give them common scale. Then pair wise comparison method was applied to give weight for each factor. These factors were also rated based on their degree of importance to malaria incidence. While assigning the weights for the factors previous researches, malaria control experts and local condition of the area under investigation were taken in to consideration.

Table 5.Weight derivation of hazard factors (obtained from IDRISI software)

Hazard Factors	1	2	3	4	5	6	Eigen vector	Influence (%)
1) Elevation	1	1	2	3	4	6	0.31	31
2) Distance to water bodies	1	1	2	3	4	5	0.24	24
3) Rainfall	1/3	1/2	1	2	3	4	0.2	20
4) Temperature	1/4	1/3	1/2	1	2	3	0.15	15
5) Road	1/5	1/4	1/3	1/2	1	2	0.06	6
6) Slope	1/6	1/5	1/3	1/3	1/2	1	0.04	4

Table 6. Hazard factors rating and their weights (Saaty, 2008).

Factor/Criteria	Weight	Rating	Value	Hazard
Elevation	0.2	343-651 m	3	High
		651 - 996 m	2	Moderate
		996 – 2050 m	1	Low
Slope	0.06	< 13%	3	High
		13 – 26 %	2	Moderate
		26 – 69%	1	Low
Distance to water bodies	0.31	< 1.5km	3	High
		1.5 - 5km	2	Moderate
		>5km	1	Low
Road	0.04	<5km	3	High
		5-15km	2	Moderate
		>20km	1	Low
Temperature	0.15	283- 268	3	High
		268-240	2	Moderate
		240-213	1	Low
Rainfall	0.24	213-501	3	High
		501-603	2	Moderate
		653-923	1	Low

5. Malaria Risk Factor Maps

5.1. Malaria Hazard Factor

The malaria hazard layer was computed by overlaying the six selected causative factors of distance to water body, elevation, slope, distance to roads, temperature and rainfall in weighted over lay module of ArcGIS 10.5. Weighted overlay technique was used to combine individual variables to create hazard map. The hazard factor was obtained by simple additive weighting method using the following formula. $Hi = \sum wixi$. Where, Hi = Hazard index, wi refers to weight and xi refers to the variables used. Hence it gives the following. Hi =∑ (Elevation*0.2 + Distance to water bodies * 0.31 + Rainfall * 0.24 + Temperature*0.15 + Road * 0.06 + Slope * 0.04). From this calculation we get the following tabular values.

Table.7. Malaria Hazard.

Values	Value	Area(km²)	Percent Area (%)	Hazard
100-160	1	4791.5	34.91	Very Low
160-195	2	2916.3	21.25	Low
195-230	3	1153.18	8.4	Moderate
230-270	4	1778.49	12.95	High
270-300	5	3084.95	22.47	Very High

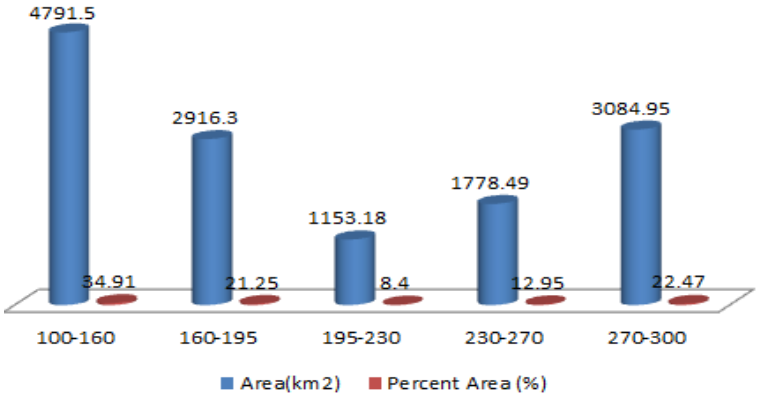

Figure 6. Malaria hazard chart.

Table 9 above shows the extent of malaria hazard in the district. 22.47% or 3084.95 km² of the area under investigation was very hazardous to malaria where as 12.95% or 1778.49 km² of it was found to be under high malaria hazard.

While 8.4% or 1153.18 km² of the area was with moderate hazard 21.25% or 2916.3 km² fall under low influence to malaria hazard. The remaining 34.91% or 4791.5 km² area of the district was with very low category. Both the table and the hazard figure resemble the responses given from the questionnaires and interviews.

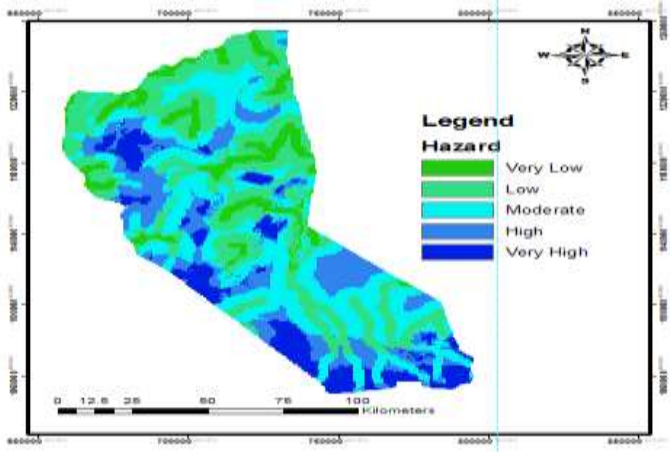

Figure 7. Malaria Hazard map.

As can be noted from figure (6) above, spatially the malaria hazard of the district was classified into very high, high, moderate, low and very low. As can be observed from the legend of the map the very blue colour represents very high hazard to malaria. Low laying areas with higher temperature and areas which seem to be far from road accesses were highly hazardous. The electron gold color/shade is showing areas with fewer hazards to malaria incidence. In addition, kebelles which were in close proximity to water bodies such as streams, irrigation canals and areas where there was sporadic rainfall are identified as very high and high hazard areas.

5.2. Elements at Risk Factor

Land cover types of the area were considered as important risk factors in malaria transmission. Land cover which is used to identify elements at risk refers to the physical state of the land surface as in cropland, mountains or forests etc. The land cover map was reclassified depending on its suitability to mosquito breeding. It was produced from recent USGS Landsat 8 imagery. Maximum likelihood supervised classification technique was applied to classify the image in ERDAS IMAGINE 2014. Accordingly, five land cover classes namely, water bodies, forests, settlement/farmland, bush land and bare/open land were identified (See Table, chart and figure below). The element at risk layer was then developed by rasterizing and reclassifying land cover image on the basis of malaria susceptibility. Literatures revealed that water bodies such as irrigation areas, streams, and ponds have high impact on malaria transmission and were given high score. Table 10 also shows next to water bodies forests can be a source of the vector.

Table 8. Land cover types/Elements at risk.

Land cover Classes	Value	Area(km^2)	Percent _Area (%)	Risk
Water	5	552	3.76	Very High
Forest	4	525	3.57	High
Settlement/Farm land	3	1,687	11.49	Moderate
Bush Land	2	5,887	41.06	Low
Bare/open land	1	6,028	40.09	Very Low

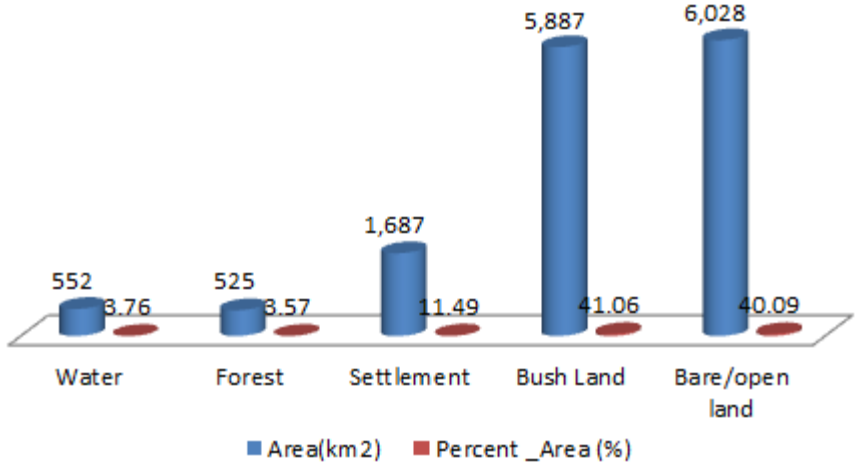

Figure 8. Land cover chart.

As can be seen from the table and chart above water body and forest were considered as most suitable for mosquito breeding based on literatures and malaria control experts. They were labeled as very high, forest as high, settlement as moderate farmland and settlement as moderate, bare and shrub lands as low. As a result, 5, 4, 3, 2 and 1 were the new values given, respectively. The above table also illustrates 3.76% of the area was under very high risk to malaria where as 40.09% was at very low risk.

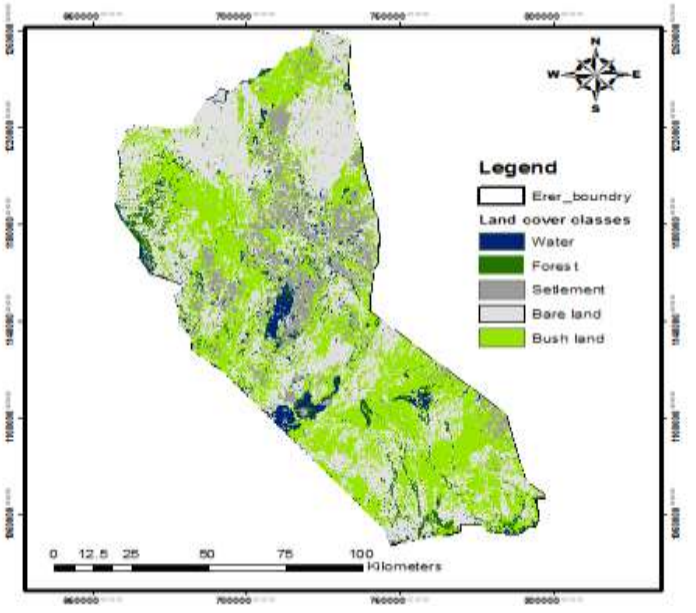

Figure 9. Elements at risk map.

In Figure 9 above, blue colors represent water bodies such as streams, irrigation canals water pools etc. while forests are being colored by burnt umber. The dark and gray shades are showing settlements and bare lands respectively. The last macaw green is representing scattered bush land of the area.

5.3. Vulnerability to Malaria Factor

Vulnerability (Accessibility index) was generated from the district health station point data. The health facilities location was digitized and georeferenced in ArcGIS10.5. WHO (2013) states that areas found within 3km radius from a health centers are assumed to be at lesser malaria risk than areas found outside this distance. Hence, classes of distances < 3000 m, 3000-4000 m, 4000-5000 m, 5000-6000 m and > 6000 m were considered to buffer vulnerability index. More over Euclidian distance was used to create a raster layer that represents access to health care (See Table and figure 8 below).

Table 9. Vulnerability.

Health facility distance	Ranking	Area(km2)	Percent area (%)	Vulnerability
< 5 km	1	1855	14.52	Very Low
6-15 km	2	4643	36.34	Low
16-25 km	3	4490	35.15	Moderate
26-36 km	4	1692	13.25	High
>36 km	5	92	0.72	Very High

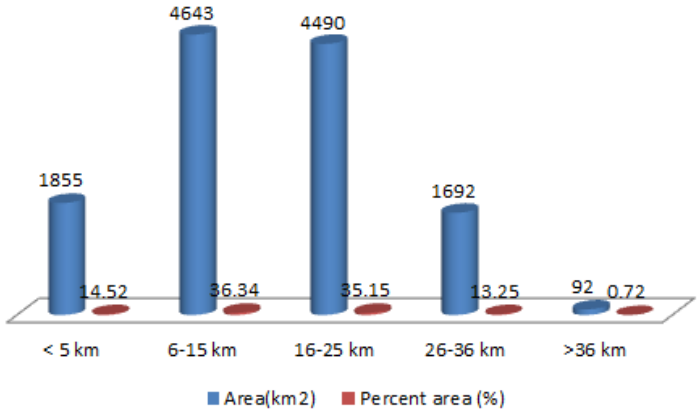

Figure 10. Vulnerablity index chart.

As can be noted from the table above the classes were given values of 1, 2, 3, 4 and 5 and were designated as very low, low, moderate and high and very high malaria vulnerablity levels respectively.

0.72% or 92 km² of the area fall under very high vulnerablity to malaria becouse these areas are with scarce health facilities.13.25% or 1692 km² of the district is also highly vulnerable.The other 35.15% or 4490 km² and 36.34 or 4643 km² of the area was designated to be moderate and low vulnerablity respectively.

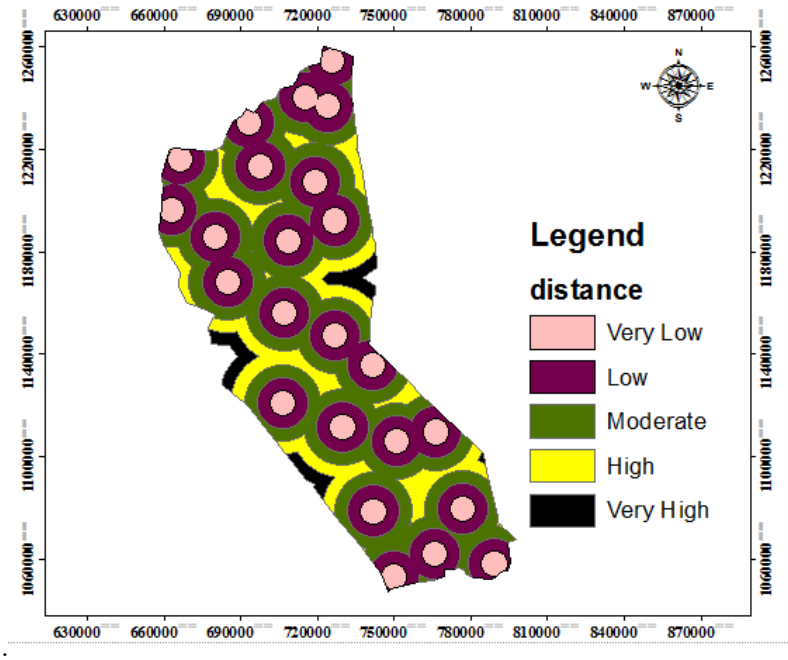

Figure 11. Vulnerability index map.

Therefore, access to health clinics and hospitals in the area would greatly affect the populations'vulnerability to malaria.The study area was classiffed in to five scales i.e very low, low, moderate, high and very high malaria vulnerablity. From Figure 11 above, it is

possible to show that the rose quartz shade is representing areas which are at nearby distances from health facilities such as health centers and health posts.Those areas which are labeled as very low vulnerable becouse they are accesible.The purple heart color show the areas with low vulnerablty. Spruce green shade show moderate areas in the distrct while the solar yellow and black colors are representing the high and very high vulnerable areas due to their inaccesiblity to health facilities.

5.4. Malaria Risk Mapping

In disease modeling risk is the probability of developing a given disease over a specified period of time (WHO, 2013). The development of malaria risk map of the study area was done on the basis of risk computation model as given by Shook, (1997). Risk = Element at risk * Hazard * vulnerability. Rating and weighting of the three risk factors was determined based on expert's opinion and literatures. The calculation is provided below in Figure.9.

Table 10. Risk factors rating and their weights (Saaty, 2008) and expert's opinion.

Factors	Rating	Value	Weight	Area(Km^2)	Risk
Hazard	100-160	1	0.5	8791	Very Low
	160-195	2		3916	Low
	195-230	3		5153	Moderate
	230-270	4		2778	High
	270-300	5		2084	Very High
Vulnerability	< 5 km	1	0.25	1855	Very Low
	6-15 km	2		4643	Low
	16-25 km	3		4490	Moderate
	26-36 km	4		1692	High
	>36 km	5		92	Very High
Elements at risk	Water bodies	5	0.25	552	Very High
	Forest	4		525	High
	Settlement	3		1,687	Moderate
	Bush land	2		5,887	Low
	Bare/open land	1		6,028	Very Low

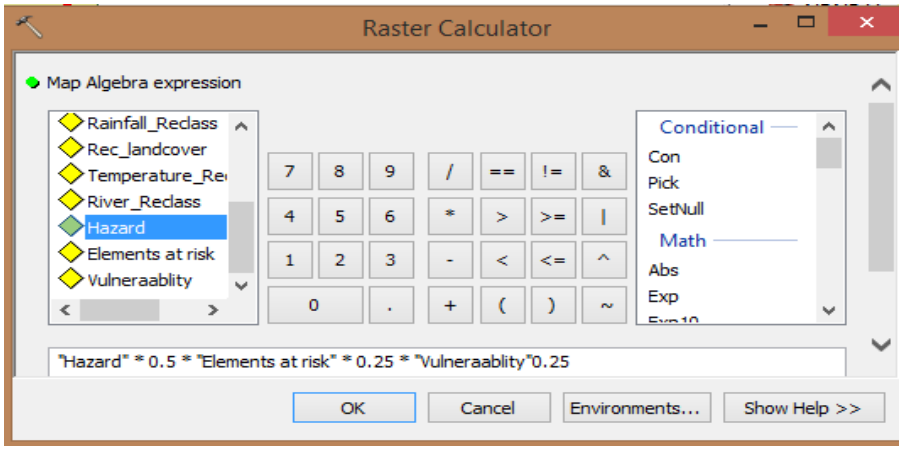

Figure 12. Raster calculation of risk factors.

Using raster calculator, R = Hazard*0.5*Elements at risk*0.25*Vulnerability*0.25 would give the malaria risk map/model. The following tabular and map values are the final risk results produced from this calculation.

Table 11. Malaria risk.

Values	Area(km²)	Percent area	Risk
1	109.50	0.82	Very Low
2	2504.00	18.93	Low
3	4278.40	32.35	Moderate
4	3698.40	27.96	High
5	2634.30	19.92	Very High

The final out put raster layer generated by multiplying the risk components is the raster layer. It was reclassified according to the risk level in to five sub groups as very high, high, moderate, low and very low risk areas as given in Table 13 above figure 10 below. 19.92% or 2634.30 km² of area was found to be under very high risk to malaria and this was also confirmed by the socio-economic data collection tools. Areas which are found to be at very and high risk in the final malaria risk model were similar to the reports compiled from the questionnaires, interviews and district officials. The dark colored areas in the following map are showing areas of very high and high malaria risk zones.

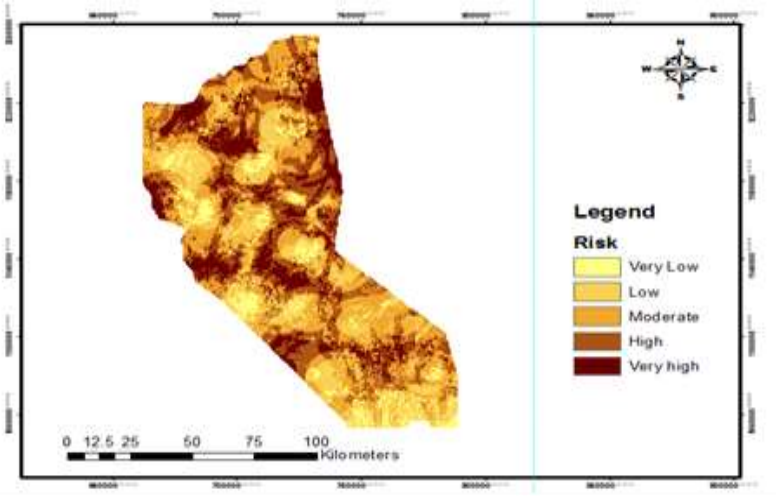

Figure 13. Malaria risk map.

6. Conclusion and Recommendation

In the study, the trend of the malaria infection of the district was determined for the last ten years. It was found that there is alternate or dynamic trend with 2006 E.C being the peak year while the minimum case observed was during 2008 E.C. Furthermore, the distributed questionnaires and key informant interviews indicated that spraying buildings with anti-mosquito chemicals, environmental sanitation campaigns, such as removing grasses and filling of water ponds, distribution of mosquito nets and providing mobile health services were some of the malaria copying mechanisms employed in the district. It is also found that plasmodium falciparum is the dominant malaria type which accounts 99% of the malaria type in the area.

Multi criteria pair wise comparison method was used both for the hazard mapping and the overall risk modeling. The result of the findings shows that large part of the district was found in hazard and risk area of malaria. The risk areas identified in the hazard and risk models were compatible to the findings from the questionnaires and interviews. Finally, it was recognized that both Geographic information system and remote sensing were instrumental in providing benchmarks for assessing, control and indicate which geographic areas should be prioritized.

Based on the spatial distribution of the hazard and risk maps and socio-economic reports the government, and NGO need to pay attention for indoor residual spraying or application of long acting chemical insecticides on the walls and roofs of all houses to kill adult vector mosquitoes that land and rest on these surfaces. In addition, it is recommended that the local administrators, district officials and other stockholders should mobilize the community to clean its environment especially during rainy seasons when there are ponds and water pools as they are the sources of the vector. Finally, the government or the NGO should emphasis to expand health clinics, facilities and personnel where there is scarcity in the district.

7. Acknowledgment

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7. Implications of Ethiopia Productive Safety Net Program on Household Dietary Diversity and women Body Mass Index: A Cross-Sectional Study

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Abstract: Poor nutritional status of women remained central problem in Ethiopia through increasing vulnerability to adverse health and reproductive outcomes that perpetuate across life course. Women nutrition matters not only for Public health relevance of breaking intergenerational cycle of malnutrition but also for its high return. Ethiopia Productive safety net program meant to protect chronically food insecure households against shocks through cash or food transfer scheme. Unfortunately, its effect on food access and women BMI remained unexplored in drought hot spot area of eastern Ethiopia. This study was intended to assess the difference in household dietary diversity and women BMI among PSNP and non-PSNP households and factors associated with it. Community based cross-sectional study design was carried out in Kombolcha district of Eastern Ethiopia from July 1 to 28, 2015. Household Dietary Diversity and women BMI were compared. Wealth index was categorized as lowest, middle or highest asset category. Ordinal regression was used to identify factors associated with women BMI. The prevalence of undernutrition was 27.3 percent and 20.2 percent for women PSNP and non-PSNP households, respectively. PSNP membership had large effect on HDD and small effect on women BMI. Ordinal regression yielded significant association for wealth index, better health care service compared to previous year with an OR of 0.647 (95% CI, 0.429 to 0.974) and reducing selling assets for the sake of buying foods with an OR of 1.575 (95% CI, 1.057 to 2.349). Among PSNP and non-PSNP households the prevalence of severe chronic energy deficiency was 3.4 percent and 1.8 percent, respectively and associated with economic status and health care utilization that suggest considering income generating activity and nudging for minimum health care as a condition for transfer.

Keywords: BMI, PSNP; social protection; HDD; Ethiopia

1. Introduction

Malnutrition has continued to be major global issue in post MDGs era. Ending this problem has continued to receive more attention and commitment for its extraordinary contribution toward progress of SDG (Sustainable Development Goal) targets [1]. Poor

nutritional status of women remained central problem in Ethiopia. According to the Ethiopia Demographic and Health Survey (EDHS) about 27 percent of women of reproductive age are chronically malnourished[2].

Women nutrition matters not only for Public health relevance of breaking intergenerational cycle of malnutrition but also for its high return. A major current focus of women nutrition revolve around how to ensure women decision making toward greater right to food and nutrition security and maximize improvement in social protection programs [3,4]. Social protection is a nutrition sensitive development efforts aim to improve the underlying determinants of nutrition or avoid harm to immediate causes among nutritionally vulnerable populations and individuals [5]. It aims at increasing purchasing power and thus empowering women to make better choices for self and family care with expected positive influence on nutritional status of a women and children [6,7].

Ethiopia Productive safety net program is one of such social inclusion intervention that relies on meeting eligibility criteria with intention of reducing vulnerability and attaining food security. It emphasizes to empower and support vulnerable women among other target groups by improving water security, fire woods availability and nutrition insecurity [8,9].

However, cascades of chronic food insecurity that lead to migration of key household member to towns for work leaves women under immense workload of home subsistence farming (normally more than 50% of women work in agriculture), childcare and public work of PSNP [9-11]. In addition to this, transfers not directed to women influence intrahousehold resource allocation by leaving women with limited bargaining power [12]. This is worsened by women triple burdens of land access, namely they account for less than 20% of the landholders, policy of land state-ownership and limited inputs even when they have access to land. [11,13]

Ethiopia PSNP use combination of geographic and community based targeting. While it has been shown that community-based targeting effectively identifies the poor, geographic targeting that considers differences among homogenous poor and vulnerable groups remain questionable [14]. That is, inclusion of most deprived and vulnerable people, harmonization with other interventions and sensitization of all stakeholders on role of women are far from optimal [15]. It can be argued most vulnerable need equity that best work in enabling environment to new skills and activities that strengthen social capital beyond ease of implementation and gender based quota in expense of real change [16,17]. According to [18], knowledge-transfer interventions have a greater potential in reducing food insecurity and poverty than direct transfer.

Generally, ensuring food and nutrition security at the household level needs investing in nutrition sensitive interventions, protecting women's rights and improving their social and nutritional status [11]. A key step in understanding different PSNP make is to understand the relationship between poverty levels based on household consumption and asset-based wealth index [19]. Based on this, appraisal of effect of PSNP across geographic areas is of great interest in terms of women nutritional status and the ability of their households to access adequate quantity and quality of food that promotes

health. Therefore, this study was intended to assess the difference in household dietary diversity and BMI among PSNP and non-PSNP households and factors associated with them.

2. Methods and materials

2.1. Study Setting and Design

Community based cross-sectional study design was carried out in Kombolcha district of Eastern Ethiopia from July 8 to 28, 2015. This period overlapped with failed spring (mid-February-May) rain that affected crop production from the first harvest that would provide 20 percent of food production followed by end of six months of PSNP cash transfer[20].

2.2. Study population

The district contains 19 kebeles (smallest administrative units in Ethiopia next to district) out of which 10 are non-beneficiary and 9 *kebeles* (total of 2375 households) benefited from cash transfer. This can be translated to about 9,752 people that receive cash in exchange for participating in public work and 1,409 people with direct support. For this study, five PSNP and six non-PNPP kebeles were selected randomly.

2.3. Sample Size Determination

The analysis was performed on data that were already available for child wasting. Excluding 52 women, final sample size was 623 women from PSNP and 635 non-PSNP, total of 1258. This sample size is sufficient for the analysis of the data to produce results with sufficient statistical precision

2.4. Sampling Procedure

Information on women were collected during mother's interview eligible for children aged six months to five years being processed in another publication. Hence, participants were selected from randomly selected five PSNP and six non-PSNP *kebeles*. Women eligible for a child interview were identified from lists obtained from district PSNP office and respective *kebele* health extension workers. Both lists have finally ascertained by social networks leaders called "*gare*" (group that containing 25-30 women). In order to minimize handout expectations and spillover effect of the transfer, women from non-PSNP beneficiary households were entirely differentiated from non-beneficiary *kebeles* and pregnant women were excluded from this analysis.

2.5. Study Variables

The primary outcome of this study was women BMI while the secondary outcome was HDDS. In the statistical analyses, factors considered as potential confounders were maternal age. Factors considered potential effect modifiers were sex of head of household and PSNP beneficiary status.

Body Mass Index (BMI): This is proxy of energy status (undernutrition) calculated as weight (kg) divided by the square of height (m^2). Women height was measured to the nearest 0.5 cm without shoes, feet flat, heels together, legs straight using portable wooden height-measuring board with a sliding head bar following standard anthropometric techniques. Heights <145 cm were classified as stunted. Weight was measured in repeatedly to the nearest 100 g using an electronic scale (SECA). A BMI of less than 17-18.4 defines marginal energy deficiency, 16-17 moderate energy deficiency and that of less than 16.0 defines severe chronic energy deficiency. A BMI of >25 signifies overweight, and >30 signifies obesity. Even though a global database on women nutrition is not available, a BMI of 20–25 kg/m^2 is recommended for good health and is associated with normal fertility. A weight for height equivalent to a BMI of 18 kg/m^2 and lower is considered too low for successful reproductive ability [21].

Household Dietary Diversity: It is a measure of the total number of different food groups consumed in the last 24 hours by household member with well-grounded construction of diet quality and accuracy with its association with incomes. HDDS ranges from 0–12, the higher the better and it is a good indicator of both quantity and quality. It is included in the acute food insecurity reference table for household group classification of the IPC. HDDS does not have established categorical cutoffs and is analyzed only as a scale measure. For households with unusual food intake in previous 24-hours, another appointment was made for the interview. Due emphasis was given to acquire response with minimal social desirability bias [22-24].

Household Wealth Index (HWI): is proxy measure of household income for long-term wealth. Principal components analysis (PCA) was run using thirty-eight items comprising productive assets, livestock, household goods and consumer durables. It was used as a continuous variable, and each household was classified as being in the lowest, middle or highest asset category.

Statistical analysis methods

The SPSS Version 23 for Windows software package was used for statistical analysis. To examine whether associations differed across groups, stratification was done based on PSNP and wealth index. Descriptive statistical analysis was conducted to describe the characteristics of participants. The selection of each factor was based on the rotated component matrix greater than 0.50. One-way ANOVA was conducted by flipping the model around so that HDDS the outcome variable and women BMI and wealth index. The independent samples t-test was used to compare means HDDS across PSNP and other variables. In order to check whether the assumptions of MANOVA were met, preliminary assumption testing for normality, linearity, univariate and multivariate outliers, homogeneity of variance–covariance matrices and multi-collinearity were conducted. No significant violation was found. Further, ordinal logistic regression model was used in this data analysis for prediction of women BMI (dependent variables). The odds ratio (OR) was used as the primary measure of strength and direction of the

relationship between each independent variable and the women BMI that were categorized to levels underweight (BMI>18.4), Normal (BMI 18.5-24.9) and overweight (BMI ≥25). In this analysis, odds ratios less than 1 indicated a negative relationship.

3. Result

3.1. Characteristics of Study Population

The study included 1311 women out of which 39 were pregnant, and 14 with out of range values, which resulted in final sample size of 1258. Table 1 shows the characteristics of participants stratified by PSNP. From the total participants, 50.5% (653) were non-PSNP and 49.5% (623) were PSNP households. There were 146 (11.6%) female-headed households mainly 57.5% (84) from PSNP households.

Table 1. Characteristics of women from PSNP and non-PSNP households in Kombolcha district, 2015.

Variables	Non-PSNP(n=635)	PSNP (n=623)	Total (n=1258)
Head of HH			
	573 (90.2%)	542(86.5%)	1114 (88.4%)
Female	62 (9.8%)	84(13.5%)	146 (11.6%)
Intentional last pregnancy			
No	)	170 (27.3%)	270 (21.5%)
Yes	)	435 (72.7%)	988 (78.5%)
Family planning use			
No	)	422 (67.7%)	899 (71.5%)
Yes	)	201 (32.3%)	359 (28.5%)
Breast feeding now			
No	)	371 (59.6%)	702 (55.8%)
Yes	)	252 (40.4%)	556 (44.2%)
Less school attrition			
No	372 (58.6%)	293 (47%)	665 (52.9%)
Yes	263 (41.4%)	330 (53%)	593 (47.1%)
More health care services			
No	153 (24.1%)	172 (27.6%)	325 (25.8%)
Yes	482 (75.9%)	451 (72.4%)	933 (74.2%)
lling assets for food			
No	449 (70.7%)	519 (83.3%)	968 (76.9%)
Yes	186 (64.1%)	104	290 (23.1%)

		(16.7%)	
Vegetable garden ownership			
No	550 (86.6%)	546 (87.6%)	1096(87.1%)
Yes	85 (13.4%)	77 (12.3%)	162 (12.9%)
Wealth index			
Low		341(54.7%)	415 (33 %)
Medium		221(35.5%)	417 (33.1%)
High	)	61 (9.8%)	426 (33.9%

3.2. Prevalence of Chronic Energy Deficiency of Women

Overall prevalence of underweight (BMI<18.5) was 23.7 percent. Out of this, the prevalence of BMI severe energy deficiency (ED) was 3.2% among PSNP households, which was higher than non PSNP households (1.4%) were.

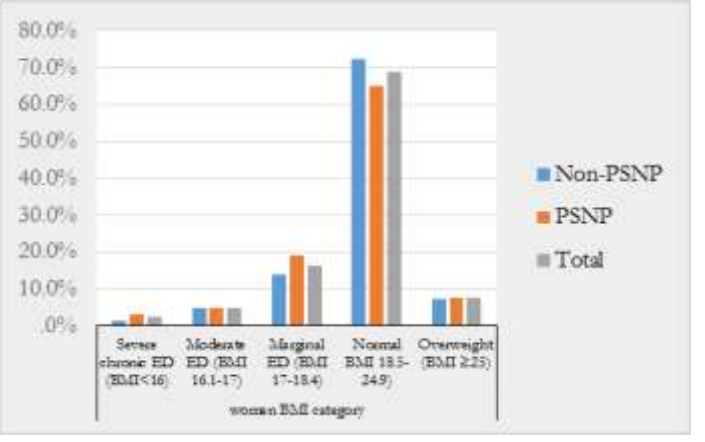

Figure 1. Prevalence of chronic energy deficiency of women from PSNP and non-PSNP households in Kombolcha district, 2015.

The total mean HDDS was 5.76±1.59 and the mean difference between PSNP and non-PSNP households was statistically significant (Table 2). The magnitude of the differences in the means as indicated by eta squared was 0.142.

Table 2. Effect of PSNP on characteristics of women from PSNP and non-PSNP households in Kombolcha district, 2015.

	mean ±SD			*Mean differences*	Eta squared
	Total	Non-PSNP	PSNP		
HDD	5.76±1.59	6.36±1.5	5.15±1.37	1.2**	0.142
Women BMI	20.29±2.46	20.61±2.46	19.97±2.41	0.63**	0.017
Women Age	28.75±5.85	27.98±5.64	29.54±5.96	-1.6**	0.018

Number of under five children	1.73±0.69	1.69±6.80	1.76±0.694	-0.066	0.002
Family size	6.2±2.2	6.18±2.43	6.23±1.96	-0.047	0
Land size (hec)	0.56±0.36	0.639±.412	0.470±0.26	0.0194**	0.056

***P<0.001.*

A multivariate analysis of variance was performed to find any group differences based on a linear combination of women BMI that indicate utilization and HDD that showed access and quality aspect of food insecurity. Inclusion of both dependent variables in the analyses provide the maximum amount of information regarding the effects of PSNP. Hence a two-way MANOVA was employed in which a 2 PSNP (beneficiary and non-beneficiary) ×3 wealth index (Low, medium and high socio-economic status) were the between participant factors. Using Wilks' criteria combined dependent variable was significantly affected by state of PSNP membership, F (2, 1251) = 40.995, p <0.001; Wilks' Lambda = .938; and the wealth index F (4, 2502) = 8.269, p <0.001; Wilks' Lambda = .974; but not by their interaction F (4, 2504)=2.2, p<.993, $\square^2$ =0.004. The result showed association between PSNP and the combined dependent variable ($\square^2$= .062) and wealth index ($\square^2$= .013). This indicates that the linear composite of HDD and women BMI differs significantly with respect to PSNP membership and across wealth levels (Table 2).

Follow-up ANOVAs for investigating main effect on the individual dependent variables (Table 3) indicated that effects of both PSNP and wealth index were significant for HDD. However, only HDD differ significantly across wealth levels. Tukey procedure to conduct pairwise comparisons of women BMI using an alpha of .01 for each outcome showed significant mean difference in HDD across wealth category (p<0.001) with more pronounced mean difference between low and high wealth levels. Hence, non-PSNP households scored more on both outcomes (Table 2).

Table 3. Means and Standard Deviations of women BMI and HDD as a PSNP and wealth category for PSNP and non-PSNP households in Kombolcha district, 2015.

		Women BMI		HDD	
Group	n	M	SD	M	SD
PSNP					
No	635	20.6	2.46	6.35	1.57
Yes	631	19.97	2.4	5.15	1.36
Wealth index					
Low	415	20.16	2.47	5.09	1.48
Medium	417	19.97	2.37	5.7	1.37
High	426	20.72	2.46	6.4	1.6

Table 4. Effect of PSNP, wealth index and their interaction on women BMI and HDD for PSNP and non-PSNP households in Kombolcha district.

IV	Dependent variables	Univariate F	df	Partial□ □ 2
Wealth index	Women BMI	2.9	2/1252	0.005
	HDD	13.7**	2/1252	0.021
PSNP	Women BMI	9.2**	1/1252	0.007
	HDD	75.9**	1/1252	0.057
Interaction of PSNP × wealth index	Women BMI	.28	2/1252	0
	HDD	4.3*	2/1252	0.007

*<0.05, **<0.01

3.3. Predictors of Women Chronic Energy Deficiency

To examine factors associated with nutritional status, women BMI were categorized as underweight (BMI<18.5), normal (BMI 18.5-25) and overweight (>25). Ordinal regression conducted (Table 4) yielded significant association for wealth index, better health care service compared to previous year, and reducing selling assets for the sake of buying foods. As the most notable outcome, controlling for the other explanatory variables, being in the middle wealth index (OR= 0.533) have 46.7 percent lower odds than women from high wealth index to be in higher BMI category.

Table 5. Multivariable ordinal regression model for predicting the risk of higher category of BMI for women from PSNP and non-PSNP households in Kombolcha district, 2015.

	B	SE(B)	*P*	OR	95% CI
HDD	0.067	0.065	0.307	1.069	0.941 -1.215
Age of mother (years)	-0.008	0.02	0.665	0.992	0.954- 1.03
Total land size (Hectare)	-0.24	0.221	0.279	0.787	0.51- 1.214
Family size	0.057	0.049	0.24	1.059	0.962- 1.166
PSNP					
No	0.165	0.218	0.45	1.179	0.769- 1.808
Yes *(ref)*	0			1	
Wealth index					
Low	-0.343	0.269	0.203	0.71	0.419- 1.203
Medium	-0.629	0.231	0.006	0.533	0.339-0.837
High *(ref)*	0			1	
Gender of head of household					
Male	-0.19	0.306	0.53	0.825	0.453-1.504
Female *(ref)*	0			1	
Breastfeeding now					
No	-0.636	0.366	0.082	0.53	0.259-1.084

Yes *(ref)*	0			1	
More health care than previous year					
No	-0.436	0.209	0.037	0.647	0.429-0.974
Yes *(ref)*	0			1	
Less attrition					
No	-0.261	0.207	0.207	0.77	0.514-1.155
Yes *(ref)*	0			1	
Reduced selling assets for food					
No	0.455	0.204	0.026	1.575	1.057-2.349
Yes *(ref)*	0			1	
Intention to have more child					
No	0.27	0.207	0.193	1.31	0.872-1.967
Yes *(ref)*	0			1	

4. Discussion

This study was set out to assess the differences in women nutritional status as determined by BMI and factors associated with it among PSNP and non-PSNP households. Emphasis was also given to understand how asset-based wealth index interact with PSNP to influence HDD and women nutritional status.

Difference in women BMI and HDD

There were large differences in HDD with respect to PSNP, which were indicative evidence for large effect on household food access. Nevertheless, PSNP has small effect on women BMI. There was high prevalence of women underweight in this study. According to the 2011 EDHS reports, 27% of women were thin that is comparable to PSNP (27.3%) and but lower than non-PSNP (20.2%) household women. However, a 6% overweight/obese is lower than study reported here [2]. In contrast to finding from rural India and Nigeria where chronic energy deficiency are lower than obesity category [25,26], this study showed lower obesity, still with some impending "food insecurity–obesity paradox," related to negative coping strategies in response to food insecurity [27].

One notable finding was severe chronic energy deficiency for PSNP (3.2%) and non-PSNP (1.4%) women. Compared to prevalence finding from low- and middle-income countries that range between 1.8 to 6.2%, it is clear that PSNP result is comparable to Madagascar (3.4%). This level of undernutrition is related to high morbidity, mortality and poor maternal-fetal outcomes with potential of perpetuating intergenerational malnutrition [28]. This reinforce how addressing PSNP beneficiary demand-side barriers through conditional minimum preventative health care is mandatory [29]. Evidence from Shigutes et al(year) reports showed increased community based health insurance uptake and retention through increased awareness, pressure to join the scheme and risk aversion behavior among PSNP households. This imply not only PSNP untapped potential but also to missed opportunity of making PSNP platform to address most pressing maternal and child health care issues [30].

Like other similar programs, there was lower mean HDD among PSNP households that can be explained by effect of cash transfer where markets are not able to respond to increased demand by increasing supply, thereby pushing up local prices and reduced access to food groups during usual lean transfer seasons [31]. The unexpected high magnitude of women undernutrition and lower HDD among women from non-PSNP is against key design feature of a good public works program which is avoiding restrictions of all eligible as far as the wage rate is not higher than unskilled manual labor [32]. Taking into account PSNP membership and wealth index together, there was a difference in mean of linear combination of the HDD and women BMI, but with non-significant interaction. This demonstrated that the effect of economic status on linear combination of the HDD and BMI is not different for PSNP and non-PSNP members.

Predictors of women BMI

Women BMI shows undernutrition due to energy deficiency, health status, and access to health services and sanitation. The finding of this study showed reduced BMI for middle wealth index that concur with other low and middle-income countries where the highest wealth quantile is associated with better BMI [28,33]. Nevertheless, for lower wealth index the BMI reduction was not significant. The most likely explanation for this finding is related to control, ownership, and struggle to retain assets among middle wealth group. It also raise concern related to women empowerment which is positively associated with calorie availability and dietary diversity at the household level [34]. This implies to gender sensitivity aspect of nutrition security that should take into account the reproductive, social and cultural norms and differentials in income shocks and of subsequent poverty[35].

On the other hand, women from households that did not reduced selling assets for food were 1.575 times the odds for women from households that reduced selling assets of being at or below higher BMI level. Households distress sales of assets is one of the outcome indicators for the PSNP public works component in Ethiopia and it shows extent of reduction in households' short-term vulnerability to shocks. Negative effect of reduced uptake of health care services also happen when irreversibility is created by asset decapitalization to cope with a shock, and health facilities may not be used because of an income shock, leading to a long run loss in labor productivity [36].

5. Conclusion

This study provides compelling evidence of PSNP's large effect on HDD and its low effect on women's BMI. The overall mean value of women BMI was within the normal range. However, there was high magnitude of women undernutrition and low HDD that should be addressed through additional income-generating opportunities and health related conditionality directed to women. In addition, reassessing strategy to implement right based approach to address chronically food insecure households residing in non-beneficiary *kebeles* should be thought. The improvements noted in our study were not only revisiting women that were thought the primary target of this intervention, but also including comparative groups exclusively residing in non-beneficiary kebeles. However,

the levels of women's empowerment, which is one of the several questions to be resolved and central to food and nutrition security, need to be established in future studies.

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8. Prevalence of Cardiovascular Diseases and its Risk Factors in Adult Diabetic Patients in Hiwot Fana Specialized University Hospital and Jugel Hospital, Eastern Ethiopia

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Abstract: Diabetes patients are at high risk for several cardiovascular disorders. Cardiovascular complications are now the leading causes of diabetes-related morbidity and mortality. The public health impact of cardiovascular disease (CVDs) in patients with diabetes is already enormous and is increasing. But there is limited data on the prevalence of cardio vascular diseases and its risk factors among diabetic patients in Ethiopia. To determine the prevalence of cardiovascular diseases and their risk factors in adult diabetic patients in Hiwot Fana Specialized University hospital and Jugel hospital, Eastern Ethiopia. Institutionalbased cross sectional study was conducted on a total of 416 study participants (age ≥18 years) from February 1- March 2, 2016. Data was collected using questionnaire, measurements of weight, height, blood Pressure (BP), electrocardiogram (ECG) as well as laboratory findings of Blood Lipids, Triglycerides, and High-Density Lipoprotein (HDL) Cholesterol. Data was cleaned, edited, and entered into a computer and analyzed using SPSS, version 16.0 software packages. A bivariate analysis was done to see the association between dependent and independent variables. Significant association was identified on the basis of Odds ratios (OR) at 95% confidence intervals (CI). P-values of 0.05 were considered statistically significant. A total of 416 patients, 183(44%) males and 233(56%) females took part in the study. Their age ranged from 18 to 90 years, with a mean of 52 years (SD±14.7). Type 2 diabetes accounted for 288 (69.2%) and the rest were type 1 diabetics. The prevalence of CVD was 14.8% in type 1 and 15.6% in type 2 DM patients. We did not find statistically significant difference between CVD and DM type (OR=0.94, 95%CI=0.52, 1.68, P=0.838). Statistically significant association found between CVD and metabolic syndrome among type 2 DM patients (OR=0.48, 95%CI=0.25, 0.92, p=0.028). We did not find statistically significant association between CVD and risk factors among type 1 DM patients. Dyslipidemia was the commonest risk factors of CVD in individuals with DM patients (85.2 % in type 1 and 83.3 % in type 2 DM patients), followed by uncontrolled blood

sugar level (85.2 % in type 1 and 83.3 % in type 2 DM patients) and hypertension (74.2% in type 1 and 71.5% in type 2 DM patients). It was also observed that three-fourth of our study participants were not taking regular walk or any fitness activities, consumption of saturates oil/fat and had 3 or more CVD risk factors. Metabolic syndrome was significantly associated with CVD among type 2DM patients. Dyslipidemia, hyperglycemia, hypertension, physical inactivity and consumption of saturated oil were the common risk factors in our study participants. Majority of the participants also had 3 or more CVD risk factors. Considering this result, simultaneous management and control of metabolic syndrome components, identification and treatment of lipid abnormalities and regular walking or some fitness activities and consumption of low in saturated oil and fat is recommended.

Keywords: Cardiovascular diseases; Risk factors; Diabetes Mallitus; eastern Ethiopia

1. Introduction

Cardiovascular disease is an overarching term that refers to a group of diseases involving the heart or blood vessels. While there are many diseases in this classification, over 82% of the mortality burden is because of ischaemic or coronary heart disease (IHD), stroke (both hemorrhagic and ischaemic), hypertensive heart disease or congestive heart failure (CHF), peripheral arterial disease and cardiomyopathy (WEF, 2011).

Abundant evidence shows that patients with type 1 diabetes or type 2 diabetes are at high risk for several cardiovascular disorders. Cardiovascular complications are now the leading causes of diabetes-related morbidity and mortality. The public health impact of cardiovascular disease (CVDs) in patients with diabetes is already enormous and is increasing (Grundy et al., 1999).

Cardiovascular disease previously considered rare in Africa is becoming increasingly prevalent probably owing to the adoption of western lifestyle and diabetes mellitus is a major contributor. In a prospective study conducted in Ghana, 11.3% of the study population had coronary artery disease making it the fifth most common cardiovascular disease and 22.5% of these patients had diabetes (Unachukwu and Ofori, 2012). Stroke is one of the leading causes of death and physical disability worldwide and diabetes is a recognized risk factor for ischemic stroke. Diabetes increases the risk of stroke by up to four-fold and in patients presenting with a stroke the prevalence of diabetes is three times that of matched controls (Kissela and Air, 2006). A study in Benin City Nigeria revealed that diabetes mellitus independently conferred a 3.23 times greater risk for stroke (Amu et al., 2005)

The major risk factors for CVD include tobacco use, high blood pressure, high blood glucose, lipid abnormalities, obesity, and physical inactivity. The global variations in CVD rates are related to temporal and regional variations in these known risk factors. Although some risk factors, such as age, ethnicity, and gender, obviously cannot be modified, most of the risk is attributable to lifestyle and behavioural patterns, which can

be changed. The hazards of alcohol use, smoking, high blood pressure, high cholesterol, and overweight and obesity are globally widespread and have large health effects (Lopez et al., 2006).

A retrospective study in Tikur Anbesa Hospital showed that CVDs were responsible for 16% of deaths among diabetic admissions 2nd to acute complications and infections that caused 18% of deaths (Seyoum et al., 1999). Another study conducted in Jimma demonstrated that prevalence of the cardiovascular risk factors such as hypertension, obesity, physical inactivity and dyslipidemia were common among diabetic patients in Jimma University Specialized Hospital (Tamiru and Alemseged, 2010).

In the last few years, life style of the Ethiopian population is changing due to urbanization and demographic transition (CSA, 2006; FDEPCC, 2008). As a result, the burden of NCDs could be on the rise but there are few studies carried on burden of cardiovascular diseases in diabetic patients. Therefore, this study aimed to assess the prevalence of cardiovascular diseases and their risk factors among adult diabetic patients in Hiwot Fana Specialized University hospital and Jugel hospital, Eastern Ethiopia.

2. Methods

2.1. Study Design and Setting

Institutional based cross-sectional study was conducted from February 1- March 2, 2016 in Hiwot Fana Special University Hospital and Jugel hospital, which are found in Harar town, capital city of Harari People Regional state. The town is located in the Eastern part of the country, 515 kms away from the capital, Addis Ababa. Harar is one of the most popular historical towns in the eastern part of Ethiopia. During the survey, 424 DM patients (208 in jugal hospital and 216 in Hiwot Fana Special University Hospital) were attending in both hospitals DM clinics.

2.2. Sample Size and Sampling Techniques

Sample size was determined by a single population proportion formula considering estimated proportion of the population with cardio vascular diseases was 50%, because there were no previous studies conducted and a precision of 95%. Including non-response rate of 5%, the final sample size was 403. But all DM patients attending in Hiwot Fana Special University Hospital and Jugel hospital who fitted to the inclusion criteria were included in the study (five patients whose age less 18 years and 3 pregnant women were excluded from the study).

2.3. Data Collection, Data Collection Tools and Procedures

Data was collected by trained 1 internist, 4 BSc clinical nurse and two Medical laboratory technologists. Data was collected by

Face to face interview: For this purpose**,**questionnaire was adopted from WHO steps instrument (WHO STEPS) and was translated into local languages (Amharic and Oromiffa). The questionnaire used to collect variables like socio-demographic

characteristics (age, sex, marital status and soon), and life style behaviors including, physical activity.

***Weight and height Measurements*:** Height was measured by using a stadiometer while the participants were in an upright position, without shoes, to the nearest 0.5 cm with participant standing erect against the wall with heels together and touching the wall, and head held in upright position. Weight was measured using a digital weighing scale. The scale was calibrated to the zero level before each measurement, and was tested for repeatability of the measures. Weight was measured with minimum cloths and no footwear on a standardized weighing machine marked from 0 to 130 kg and was recorded to the nearest 0.5 kg. Body mass index (BMI) was calculated using the formula weight in kilograms divided by the square of the height in meters weight (kg)/ height (m^2). Obesity was defined as BMI > 25 for males as well as females.

Electrocar-diogram (ECG): Electrocardiogram (ECG) was taken from all patients. Patients with ECG changes suggestive of cardiovascular diseases were defined as cardiovascular diseases (CVD).

***Blood pressure measurement*:** Calibrated mercury column type sphygmomanometer (regularly inspected and validated) was used. Three separate measurements were obtained on the left arm of the seated subject using a cuff of an appropriate size and the average BP reading was recorded. The average of the readings of SBP and DBP were taken as the BP of the participant. The three blood pressure measurements were obtained after the subject was rested for at least five minutes in a seated position. The second and third measurement was taken five-to-ten minutes after the first and second measurement respectively.

***Laboratory examination of blood*:** For laboratory examination, blood sample was taken from the respondents for blood glucose, total cholestrol, Triglycerides, LDL Cholesterol and HDL Cholesterol analyses for those diabetic individuals who were coming at the day of regular appointment. Patients were asked to do an overnight fasting of at least 14h, after which, about5 ml of venous blood was taken using a 5ml disposable syringe and transfer into a 5ml test tube. All the collected venous blood samples were taken to the Hiwot Fana Specialized University Hospital clinical chemistry laboratory department and Jugel hospital chemistry laboratory department, serum separated within 2h of collection. The samples were analyzed by a trained technologist, then after. Serum glucose was estimated using enzymatic reaction by glucose oxidase and lipid profile tests (cholesterol, HDL, LDL and triglyceride) were carried out by methods described by the manufacturers of the test kits (BioSystem S.A. Costa Brava, 30, Barcelona, Spain).

2.4. Data Analysis and Interpretation

The data was cleaned, edited, and entered into a computer to be analyzed using SPSS, version 16.0 software package. A Bivariate logestic regression was done to see association between dependent and independent variables, and other descriptive statistics were used where necessary. Variables which having significant association were identified on the basis of Odds ratios (OR) at 95% confidence intervals (CI). P-values of 0.05 were considered statistically significant.

2.5. Quality Assurance

Two days of oral training and practical demonstrations on interview techniques, measurement procedures and laboratory procedures were given to data collectors. Close supervision was done by the principal investigator and co-nvestgators throughout the data collection. Collected data were checked for completeness and consistency daily. The questionnaire was pretested on 5% of the study participants in Dilchora hospital diabetic patients and modifications were made on the basis of the findings. Weight measuring scales were checked and adjusted at zero level between each measurement and height was measured following the standard steps. Blood pressures were measured three tims in a sitting position using standard mercury sphygmomanometer BP cuff with the appropriate cuff size that covers two-thirds of the upper arm after the participant rested for at least five minutes and no smoking or caffeine 30 minutes before measurement. Before measuring BP, it was made sure that the subjects had not consumed any hot beverages, such as tea or coffee or smoked/ chewed tobacco or undertaken vigorous physical activity within the 30minutes preceding the interview.

2.6. Ethical Consideration

Ethical clearance was obtained from Haramaya University Colleges of Health and Medical Sciences Institutional Health Research Ethical Review Committee. Then Permission letter was obtained from hospitals medical officers. Respondents were fully informed about the purpose of the study and singed their consent. Information obtained during the study was keep confidential. Participants having CVD by our measurement were advised and treated by the internist in study group.

3. Result

3.1. Socio demographic Characteristics of Study Population

A total of 416 patients (183(44%) males and 233(56%) females) took part in the study. Their age ranged from 18 to 90 years, with a mean of 52 years (SD±14.7) and 265 (63.7 %) of them were older than 50 years. Two hundred and four (49%) of them were orthodox and 181(43.5%) of them were from Oromo ethnic group. Two hundred and one (48.3%) of them were Married and 145(34.9%) were illiterate, while 108 (26 %) had primary education. Eighty-six (20.7%) were retired (table 1). Type 2 diabetes accounted for 288 (69.2%) and the rest were type 1 diabetics. Two hundred and twenty-four of them were currently treated with oral anti-diabetic drugs and the rest with insulin. Only

115 (27.6%) participants had FBG below 126 mg/dl while 66 (15.9 %) had a FBG of 250 mg/dl or more (Table 1).

Table 1. Characteristics of the patients with diabetes mellitus (n = 416) in Hiwot Fana Specialized University hospital and Jugel hospital, Eastern Ethiopia from February 1-March 2, 2016.

Variable	Number	Percent
Sex		
Male	183	44
Female	233	56
Age in years		
<30	31	7.5
30-39	48	11.5
40-49	72	17.3
50-59	108	26.0
≥60	157	37.7
Religion		
Orthodox	204	49.0
Muslim	183	44.0
Protestant	24	5.8
Catholic and Adventist	5	1.2
Ethnicity		
Oromo	181	43.5
Amhara	159	38.2
Harari	51	12.3
Tigre	15	3.6
Gurage	10	2.4
Education status		
Illiterate	145	34.9
Able to read and write	27	6.5
Primary school	108	26.0
Secondary school	102	24.5
Above secondary	34	8.2
Marital status		
Married	201	48.3
Single	111	26.7
Divorced	18	4.3
Separated	8	1.9
Widowed	78	18.8
Occupational status		
Governmental employee	77	18.5
private employee	52	12.5
Peasant	64	15.4
Student	15	3.6
Daily laborer	33	7.9
Jobless	9	2.2
House wife	80	19.2
Retired	86	20.7
Current treatment		

Oral anti-DM	242	58.2
Insulin	174	41.8
FBG (mg/dl)		
<126	115	27.6
126-179.9	130	31.2
180-249.9	105	25.2
≥250	66	15.9
Type of DM		
Type 1	128	30.8
Type 2	288	69.2

3.2. Cardiovascular Risk Factors in Patients with Type 1 Diabetes Mellitus (DM)

The duration of diabetes ranged from 1 to 44 years, with a mean of 8.3 years (SD±6.3) and duration of diabetes was less than 5 years in 45 (35.2 %) of the study subjects. The mean BMI was 23.33 (SD±4.97) with ranged from 11.5 to 37.89 and only 10 (7.8 %) of the study subjects were found obese. Seventy-five (58.6%) of them were hypertensive participants out of these cases 67 (89.3%) were on ant-hypertensive treatment. Lipid abnormalities were prevalent in a large number of our patients, 109 (85.2%) of them had dyslipidemia. Low HDL cholesterol was found 92 (71.9%) study subjects while 40(31.2%) of them had high LDL cholesterol. Thirty-nine (30.5%) had high total cholesterol and high triglyceride also found in 36 (28.1%) of patients. Current Smoking habit and alcohol use was reported from 15(11.7%) and 28 (21.9%) of type 1 DM patients, respectively. Only 10(7.8%) had history of CVD among their families. Fifty-four (42.2%) of our study participants had metabolic syndrome while only 33(25.8%) had fasting blood sugar level <126mg/dl. It was also observed that 92 (71.9%) were not practicing regular walking or any fitness activities (Table2).

Table 2. Prevalence of Cardiovascular risk factors in patients with type 1 diabetes mellitus (DM) in Hiwot Fana Specialized University hospital and Jugel hospital, Eastern Ethiopia from February 1-March 2, 2016.

Variable	Number	Percent
Duration of DM		
<5 years	45	35.2
5-10 years	43	33.6
>10 years	40	31.2
Obesity		
No	118	92.2
Yes	10	7.8
BP		
Normal	53	41.4
Hypertensive	75	58.6
Triglyceride		
Normal	92	71.9
High (Risk)	36	28.1
Total cholesterol		

Normal	89	69.5
High (Risk)	39	30.5
LDL		
Normal	88	68.8
High (Risk)	40	31.2
HDL		
Normal	36	28.1
Low (Risk)	92	71.9
Chat chewing		
Never	63	63
Yes I'm currently chewing	52	52
I currently quitted chewing	13	13
Alcohol use		
Yes	28	21.9
No	100	78.1
Physically inactive		
Yes	92	71.9
No	36	28.1
Current smoking		
Yes	15	11.7
No	113	88.3
Family history of CVD		
Yes	10	7.8
No	118	92.2
Type of fat/oil used to prepare food		
Unsaturated oil	29	22.7
Saturated oil	98	76.6
Butter from animal	1	0.8
Metabolic syndrome		
Yes	54	42.2
No	74	57.8
Dyslipidemia		
Yes	109	85.2
No	19	14.8
FBS (<126mg/dl)		
Yes	33	25.8
No	95	74.2

Out of 6 common CVD risk factors (hypertension, uncontrolled fasting blood sugar, obesity, dyslipidemia, smoking and physical inactivity), majority (72.6%) of study subjects had ≥3 CVD risk factors (fig. 1).

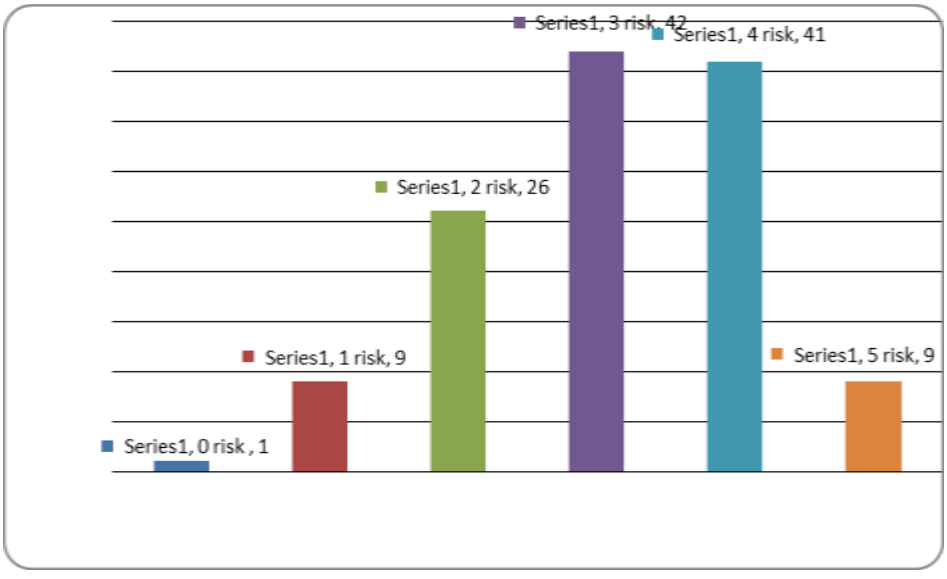

Figure 1. Frequency of multiple CVD risk factors (hypertension, uncontrolled fasting blood sugar, obesity, dyslipidemia, smoking and physical inactivity) in type 1 diabetic patients.

3.3. Cardiovascular Risk Factors in Patients with Type 2 Diabetes Mellitus (DM)

The duration of diabetes ranged from 1 to 30 years, with a mean of 7 years (SD±5.3) and duration of diabetes was less than 5 years in 117 (40.6%) of the study subjects. The mean BMI was 25.42 (SD±4.57) with ranged from 14.82 to 39.84 and only 38 (13.2%) of the study subjects were found obese. Hundred and eighty-six (64.6%) were hypertensive participants out of these cases 140 (75.3%) were on ant-hypertensive treatment. Lipid abnormalities were prevalent in a large number of our patients, 240 (83.3%) of them had dyslipidemia. Low HDL cholesterol was found 181 (62.8%) study subjects while 104 (36.1%) of them had high LDL cholesterol. Hundred and seven (37.2%) had high total cholesterol and high triglyceride also found in 106 (36.8%) of patients. Current Smoking habit and alcohol use was reported from 14(4.9%) and 75 (26 %) of type 2 DM patients respectively. Only 24 (8.3%) had history of CVD among their families. Hundred and twenty-three (42.7%) of our study participants had metabolic syndrome while only 82 (28.5%) had fasting blood sugar level <126mg/dl. It was also observed that 224 (77.8%) were not practicing regular walkor any fitness activities (Table3).

Table 3. Prevalence of Cardiovascular risk factors in patients with type 2 diabetes mellitus (DM) in Hiwot Fana Specialized University hospital and Jugel hospital, Eastern Ethiopia from February 1-March 2, 2016.

Variable	Number	Percent
Duration of DM		
<5 years	117	40.6
5-10 years	114	39.6

>10 years	57	19.8
Obesity		
No	250	86.8
Yes	38	13.2
BP		
Normal	102	35.4
Hypertensive	186	64.6
Triglyceride		
Normal	182	63.2
High (Risk)	106	36.8
Total cholesterol		
Normal	181	62.8
High (Risk)	107	37.2
LDL		
Normal	184	63.9
High (Risk)	104	36.1
HDL		
Normal	107	37.2
Low (Risk)	181	62.8
Chat chewing		
Never	149	51.7
Yes I'm currently chewing	108	37.5
I currently quitted chewing	31	10.8
Alcohol use		
Yes	75	26.0
No	213	74.0
Physically inactive		
Yes	224	77.8
No	64	22.2
Current smoking		
Yes	14	4.9
No	274	95.1
Family history of CVD		
Yes	24	8.3
No	264	91.7
Type of fat/oil used to prepare food		
Unsaturated oil	79	27.4
Saturated oil	205	71.2
Butter from animal	4	1.4
Metabolic syndrome		
Yes	123	42.7
No	165	57.3
Dyslipidemia		
Yes	240	83.3
No	48	16.7
FBS (<126mg/dl)		
Yes	82	28.5
No	206	71.5

Out of 6 common CVD risk factors (hypertension, uncontrolled fasting blood sugar, obesity, dyslipidemia, smoking and physical inactivity), majority (75.3%) of study subjects had ≥ 3 CVD risk factors (Figure 2).

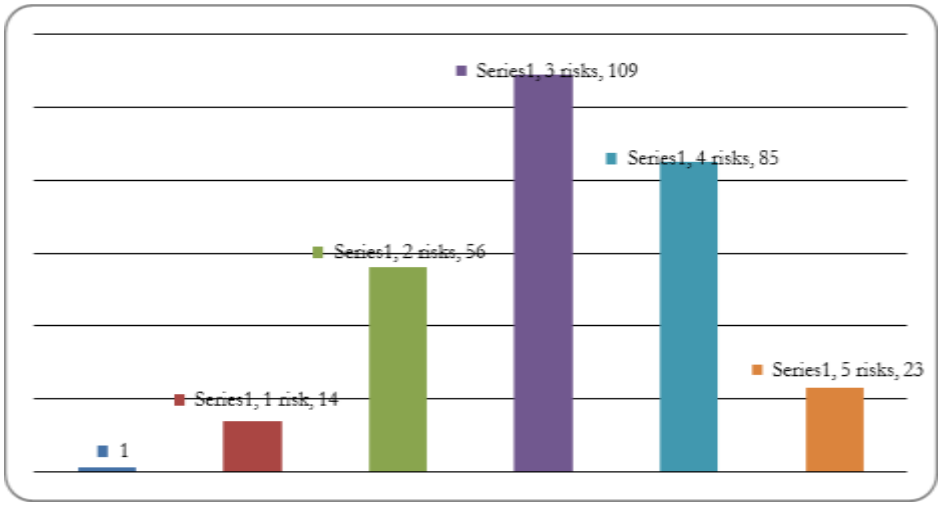

Figure 2. Frequency of multiple CVD risk factors (hypertension, uncontrolled fasting blood sugar, obesity, dyslipidemia, smoking and physical inactivity) in type 2 diabetic patients.

3.4. Prevalence of Cardiovascular Disease (CVD) in all DM Patients

Overall 64 (15.4%) of our study participants had CVD. The major CVD identified by ECG was ischemic heart disease (IHD) which account 89% (57/64) followed by Left ventricular hypertrophy (LVH) which account 11% (7/64). The prevalence of CVD was 14.8% in type 1 and 15.6% in type 2 DM patients. We did not find statistically significant association between CVD and DM type (OR=0.94, 95%CI=0.52, 1.68, P=0.838).

3.5. Prevalence of Cardiovascular Disease (CVD) in Type 1 DM Patients

The overall prevalence of CVD in type 1 DM patients is 14.8% (19/128). CVD was found among 16.7 % of male participants and magnitude of CVD was more than the females; however, we did not find statistically significant association between CVD and sex in type 1 DM patients (OR=1.31, 95%CI=0.49, 3.48, P=0.587). CVD is more common in patients with DM duration of 5-10 years (20.9%) than patents with duration of <5 years (11.1%) and > 10 years (12.5%) but we did not find statistically significant association between CVD and DM duration (OR=0.87, 95%CI=0.23, 3.27; OR=1.85, 95%CI=0.56, 6.09) (Table 4).

Dyslipidemia is common in individuals with type 1 DM patients and the prevalence of CVD among these individuals is (15.6%) more than individual without dyslipidemia (10.5%). However, no statistically significant association was found between CVD and

dyslipidemia (OR=0.63, 95%CI=0.13, 3.01, P=0.569). Other lipid abnormalities were also prevalent in a large number of our patients and the prevalence of CVD was 19.4%, 12.8%, 10.0% and 17.4%) in patients with high triglyceride, high total cholesterol, high LDL and low HDL level respectively. But there was no significant statical association found between these lipid abnormalities and CCVD (OR=0.62, 95%CI=0.22, 1.73; OR=1.26, 95%CI=0.42, 3.80; OR=1.84, 95%CI=0.57, 5.97; OR=0.87, 95%CI=0.11, 1.58) (Table 4).

The prevalence of CVD among obese patients was 20.0% which is higher than their counter parts (non- obese) with prevalence of 14.4%. CVD was also higher (18.7%) in hypertensive patents than their counter parts (non- hypertensive patients) but we did not find statistically significant association between CVD and obesity and hypertension (OR=0.67, 95%CI=0.13, 3.44; OR= 0.45, 95%CI=0.15, 1.34) (table 4). There was no statistically significant association found between CVD and behavioral factors such as Chat chewing, alcohol use, smoking, physical activities (OR=1.20, 95%CI=0.44, 3.30; OR=0.63, 95%CI=0.17, 2.33; OR=1.15, 95%CI=0.23, 5.56; OR=0.64, 95%CI=0.19, 2.08). The prevalence of CVD among study participants with metabolic syndrome was 18.5% while 12.2% among their counter parts (participants without metabolic syndrome). But there was no statistically significant association found between CVD and metabolic syndrome. (OR=0.60, 95%CI=0.22, 1.62, p=0.321) (Table 4).

Table 4. Prevalence of cardiovascular disease (CVD) in type 1 DM patients in Hiwot Fana Specialized University hospital and Jugel hospital, Eastern Ethiopia from February 1-March 2, 2016.

Variable	CVD		COR(95% CI)	p-value
	Without CVD	With CVD		
Sex				
Male	50(83.3%)	10(16.7%)	1.31(0.49, 3.48)	0.587
Female	59(86.8%)	9(13.2%)	1	
Duration of DM				
<5 years	40(88.9%)	5(11.1%)	0.87(0.23, 3.27)	0.843
5-10 years	34(79.1%)	9(20.9%)	1.85(0.56, 6.09)	0.310
>10 years	35(87.5%)	5(12.5%)	1	
Obese				
No	101(85.6%)	17(14.4%)	0.67(0.13, 3.44)	0.635
Yes	8(80.0%)	2(20.0%)	1	
Hypertensive				
No	48(90.6%)	5(9.4%)	0.45(0.15, 1.34)	0.155
Yes	61(81.3%)	14(18.7%)	1	
Triglyceride				
Normal	80(87.0%)	12(13.0%)	0.62(0.22, 1.73)	0.363
High (Risk)	29(80.6%)	7(19.4%)	1	
Total cholesterol				
Normal	75(84.3%)	14(15.7%)	1.26(0.42, 3.80)	0.670
High (Risk)	34(87.2%)	5(12.8%)	1	

LDL				
Normal	73(83.0%)	15(17.0%)	1.84(0.57, 5.97)	0.304
High (Risk)	36(90.0%)	4(10.0%)	1	
HDL				
Normal	33(91.7%)	3(8.3%)	0.43(0.11, 1.58)	0.205
Low (Risk)	76(82.6%)	16(17.4%)	1	
Chat chewing				
No	64(84.2%)	12(15.8%)	1.20(0.44, 3.30)	0.716
Yes	45(86.5%)	7(13.5%)	1	
Alcohol use				
No	84(84.0%)	16(16.0%)	1	
Yes	25(89.3%)	3(10.7%)	0.63(0.17, 2.33)	0.490
Physically inactive				
No	32(88.9%)	4(11.1%)	0.64(0.19, 2.08)	0.460
Yes	77(83.7%)	15(16.3%)	1	
Currently smoking				
No	96(85.0%)	17(15.0%)	1.15(0.23, 5.56)	0.861
Yes	13(86.7%)	2(13.3%)	1	
Family history of CVD				
No	100(84.7%)	18(15.3%)	0.61(0.61, 5.17)	0.657
Yes	9(90.0%)	1(10.0%)	1	
Type of fat/oil used to prepare food				
Unsaturated	24(82.8%)	5(17.2%)	1.26(0.41, 3.86)	0.680
Saturated oil and Butter from animal	85(85.9%)	14(14.1%)	1	
Metabolic syndrome				
No	65(87.8%)	9(12.2%)	0.60(0.22, 1.62)	0.321
Yes	44(81.5%)	10(18.5%)	1	
Dyslipidemia				
No	17(89.5%)	2(10.5%)	0.63(0.13, 3.01)	0.569
Yes	92(84.4%)	17(15.6%)	1	
Uncontrolled FBS				
No	28(84.8%)	5(15.2%)	1.03(0.34, 3.12)	0.954
Yes	81(85.3%)	14(14.7%)	1	

3.5. Prevalence of Cardiovascular Disease (CVD) in Type 2 DM Patients

The overall prevalence of CVD in type 2 DM patients is 15.6% (45/288). CVD was found among 17.1 % of male participants and magnitude of CVD was more than the females; however, we did not find statistically significant association between CVD and sex in type 2 DM patients (OR=1.21, 95%CI=0.63, 2.29, P=0.559). CVD is more common in patients with DM duration of 5-10 years (17.5%) and > 10 years (17.5%) than patents with duration of <5 years (11.1%), but we did not find statistically significant association between CVD and DM duration (OR=0.69, 95%CI=0.28, 1.65; OR=1.00, 95%CI=0.43, 2.30) (Table 5).

Dyslipidemia is common in our study participants with type 2 DM patients and the prevalence of CVD among these individuals is (16.7%) more than individual without

dyslipidemia (10.4%). However, no statistically significant association was found between CVD and dyslipidemia (OR=0.58, 95%CI=0.21, 1.55, P=0.281). Other lipid abnormalities were also prevalent among majority of the study participants and the prevalence of CVD was 19.8%, 19.6%, 18.3% and 17.1% in patients with high triglyceride, high total cholesterol, high LDL and low HDL level respectively. But there was no significant statical association found between these lipid abnormalities and CCVD (OR=0.61, 95%CI=0.32, 1.16; OR=0.62, 95%CI=0.32, 1.19; OR=0.73, 95%CI=0.38, 1.40; OR=0.72, 95%CI=0.36, 1.44) (Table 5).

The prevalence of CVD among obese patients was 21.1%, which is higher than their counter parts (non- obese) with prevalence of 14.8%. CVD was also higher (18.3%) in hypertensive patients than their counter parts (non- hypertensive patients) but we did not find statistically significant association between CVD and obesity and hypertension (OR=0.65, 95%CI=0.27, 1.53; OR= 0.54, 95%CI=0.26, 1.11). There was no statistically significant association found between CVD and behavioral factors such as Chat chewing, alcohol use, smoking, physical activities (OR=1.58, 95%CI=0.78, 3.16; OR=1.34, 95%CI=0.6, 2.69; OR=2.48, 95%CI=0.31, 19.50; OR=1.52, 95%CI=0.74, 3.12). The prevalence of CVD among study participants with metabolic syndrome was 21.1% while 11.5% among their counter parts (participants without metabolic syndrome). There was statistically significant association found between CVD and metabolic syndrome. Patients with type 2 DM with metabolic syndrome 62% more likely develop CVD compared to type 2 DM patients without metabolic syndrome (OR=0.48, 95%CI=0.25, 0.92, p=0.028) (Table 5).

Table 5. Prevalence of cardiovascular disease (CVD) in type 2 DM patients in Hiwot Fana Specialized University hospital and Jugel hospital, Eastern Ethiopia from February 1-March 2, 2016.

Variable	CVD		COR(95% CI)	p-value
	Without CVD	With CVD		
Sex				
Male	102(82.9%)	21(17.1%)	1.21(0.63, 2.29)	0.559
Female	141(85.5%)	24(14.5%)	1	
Duration of DM				
<5 years	102(87.2%)	15(12.8%)	0.69(0.28, 1.65)	0.406
5-10 years	94(82.5%)	20(17.5%)	1.00(0.43, 2.30)	1.000
>10 years	47(82.5%)	10(17.5%)	1	
Obese				
No	213(85.2%)	37(14.8%)	0.65(0.27, 1.53)	0.326
Yes	30(78.9%)	8(21.1%)	1	
Hypertensive				
No	91(89.2%)	11(10.8%)	0.54(0.26, 1.11)	0.097
Yes	152(81.7%)	34(18.3%)	1	
Triglyceride				
Normal	158(86.8%)	24(13.2%)	0.61(0.32, 1.16)	0.138
High (Risk)	85(80.2%)	21(19.8%)	1	
Total cholesterol				

Normal	157(86.7%)	24(13.3%)	0.62(0.32, 1.19)	0.153
High (Risk)	86(80.4%)	21(19.6%)	1	
LDL				
Normal	158(85.9%)	26(14.1%)	0.73(0.38, 1.40)	0.354
High (Risk)	85(81.7%)	19(18.3%)	1	
HDL				
Normal	93(86.9%)	14(13.1%)	0.72(0.36, 1.44)	0.363
Low (Risk)	150(82.9%)	31(17.1%)	1	
Chat chewing				
No	148(82.2%)	32(17.8%)	1.58(0.78, 3.16)	0.197
Yes	95(88.0%)	13(12.0%)	1	
Alcohol use				
No	182(85.4%)	31(14.6%)	1	
Yes	61(81.3%)	14(18.7%)	1.34(0.6, 2.69)	0.400
Physically inactive				
No	51(79.7%)	13(20.3%)	1.52(0.74, 3.12)	0.244
Yes	192(85.7%)	32(14.3%)	1	
Current smoking				
No	230(83.9%)	44(16.1%)	2.48(0.31, 19.50)	0.386
Yes	13(92.9%)	1(7.1%)	1	
Family history of CVD				
No	225(85.2%)	39(14.8%)	1.92(0.71, 5.14)	0.193
Yes	18(75.0%)	6(25.0%)	1	
Type of fat/oil used to prepare food				
Unsaturated oil, Butter from animal	65(82.3%)	14(17.7%)	1.23(0.61, 2.47)	0.547
Saturated oil	178(85.2%)	31(14.8%)	1	
Metabolic syndrome				
No	146(88.5%)	19(11.5%)	0.48(0.25, 0.92)	0.028
Yes	97(78.9%)	26(21.1%)	1	
Dyslipidemia				
No	43(89.6%)	5(10.4%)	0.58(0.21, 1.55)	0.281
Yes	200(83.3%)	40(16.7%)	1	
Uncontrolled FBS				
No	70(85.4%)	12(14.6%)	0.89(0.43, 1.84)	0.770
Yes	173(84.0%)	33(16.0%)		

4. Discussion

The prevalence of CVD in type1 DM patients in the present study area was 14.8%. It is comparable with the findings of similar studies in Finland (15.8%) (Lehto et al.,1999). But higher than the findings of similar studies in 16 European countries (6.5%) (Soedamah-Muthu et al.,2004). The difference might be due to differences in risk factors predicting CVD. The prevalence of CVD in type 2 DM patients in the present study

area is 15.6%. It is comparable with the findings of similar studies in Italy (16.2%), India (11%) and Spain (18.9%) (Avogaro et al., 2007; Mohan et al., 2010; Jurado et al.,2004).

Metabolic syndrome is a cluster of metabolic abnormalities that often co-exist and would lead to a marked increase in the risk of cardiovascular disease (CVD). Metabolic syndrome is common in individuals with type 2 diabetes mellitus (DM). The total CVD risk attributable to the syndrome has been observed to exceed the sum of the risk from each of the separate components (Afsana et al., 2010; Eckel et al., 2005). The prevalence of metabolic syndrome was high among type 2 diabetic patients in the present study. High prevalence of metabolic syndrome in type 2 patients was also reported by studies carried out in Ghana, Iran, Malaysia **(** Nsiah et al., 2015; Bonakdaran et al., 2011; Tan et al., 2013**).**

Metabolic syndrome was an independent risk factor for CVD in type 2 DM patients in the present study area. Patients with metabolic syndrome were 62% more likely develop CVD compared to those patients without metabolic syndrome. It was in agreement with a study conducted in Iran. In this study Metabolic syndrome was one of the risk factors significant independent predictors of CVD. The study recommended the importance of better detection and treatment of metabolic risk factors of CVD in type 2 DM patients (Bonakdaran et al., 2011).

Metabolic syndrome is generally associated with type-2 diabetes, and few data exist on its occurrence in type-1 diabetes. Metabolic syndrome was common in patients with type-1 diabetes in the present study. It was in agreement with a study conducted in Spain and Finland (Chillarón et al., 2010; Thorn et al., 2009). A Spanish hospital study showed that 32% type 1 DM out patients had metabolic syndrome. From the finish study, the prevalence of metabolic syndrome was 44%. These two studies demonstrated that metabolic syndrome was associated cardiovascular morbidity in type 1 diabetes. But there was no significant statical association found between metabolic syndrome and CVD in the present study. This could be the result of a limited number of type 1 DM patents in our study population.

Dyslipidemias is known to be associated with diabetes (Soedamah-Muthu et al., 2004; Jurado et al., 2009; DAI Study Group 2004). However, in our study, high levels of total and LDL cholesterol, total triglycerides and low levels of HDL cholesterol failed to predict CVD events in patients with type 1 and 2 diabetes; although our study population included a substantial number of patients with lipid abnormalities. This could be the result of a limited number of CVD events in our study population.

Studies have indicated that hyperglycemia and hypertension were independent risk factors for CVD among patients with type 1 and type 2 diabetes (Lehto et al., 1999; Soedamah-Muthu et al., 2004; Jurado et al., 2009; Avogaro et al., 2007; DAI Study Group, 2004). Although our study population included a substantial number of study participants with uncontrolled hyperglycemia and hypertension; we did not find statistically significant association between CVD and hyperglycemia and hypertension. This could be the result of a limited number of CVD events in our study population.

In the present study, it was observed that a major proportion of patients with type 1DM and type 2 DM were having uncontrolled blood sugar level of 74.2% and 71.5%

respectively despite of taking medicines or insulin. This finding was similar with studies carried out in Jimma and India with the reported proportion of uncontrolled blood sugar level of 74.2% and 75.5% respectively (Tamiru and Alemseged, 2010; Patnaik et al., 2013). This implies that only diagnosis and treatment are not sufficient to manage diabetes, along with it counseling and motivation for lifestyle modification is necessary.

Hypertension, uncontrolled fasting blood sugar, obesity, dyslipidemia, smoking and physical inactivity are the common cardiovascular disease risk factors in DM patients. Having three or more of these cardiovascular disease risk factors is high in both type 1 and 2 DM patients in this study. It is in agreement with a study conducted in Spain where three or more cardiovascular disease risk factors were observed in 91.3% of the study participant (Jurado et al., 2009). Therefore, simultaneous management of these risk factors is rigorously attended in order to prevent the occurrence of cardiovascular disease in DM patients.

The prevalence of hypertension in this study is higher (58.6% and 64.6% in type 1 1nd 2 DM patients respectively) than the one reported (46.5%) among diabetic patients in Jimma and (37.9%) from India (Tamiru and Alemseged, 2010; Patnaik et al., 2013). Higher prevalence was also reported from study carried out in Spain (74.5%) (Jurado et al., 2009). Hypertension is approximately twice as frequent in patients with diabetes compared with patients without the disease (Suwers et al., 2001). Hypertension amplifies the already high cardiovascular disease risk in diabetes. This has led to the recommendations for more aggressive treatment (i.e., reducing blood pressure) in persons with coexistent diabetes and hypertension (Unachukwu and Ofori, 2012).

More than three-fourth of the participants were dyslipidemic. Low HDL level was the most frequent compared with other lipid abnormalities. It is in agreement with a study conducted in Jimma. But different compared to the study conducted at Tikur Anbesa Hospital in 2003 where cholesterol level was more frequent lipid abnormality (Syoum et al., 2003). The difference may be due the fewer number of diabetic patients (100) included in the Tikur Anbesa Hospital study. Significant dyslipidemia also reported among Nigerian adult with diabetes (Unachukwu and Ofori, 2012). So screening of all diabetics for lipid profile along with appropriate measures will definitely reduce the risk.

The prevalence of physical inactivity was 58.5% and 55.1% among Dm patients in Nigeria and Jimma respectively (Unachukwu and Ofori, 2012; Syoum et al., 2003). This problem is higher in our study compared with these studies; it was observed that three-fourth of our study participants were not practicing regular walking or any fitness activities. DM patients in our study settings should be motivated for regular walking for 30 or some fitness activities.

5. Limitations

Previous diagnosis of CVD was not assessed due to incomplete patient records; this might underestimated the magnitude of CVD in our study participant. An ECG is a simple and valuable test. Sometimes it can definitely diagnose a heart problem. However, a normal ECG does not rule out serious heart disease. For example, you may have an irregular heart rhythm that 'comes and goes' and the recording can be normal

between episodes. Also, not all heart attacks can be detected by ECG. Angina, a common heart disorder, cannot usually be detected by a routine ECG. The other limitation of this study derives from its cross sectional design. Thus, we should recall that the findings only refer to associations, and do not imply causality.

6. Conclusion and Recommendations

The study showed that CVD constituted health problems among DM patients in the present study area. Metabolic syndrome is significantly higher in type 2 DM patients with CVD than those type 2 DM patients without CVD. Considering this result, control of metabolic syndrome components seems to be important for prevention of CVD in patients with type 2 DM.

Dyslipidemia is the commonest of all risk factors of CVD in individuals with type 1 and 2DM patients. Despite the high prevalence of these risk factors, patients did not teste for lipid profile during their regular follow up period. Early identification, prevention, and treatment of lipid abnormalities seem to be necessary, particularly in light of the high incidence of future cardiovascular disease.

The study also found out that uncontrolled hyperglycemia is common in DM patients despite of taking medicines or insulin. Hypertension is also common in DM patients despite of majority of the case were diagnosed and taking anti-hypertensive drugs. Therefore, hyperglycemic and Hypertension control should be intensified. Control of other CVD risk factors that intern affects blood sugar and hypertension might be also necessary.

Three-fourth of our study participants reported that they were not practicing regular walking or any fitness activities and use saturated oil and fat for their daily food preparations. Therefore, advising DM patients during attending their regular follow on lifestyle modifications such as regular walking for 30 minutes or some fitness activities and consumption of low in saturated oil and fat isare recommended.

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9. Prognosis value of Red Cell Distribution Width and its association with other Hematological Parameters among Admitted Congestive Heart Failure Patients in Hiwot Fana Specialized University Hospital, Harar, Ethiopia

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Abstract: Red blood cell distribution width (RDW) has emerged as a new prognostic biomarker in cardiovascular diseases. Its additional value in risk stratification of patients with congestive heart failure has not yet been established. The evidence associating red cell distribution width with a higher risk of mortality has been expanding since the initial report of its prognostic utility in heart failure patients. To determine the value of RDW and its association with other hematological parameters among admitted congestive Heart Failure (CHF patients in Hiwot Fana Specialized University Hospital, Harar, Ethiopia from September 2016 to March 2017.The cross-sectional study design was conducted among inpatient with congestive Heart Failure (CHF) visiting Hiwot Fana Specialized University Hospital. Sample was collected during admission and Red blood cell distribution width was measured. Data collected was entered on Epi data and then exported to SPSS version 20 for analysis. Statistical significance was set at P<.05. The study participants of this study were 164, with mean age of the study participants for CHF patients 42.84 (standard deviation + 18.32years) in years, 59.8% were female study participants. More than 90% of the RDW determined among confirmed CHF patient was out of local normal reference range (11-14%). The RDW ranged from 12.60 to 36.30% (median 17.6%) and was correlated with Hemoglobin (Hgb) (Beta= -0.212 p = 0.044 95%CI -0.433 to -0.006), Mean Cell Hemoglobin Concentration (MCHC) (Beta -0.213, p = 0.044, 95% CI -26.62 to -.40) and Plateletcrit (PCT) (Beta -0.213, p = 0.044, 95% CI -26.62 to -.40). Anemia was prevalent (70.2%) among CHF patients and the normocytic normochromic types of anemia was more prevalent than the other types of anemia. RDW determined was increased among CHF patients when compared to local reference value for RDW. These parameters had inverse correlation with other hematology parameters such Hgb, MCHC and Pct. The RDW could

be used for diagnosis and prognosis purpose since it was specifically increased among CHF patients and if confirmed by further studies and other disease such as anemia which was highly prevalence need attention among CHF patients.

1. Introduction

The epidemic of CVD in Sub-Saharan African (SSA) is driven by multiple factors working collectively. Lifestyle factors such as diet and smoking contribute to the increasing rates of CVD in SSA. Some lifestyle factors are considered gendered in that some are salient for women and others for men. For instance, obesity is a predominant risk factor for women compared to men, but smoking still remains mostly a risk factor for men (*BeLue R, et al,* 2009*).*

Over the past decade, there has been a literal explosion of studies examining various prognostic biomarkers in patients with heart failure. Some of these biomarkers—such as the natriuretic peptides—directly reflect pathophysiologic processes in the diagnosis, while the prognostic links for other "heart failure biomarkers" remain less well-defined (Bonaque JC et al, 2012).

The evidence associating RDW with a higher risk of mortality has been expanding since the initial report of its prognostic utility in heart failure patients. RDW has also been shown to independently predict overall and cardiovascular (CV) mortality in the general population and various high-risk populations (Felker GM, et al, 2007).

Tonelli et al have found a graded independent relation between higher levels of RDW and the risk of heart failure, cardiovascular events, and all-cause death in people with prior myocardial infarction but no evidence of heart failure at baseline. They also recommend further explanation for the association between RDW and adverse clinical outcomes *(Tonelli M et al, 2008).*

Red blood cell distribution width has emerged as a new prognostic biomarker in cardiovascular diseases. Its additional value in risk stratification of patients with chronic heart failure has not yet been established. RDW appears to be prognostically meaningful, but this is an empty finding if such risk cannot be changed.Thus, unless and until the mechanistic reasons for the value of RDW are elucidated, a therapeutic imperative associated with its management cannot be derived and tested. This is the necessary next step in RDW-related research in heart failure. It is highly possible RDW will become a member of the standard evaluation test panel for our heart failure patients (Roland R.J et al, 2012).

RDW is easily measured, standardized and typically reported with complete blood count values at no additional cost; its independent predictive value for various CV events makes further research of other 'at-risk populations' for CV events imperative (Loffredo L et al , 2008).

The aim of this study was to determine if RDW value was different among CHF patients when compared to local reference values and if it's used as diagnosis value in addition to other clinical variables among inpatients with CHF.

2. Methods and Materials

2.1. Study Design Aand Setting

The study was conducted at Hiwot Fana Specialized University Hospital and study design was cross-sectional study among all patient with CHF visiting Hiwot Fana Specialized University Hospital from September 2016 to March 2017.

2.2. Sample Size and Sampling Technique

Convenient sampling technique was conducted among confirmed CHF patient, so all CHF patients who was admitted in the Hospital within the study period was included in the study. Data collectors interviewed the study subjects using a questionnaire on socio-demographic characteristics, risk factors and other baseline information. Baseline clinical characteristics such as CHF stage, Alcohol, Chat chewing habit was collected using a checklist.

2.3. Data Collection Methods

Sample was collected during admission and all hematological parameters was determined using the Cell Dyn hematology analyzer. We have conducted local reference range for all hematological parameters (using 77 control group which was apparently health) to compare with confirmed CHF patients hematological parameters based on central 95% of the reference population of subjects. By definition, 5% of all results from "healthy" people will fall outside of the reported RI and, as such, will be flagged as being "abnormal." *(Edward AS et al, 2000).*

The blood sample was collected, labeled, transported and stored in a proper manner to ensure sample integrity. During testing, the trained laboratory personnel was adhered strictly to the Standard Operating Procedures (SOP) and manufacturer instruction manual in each procedure to ensure the data quality for laboratory tests.

2.4. Data Analysis

Data collected was entered on Epi data and then exported to SPSS version 20 for analysis. The one-sample T-test was conducted to RDW among CHF patients and control groups. Independent T-test was also conducted to compare RDW while Hgb<12g/dl and Hgb>12g/dl. Bivariate analysis was conducted to check whether the RDW has association with other hematological parameter. The multivariate model was adjusted for potential confounding variables that show a significant association with RDW bivariate analysis. Statistical significance was set at P<.05.

3. Result

Socio-demographic variables: The study included 99 CHF patients and 82 control groups. But after excluding incomplete data the final study participants became 87 for CHF patient and 77 control group. The mean age of the study participants for CHF patients were 42.84 (standard deviation + 18.32years) in years, with range 16 to 90 years.

More than 76% and 59%, were rural community and female study participants. More than 79% and 86% of study participants did not attend education and married study participants (Table1).

Table 1 Sociodemographic variables among confirmed CHF patients from September 2016 to March 2017 at Hiwot Fana Hospital, Harar, Ethiopia.

Characteristics		Frequency	Percent
Residence	Urban	20	23.26
	Rural	66	76.74
Age	<40yrs	43	50
	≥40yrs	43	50
Sex	Male	35	40.2
	Female	52	59.8
Marital Status	Married	75	86.2
	Unmarried	12	13.8
Religion	Orthodox	7	8
	Muslim	80	92
Income	Average	8	9.4
	Better	77	90.6
Khat Chewing habit	Yes	42	48.3
	No	45	51.7
Alcohol drinking Habit	Yes	2	2.3
	No	85	97.7
Occupation	Employed	11	12.6
	Unemployed	76	87.4
use tobacco products	Yes	11	13.1
	No	73	86.9

RDW among confirmed CHF patients

The RDW ranged from 12.70 to 36.30% (median 17.6%), and only eight CHF patients (9.2%) had RDW value within the local normal range (11-14%). Accordingly, the RDW determined was 18.42 ± 3.89% (mean ± SD) after excluding the outlier and more than 90.8% of RDW determined were out of local reference range (11-14%) (Table2). One-sample t-test was conducted to compare the CHF patient and control group RDW. There was significant difference in scores for CHF patient RDW (M = 18.86, SD = 4.76) and RDW of the control (M = 12.35, SD = .80; p = .000, two-tailed). As it has been shown on the figure1 there was a huge difference between the CHF patients' and the control RDW or local reference range (Figure1)

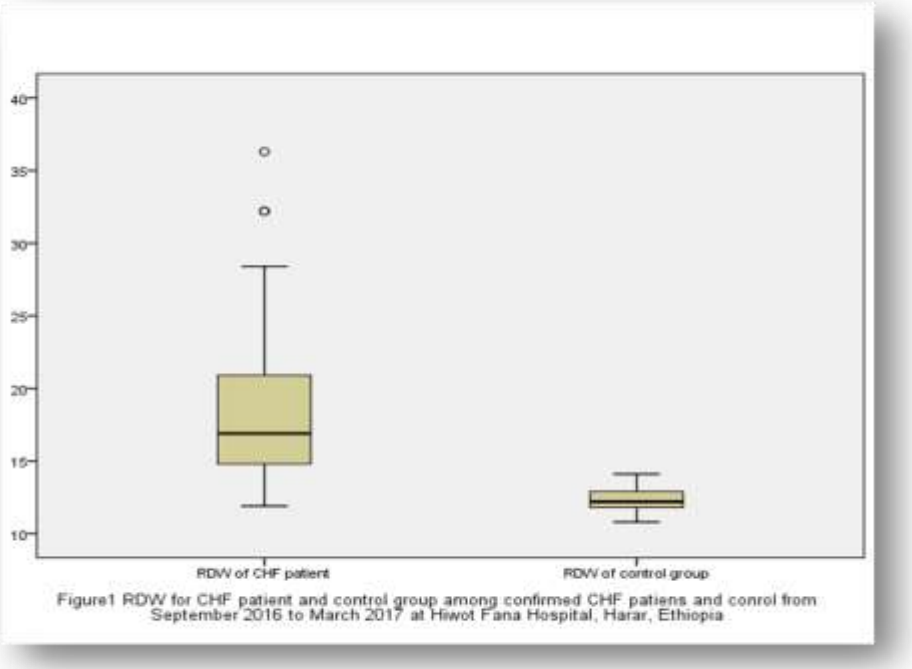

Figure1 RDW for CHF patient and control group among confirmed CHF patiens and conrol from September 2016 to March 2017 at Hiwot Fana Hospital, Harar, Ethiopia

Table 2 Frequency of RDW among confirmed CHF patients from September 2016 to March 2017 at Hiwot Fana Hospital, Harar, Ethiopia.

RDW measurement	Frequency	Percent (%)
11-14 %	8	9.2
>14%	79	90.8
Total	87	100

RBC and platelet parameters among CHF patients

Hemoglobin, Mean cell concentration (MCH), Mean corpuscular hemoglobin concentration (MCHC) and hematocrit among patient was 9.95 ± 3.9g/dl, 25 ± 4.26pg, 29.97±2.47pg/l and 33.24±13.11% 6%, respectively. The hemoglobin range among the patient was 0.72 to 20.90g/dl, from which 70.2% of the patient had less than local normal reference range for hemoglobin (12-17.2g/dl, although the reference range given by Cell Dyn Ruby was 12.9 -14.23g/dl) which means more than 70% of the CHF patient have anemia (<12g/dl). From those anemic cases, the most prevalence types of anemia was normocytic normochromic (45.46%), followed by microcytic hypochromic (35.6%) and macrocytic normochromic (18.6%) based on the local reference value for MCV (79.3 – 94.3fl).

Correlation of RDW with hematological parameters

This study also tried to analysis the correlation of RDW with other parameters both hematological and non-hematological. For this reason, the bivariate and multivariate regression analysis were conducted to check whether RDW has correlation with other

variables, accordingly the RDW has correlation with MCHC, HGB and PCT measurement or parameters among confirmed CHF patients (Table 3). From this study, as it has shown on Figure 2 RDW has been high when MCHC was lower than the local reference range (31.5 to 34.5pg/l) and it seems MCHC was sensitive to measure RDW parameter (Table3, Figure 2).

To the best of our knowledge, new finding of this study was the relation between RDW and PCT which was inversely related with RDW among confirmed CHF patients (Table 3, Figure4). The other parameters correlated with RDW was Hgb which was also inversely related with RDW (Table3, Figure3). To compare the RDW for Hgb <12g/dl and >12g/dl an independent-samples, t-test was conducted. From the finding, we have learnt that there was significant difference in scores for Hgb <12g/dl (M = 19.56, SD = 4.96) and Hgb >12g/dl (M = 17.17, SD = 3.84; t (85) = -2.45, p = .030, two-tailed).

Table 3 Multivariate regression analysis for RDW and other related parameters among confirmed CHF patients from September 2016 to March 2017 at Hiwot Fana Hospital, Harar, Ethiopia.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Low	Upper	Zero-order	Partial	Part	Tolerance	VIF
Pct	-17.460	7.085	-.247	-2.464	.016	-31.555	-3.364	-.361	-.263	-.226	.839	1.192
MCHC	-.643	.170	-.351	-3.777	.000	-.982	-.304	-.403	-.385	-.346	.976	1.024
Hgb	-.250	.117	-.216	-2.136	.036	-.483	-.017	-.368	-.230	-.196	.825	1.212
Adjusted R square = 0.285												

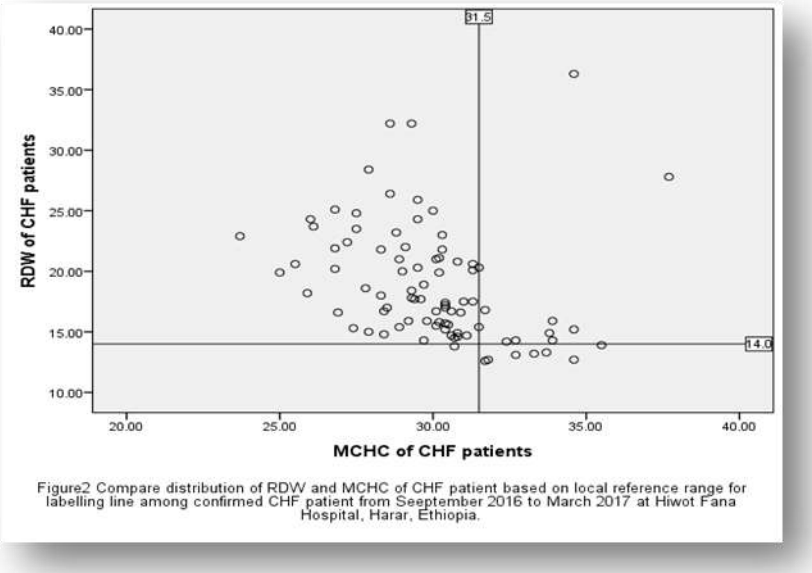

Figure2 Compare distribution of RDW and MCHC of CHF patient based on local reference range for labelling line among confirmed CHF patient from Seeptember 2016 to March 2017 at Hiwot Fana Hospital, Harar, Ethiopia.

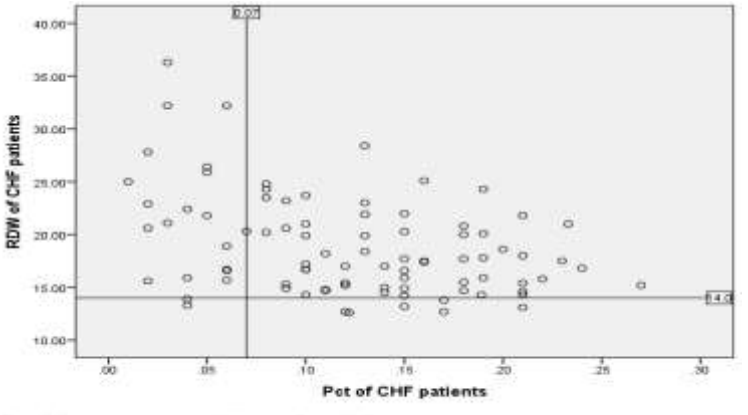

Figure3 Compare distribution of RDW and Pct of CHF patient based on local reference range for labelling line among confirmed CHF patient from Seeptember 2016 to March 2017 at Hiwot Fana Hospital, Harar, Ethiopia.

4. Discussion

The RDW is a readily available and inexpensive test for patients with CHF. However, the mechanisms of the associations between CVDs and RDW are unclear because increased RDW is associated with several CVDs with different etiologies (Zöller B, et al 2014). The intention of this study was to assess the value of RDW and other hematological parameters among confirmed CHF patient.

RBC and Platelet parameters among CHF patients

By this study, it was revealed that 70.2% of the CHF patients had anemia. Anemia can be classified based on morphology or Mean cell volume, accordingly the anemia that was common among CHF patients by this study was normocytic normochromic anemia (45.46%), followed by microcytic hypochromic (35.6%) and macrocytic normochromic (18.6%) based on the local reference value for MCV (79.3 – 94.3fl) (Perkins SL, 2003). The prevalence of anemia we have found by this study was higher than studies

conducted *by Tseliou E et al, Makubi A et al, and Ikama MS et al,* which revealed the prevalence of anemia 60%, 57% and 42% among heart failure patients, respectively (Tseliou E et al, 2014, Makubi A et al, 2014 and Ikama MS, et al, 2015). This variation might be due to reference range used by those studies vary from ours study since we used local reference range which was specific for study population.

RDW among confirmed CHF patients

More than 90% of the study participants or confirmed CHF patients had RDW greater than local reference value or control group which was conducted to verify the reference value given by hematology analyzer. One-sample t-test was conducted to compare the CHF patient and control group RWD, revealed significant difference in scores for CHF patient RDW (M = 18.86, SD = 4.76) and RWD of the control (M = 12.35, SD = .80; p = .000, two-tailed). The RDW determined was 18.86 $\pm$ 4.76% (mean $\pm$ SD) which ranged from 12.70 to 36.30% (median 17.6%), whereas the local reference value for RDW was 11-14%. This finding is consistent with the study finding by Tseliou E *et al*, in which RDW was 14.1% to 35.1% (median 18%). Increased RDW was reported in almost in all studies conducted among CHF patients although the magnitude and the study design varied (Oh J et al, 2012, Tonelli M, 2008, Bonaque JC, et al 2012, Dai Y, et al, 2014, Tseliou E et al, 2014, Wołowiec L et al, 2016).

RDW increased among CHF patients because it may represent an integrative measure of multiple pathologic processes in HF such as nutritional deficiencies, renal dysfunction, hepatic congestion and inflammatory stress (where different Inflammatory cytokines presented), explaining its association with clinical outcomes (Tseliou E et al, 2014). Clinical conditions such as iron deficiency, B12 or folate deficiency, liver disease, malnutrition, occult colon cancer, and neoplastic metastases to bone marrow and qualitative hemoglobin abnormality, increased red cell destruction (such as hemolysis), or after blood transfusion causes ineffective red cell production as a result RDW typically elevated (Tseliou E et al, 2014, Perkins SL, 2003).

Correlation (Predictors) of RDW with other variables

The correlation of RDW with other variables conducted by bivariate and multivariate regression analysis showed RDW has correlation with MCHC, HGB and PCT measurement or parameters among confirmed CHF patients (Table 3). With this study, we identified that RDW has correlation with MCHC parameter (Beta -.372 p = 0.000 95% CI -0.893 to -.285) and inversely related with RDW. This finding was consistent with study conducted by *Borne Y, et al,* which revealed that increased RDW was associated with decreased erythrocytes and MCHC (Borne Y, et al, 2011). The MCHC is expressed in grams of hemoglobin per deciliter of packed red blood cells (measures the amount hemoglobin per unit blood). This represents measurement of Hgb or the ratio of hemoglobin mass to the volume of red cells (Perkins SL, 2003).

The RDW has also correlation with PCT (Beta -0.213, p = 0.044, 95% CI -26.62 to -.40) and was inversely related with RDW among confirmed CHF patients. Although there was limited study with regards to PCT and RDW correlation, the study conducted by

Borne Y, et al was inconsistent with our finding and revealed that increased RDW was associated with increased mean corpuscular volume (MCV), leucocyte and platelet counts (Borne Y, et al, 2011). The PCT provides reliable data regarding total platelet mass and indicates the number of circulating platelets in a unit volume of blood, analogous to the hematocrit for erythrocytes (Akpinar I et al , 2014, Hamur H et al 2016). The RDW had correlation with Hgb (Beta= -0.212 p = 0.044 95% CI -0.433 to -0.006), it was also inversely related with RDW measurement. An independent-samples t-test was conducted to compare the RDW for Hgb <12g/dl and ≥12g/dl. There was significant difference in scores for Hgb <12g/dl (M = 19.56, SD = 4.96) and Hgb ≥12g/dl (M = 17.17, SD = 3.84; t (85) = -2.45, p = .030, two-tailed). The magnitude of the differences in the means (mean difference = -2.41, 95% CI: –4.580 to -.246) was moderate (eta squared = .066).

This finding was consistent with the study conducted by *Tonelli M*, et al, that revealed patients with higher RDW levels had lower levels of hemoglobin (Tonelli M, 2008), again other study by *Wołowiec L et al,* revealed both RDW and hemoglobin concentration important predictors of mortality among patients hospitalized with CHF (Wołowiec L et al, 2016). Besides this, study conducted among congestive heart failure patients by Dai Y, et al, revealed Hgb is independent predictors of RDW (Dai Y, et al, 2014). Anemia increased because of low hgb among CHF patients and RDW is increased in those patients, that's why hemoglobin was inversely related with RDW.

Limitation of the study

This study was cross-sectional study, although we planned to apply longitudinal prospective design due to scarcity of budget and short period of time allowed for the study.

5. Conclusion

More than 90% of the RDW determined among confirmed CHF patient was out of local normal reference range (11-14%). RDW ranged from 12.70 to 36.30% (median 17.6%) and was correlated with Hgb (Beta= -0.212 p = 0.044 95% CI -0.433 to -0.006), MCHC (Beta -0.213, p = 0.044, 95% CI -26.62 to -0.40) and PCT (Beta -0.213, p = 0.044, 95% CI -26.62 to -0.40). Anemia was prevalent (70.2%) among CHF patient and the normocytic normochromic types of anemia was more prevalent than the other types of anemia.

6. Recommendation

The RDW was high among CHF patients based on local reference range, so if properly managed it could be used for diagnosis and prognosis purpose among CHF patients in the future even could be included in protocol for diagnosis of CHF. For CHF patients, we need to give attention and screen to other disease such as anemia which was highly prevalent.

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10. Seroprevalence and a 5 year (September 2010- August 2015) Trends of Transfusion Transmitted Infections at Harar Blood bank in Harari regional state, Eastern Ethiopia

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Abstract: Use of unscreened blood keeps the patient at risk of acquiring many transfusion transmitted infections like Hepatitis B Virus, Hepatitis C virus, Human Immunodeficiency Virus, syphilis and other. Thus, blood transfusion demands for meticulous pretransfusion testing and screening. Knowledge of prevalence and trends of transfusion transmitted infections is important to take appropriate measures on blood bank services. To assess seroprevalence and a 5 year (September 2010- August 2015) Trends of Transfusion Transmitted Infections at Harar Blood bank in Harari regional state, Eastern Ethiopia. Data were collected from November 16- December 31, 2015Retrospective study was conducted on 11382 Blood bank cards from November 16- December 31, 2015. All consecutive blood donors' cards were reviewed by trained nurses and laboratory technicians. All data were entered to EPI data and analyzed by Statistical Package for the Social Sciences (SPSS) version 16 software. The overall Seroprevalence Transfusion Transmitted Infections in this study was 6.6%. Almost all Transfusion Transmitted Infections occurred on the first time donors (99.3%). The overall seroprevalence Hepatitis B Virus, Human Immunodeficiency Virus, Hepatitis C virus and syphilis were 4.4%, 0.6%, 0.8% and 1.1% respectively. Those in the age group 26-35 (AOR=2.1; 95% CI: 1.2,3.6) , 36-45 (AOR=4.1; 95% CI :2.4,7.1) and >46 (AOR=4.6; 95 CI :2.3,9.1) were more likely to be infected with syphilis compared to the age group 17-25. Those students (AOR= 0.2; 95% CI: 0.04, 0.8) and private employed (AOR= 0.2; 95% CI: 0.03, 0.9) were less likely to be infected with syphilis compared to unemployed. While, those male (AOR=1.9; 95% CI : 1.4,2.5) were more likely to be infected with Hepitits B virus. Government employed (AOR=0.4; 95 CI: 0.2, 0.7) and students (AOR=0.4; 95% CI: 0.2, 0.8) were less likely to be infected with Hepitits B virus than unemployed. In Hepatitis C virus, those in the age group >46 (AOR= 2.7; 95 CI: 1.2,6.2) were more likely to be infected than in the age group 17-25 years. The prevalence of Hepatitis B Virus and Human Immunodeficiency Virus decline, but the decline was not statistical significant. While the prevalence of Hepatitis C Virus and syphilis was declined significantly in most years. The problem Transfusion Transmitted Infections is lower in this study as compared to previous study conducted in Ethiopia.

But decline in trends Transfusion Transmitted Infections was not significant for some pathogens. Therefore, it should follow strictly the preliminary blood donor selection criteria to reduce the number of blood disqualified from transfusion after collection and screening. It is also important to increase the number repeated voluntary donors through promotion blood bank activity.

Keywords: Transfusion transmitted infections; Hepatitis B Virus; Hepatitis C virus; Human Immunodeficiency Virus; Syphilis, Blood bank; Harar

1. Introduction

Quarter million maternal death in the world and 15% of child mortality in Africa was due to obstetric bleeding and anemia, respectively, in which blood transfusion is always required (WHO African Region, 2006). However, every year more than 90 million units of blood are collected worldwide (WHO, 2008). And only 27 million are collected in low- and middle-income countries, whereby 82% of the world's population lives (Blood safety. 2005). In Sub-Saharan Africa (SSA) out of the estimated need of 18 million units of safe blood per year, merely about 15% were collected (WHO African Region, 2006). Ethiopia is a country with high maternal mortality 676/100,000 (Central Statistics Agency, 2011) and high motor accident (among ten top countries in the world) and with a large non-immune population for malaria (WHO African Region, 2006).

Blood transfusion Services (BTS), which is transfusion of blood and blood components, as a specialized modality of patient management saves millions of lives worldwide each year and reduces morbidity (Khan et al,.2007). It is necessary to correct severe anemia, deficiency of plasma clotting factor thrombocytopenia, Immunodeficiency state and hypoalbuminia (Talib and Khuana, 1996).

It is well known that blood transfusion is associated with a large number of complications, some are only trivial and others are potentially life threatening, demanding for meticulous pre transfusion testing and screening. Use of unscreened blood transfusion keep the patient at risk of acquiring many Transfusion Transmitted Infections (TTIs) like Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV), syphilis, malaria and etc. Blood transfusion departments have always been a major portal to screen, monitor and control TTIs. It also gives clue about the prevalence of these infections in healthy populations (Khan et al,.2007; Pallavi et al.,2011). Human Immunodeficiency Virus is one of blood transmitted disease which is causing significant morbidity and mortality. HBV is also known to be highly infectious and associated with long term morbidity due to complications like cirrhosis, portal hypertension and hepatocellular carcinoma (UNAIDS,2002) The prevalence of HBV varies across the world from 0.1 up to 0.2% in low endemic countries,3% in some Mediterranean country and up to 15% in Africa and western pacific region. It is estimated that at least 250 million chronic carrier live worldwide (WHO, 2003)

Hepatitis C Virus had been identified and characterized only 1989. About 20-40% HCV cases are acute. The majority of them progress chronic infection. The carrier stat varies across the world from 0.05- 0.5% in low endemic country such as Western

Europe, North America, and as high as 20% in Egypt and specific regions of some Asian and African country. Current estimates are that at least 200 million people are infected with HCV worldwide (Zekeria, 2003). Physicians, policy makers and patients are becoming more concerned about safe transfusion of blood. The hazardous of transfusion can be minimized by proper screening and selection of donors before collection of blood and laboratory screening of blood for TTIs. It has been accepted that prevalence of transfusion transmitted disease is much lower in healthy, voluntary blood donors as compared to professional (commercial) blood donors. In spite of donors screening with highly specific and sensitive laboratory methods, transmission of viruses through blood transfusion cannot be avoided. One of the reasons pathogen might remains undetectable by its prolonged incubation periods. So, a person can become potentially infective long before sero-conversion. Thus, careful selection by detailed medical history and examination should be carried out (Gebreselassie,1986, Fernandes et al.,2010).

There were few studies on the seroprevalence and trends of TTIs among blood donors in Ethiopia, which found with variable findings (Diro et al., 2008; Feleke et al., 2006; Baye and Yohannis, 2007; Rahlenbeck et al., 1997; Tessema et al., 2010). A study conducted among Ethiopian blood donors in 1995 showed that the seroprevalence of HIV-1, syphilis and HBV was 16.7%, 12.8% and 14.4%, respectively (Rahlenbeck et al., 1997). In another retrospective study conducted in Gondar from January 2003 and December 2007 showed a seroprevalence of HIV, HBV, HCV and syphilis of 3.8%, 4.7%, 0.7%, and 1.3%, respectively. Significantly declining trends of seroprevalence of HIV, HCV and syphilis were also observed (Tessema et al., 2010). In Harar, there was no published report to my knowledge about the prevalence and trends of TTIs among blood donors in Harari region. Therefore, this study tried to assess seroprevalence and a 5 year (September 2010- August 2015) Trends of Transfusion Transmitted Infections at Harar Blood bank in Harari regional state, Eastern Ethiopia. Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV) and Syphilis are the four major Transfusion Transmitted Infections which are routinely screened for all blood donated at Harar Blood Bank.

2. Material and Methods

2.1. Study Area and Period

Harari regional State is found in eastern Ethiopia and it is 525 km from Addis Ababa. This study was conducted in Harar Blood banking October 1 to December 30,2015. The blood banking was established 1976/77 by Ethiopian Red Cross society. It collects blood from donor at the bank and by campaigning in different institutes, screen the collected blood from donors for the four major TTIs (HIV, HCV, HBV and syphilis) and giving screened blood to recipient who are in hospital at the regional state. In addition, they prepare different blood component like platelet, plasma and give voluntary counseling for all blood donors after testing their blood sample. The blood banking was administered under Harari regional state health bureau since 2011/12 (Head of Harar blood bank laboratory personal communication)

2.2. Study Design

A 5-year (September 2010- August 2015) retrospective study was conducted on blood donors cards

2.3. Sample Size and Sampling Techniques

The sample size for prevalence and trends of Transfusion transmitted infections in this study was determined by using single proportion formula

$$n = \frac{z^2.p(1-p)}{d^2}$$

Z=1.96 for 95% confidence interval

d= 0.02 which is margin of error

p= Seroprevalence of HIV, HBV, HCV and syphilis was 3.8%, 4.7%, 0.7%, and 1.3% respectively among blood donors at Gondar University Teaching Hospital, Northwest Ethiopia (Tessema et al., 2010).

n= sample size of the study

Transfusion transmitted infections	Proportion (P) used	Sample size (n)
HIV	0.038	351
HBV	0.047	430
HCV	0.007	67
Syphilis	0.013	123

The largest sample size from the above which is 430 can be taken as the final sample size for this study. But, all (11,382) blood donors' cards registered at Harar Blood bank from September 2010- August 2015 was reviewed.

Inclusion criteria: All consecutive blood donors' cards with complete information was included in this study.

2.4. Method of Data Collection

All blood donors' cards at Harar Blood bank, which show donation of blood from September 2000- August 2015, were reviewed by trained nurses working in the blood bank. Information like age, sex, marital status, occupational status, residence, blood donor type (replacement (family, remunerated) or volunteer), frequency of donation (first, second, third time and other), and laboratory examination results were reviewed. All blood donors were passed the initial clinical and assessment by pre-donation questionnaire. Then, their blood samples were screened for HIV, HBV, HCV and syphilis by standard test using Enzyme Linked Immuno Sorbant Assay (ELISA) technique. All the positive blood samples tested were repeated in duplicate before labeling them as seropositive.

2.5. Variables

Dependent Variables

- Sero prevalence of HIV, HBV, HCV and syphilis
- Trends of HIV, HBV, HCV and syphilis

Independent variables

- Age, sex , marital status , occupation , residence , blood donor type (replacement (family , remunerated/commercial) or volunteer), frequency of donation (first, second , third time and other)

2.6. Operational definitions

Voluntary blood donors: refers to a person who gives blood, plasma or other blood components of his/her own free will and receives no payment for it, either in the form of cash or in-kind which could be considered a substitute for money.

Replacement blood donor: refers to a person who gives blood when it is required by a member of the patient's family or community. This can be relatives or friends of patients or commercial donors

Commercial donors: who were recruited and paid by patients, their families, or friends to replace blood used or expected to be used for patients from the blood bank of the hospital.

First-time donor: defined as a donor who had not previously donated blood according to his/her records.

2.7. Data Quality control

Those cards with completed data were included in this study. Training was given to two nurses before actual data collection in order to assure the quality of data. Each data collected by data collectors were checked for completeness at end of each day data collection by principal investigator. Preset of data collection tool was made at Dire Dawa blood bank

2.8.Data analysis

Data was coded, entered EPi data and cleaned before data processing. Then it was summarized and analyzed by using Statistical Package for the Social Sciences (SPSS) version 16. To define the prevalence of TTIs, the number of TTI-positive donations during each year was divided by the total number of blood donations that year/month, and the 95% confidence interval (CI). The prevalence across different years/ months and socio –demographic variables was compared using the Chi-square test. Regression

analysis was done to assess the association prevalence of each TTIs with some socio – demographic variables. The Cochran–Armitage trend test (Z) was used to determine any significant trends in the rates of infected donations over time. Statistical significance was set at $p < 0.05$.

2.9. Ethical Considerations

Ethical clearance for the study was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University. Letter support was written to Harar Red cross society blood bank from College of Health and Medical Sciences, Haramaya University. The objectives, risk and the benefits of the study were explained to head of Harar Red cross society Blood bank. Information obtained during the study was kept confidential and only intended for research purpose. Name or any identifiers of blood donors were not collected at time of review their cards.

3. Result

3.1. Socio Demographic Characteristics of the Study Participants

In this study, a total of 11382 blood donors' cards were reviewed. The mean age of the blood donors was 27 with standard deviation of ± 8.8 and range of 18-65. Majority of them were male (82.6%), in the age group of 17-25 (57.6), student (35.8%) in their occupational status and from Harari region (54.7%). Most of the blood was collected from mobile donor (56.0), and those who gave blood for first time (99.9%). Majority of the blood donors were type Blood O (45.1%) and RH positive (93.4%) (Table 1).

Table 1. Characteristics of blood donor who donated blood from 2008-2015 in Harari regional state blood bank in Eastern Ethiopia.

Variables	No(%)
Sex	
Male	9403 (82.6)
Female	1979 (17.4)
Age	
17-25	6555 (57.6)
26-35	2934 (25.8)
36-45	1402 (12.3)
≥ 46	490(4.3)
Occupation	
Farmer	1081 (9.5)
Military	1956(17.2)
Government employed	1896 (16.7)
Daily laborer	163(1.4)
Driver	222(2.0)
Factory worker	154 (1.4)
House wife	110(1.0)
Student	4079(35.8)
Private employed	1259(11.1)

Unemployed	132(1.2)
Other	330(2.9)
Donor type	
Mobile	6376 (56.0)
Replacement	4089(35.9)
Voluntary	917 (8.1)
Number of donation	
First time	11369 (99.9)
Repeated	13 (0.1)
Blood group	
A	3151 (27.7)
B	2434 (21.4)
AB	661 (5.8)
O	5136 (45.1)
RH type	
Positive	10634 (93.4)
Negative	748 (6.6)
Donor address Region	
Harari	6217(54.6)
Oromiya	3214(28.2)
Dire Dawa	919(8.1)
Somali	887(7.8)
Other(Addis, Afar, Amahar, Benishangaul, Sothern, Tigray)	144(1.3)

3.2. Trend of HIV, HBV, HCV and Syphilis

The prevalence of HBV and HIV was decline, but the decline was not statistical significant. The prevalence of HBV was the highest in the year 2008 (6.3%) and the lowest were detected in the year 2012(3.6%). The prevalence of HIV was the highest in 2008 and the lowest was detected by the year 2012(0.3%). The prevalence of HCV declined in most years, but it started to increase by year 2009 and 2012. The prevalence of syphilis declined in most years. But the highest were detected in the year 2015(2.6%). The overall decline in TTIs was not statically significant ($p > 0.05$) (Table 2).

Table 2. Trends of seropositivity of HBV, HIV , HCV and Syphilis among blood donors among blood donors from 2008-2015 in Harari regional state blood bank in Eastern Ethiopia

Year	Total screened	HBV positive No(%)	HIV positive No(%)	HCV positive No (%)	Syphilis positive No(%)
2008	253	16(6.3)	3 (1.2)	2 (0.8)	4 (1.6)
2009	239	10(4.2)	1(0.4)	3 (1.3)	-
2010	581	28(4.8)	5 (0.9)	4(0.7)	7(1.2)
2011	984	52(5.3)	8 (0.8)	5(0.5)	3 (0.3)
2012	1146	41(3.6)	3 (0.3)	35(3.1)	1(0.1)
2013	1549	76 (4.9)	8(0.5)	6(0.4)	1 (0.1)
2014	2523	110 (4.4)	10 (0.4)	23(0.9)	-
2015	4107	167 (4.1)	25 (0.6)	14(0.3)	107 (2.6)

Total	11382	500(4.4)	63 (0.6)	92 (0.8)	123 (1.1)
P value of linear regression trend		0.101	0.361	0.001	0.000

3.3. Seroprevalence and associated Factors Transfusion Transmitted Disease

The overall seroprevalence TTIs in this study was 6.6% (754/11382). Almost all TTIs occurred on those who are for the first time donors (99.3%). The overall seroprevalence HBV, HIV, HCV and syphilis were 4.4%, 0.6%, 0.8% and 1.1% respectively (Table 2). A total of 24 (0.2%) blood donors had multiple infections. The most common one is the one with HBV-syphilis (45.8%) and HIV-HBV (20.8) co infection (**Table 3**)

Table 3. Prevalence of co-infections of HIV, HBV, HCV and syphilis among blood donors from 2008-2015 in Harari regional state blood bank in Eastern Ethiopia.

Coinfections	No (%)
HBV/ HIV	5 (20.8)
HBV/HCV	4 (16.7)
HBV/Syphilis	11 (45.8)
HCV/syphilis	2 (8.3)
HIV/syphilis	2 (8.3)
Total (n=11382)	24 (0.2)

The prevalence of HIV was higher among female (0.6%), in the group 26-35 (1.0%) and private employed (1.0%), replacement (0.7%) and voluntary (0.7%) blood donor group. But the difference was not statistical significant ($p>0.05$). The prevalence of syphilis was higher among male (1.1%), >46 age groups (3.1 %), farmer (2.0%). The least were identified among students (0.3%) and replacement donor group (0.7%). The difference was statically significant ($p <0.05$). The prevalence of syphilis increases with age. Those in the age group 26-35 with prevalence rate of 1.2% were more than 2 times (AOR=2.1; 95% CI: 1.2,3.6); 36-45 with prevalence rate of 2.7% were more than 4 times (AOR=4.1; 95% CI :2.4,7.1) ; >46 with prevalence rate of 3.1% were more than 4 times (AOR=4.6; 95 CI :2.3,9.1) likely to be infected with syphilis when compared to the age group 17-25 (0.5%) . Those Students (0.3%) (AOR= 0.2; 95% CI: 0.04, 0.8) and private employed (0.4%) (AOR= 0.2; 95% CI: 0.03, 0.9) were 80 % less likely to infected with syphilis as compared to unemployed (1.5%). Replacement donors (0.3%) were 70 % less likely to be infected than voluntary donors (1.4%) (AOR=0.3; 95% CI: 1.6, 6.7) (**Table 4**).

Table 4. Characteristics of blood donors associated with HIV and Syphilis sero positivity from 2008-2015 in Harari regional state blood bank in Eastern Ethiopia.

Characteristics	HIV positive No(%)	Crude odd ratio 95% CI	Adjusted odds ratio 95% CI	Syphilis positive No(%)	Crude odd ratio 95% CI	Adjusted odds ratio 95% CI
Sex						
Male	51/9403(0.5)	1		108/9403(1.1)	1	1
Female	12/1979(0.6)	0.9(0.5,1.7)	0.6(0.3,1.1)	15/1979(0.8)	1.5(0.9,2.6)	0.9(0.5,1.5)
Age						
17-25	21/6555(0.3)	0.5(0.1,1.4)	2.2(0.7,7.3)	34/6555(0.5)	1	1
26-35	28/2934(1.0)	1.3(0.4,3.7)	0.8(0.3,2.3)	36/2934(1.2)	2.4(1.5,3.8)	2.1(1.2,3.6)***
36-45	10/1402 (0.7)	0.9(0.3,2.9)	1.1(0.4,3.6)	38/1402(2.7)	5.3(3.4,8.5)	4.1(2.4,7.1) ***
≥ 46	4/490 (0.8)	1	1	15/490(3.1)	6.1(3.3,11.2)	4.6(2.3,9.1) ***
Occupation						
Farmer	10/1081(0.9)	1.1(0.1,8.6)	0.9(0.1,7.4)	22/1081(2.0)	1.4(0.3,5.8)	1.4(0.3,6.2)
Military	12/1956(0.6)	0.9(0.1,6.9)	1.1(0.1,8.9)	40/1956(2.0)	1.4(0.3,5.7)	0.6(0.1,2.5)
Government employed	11/1896(0.6)	0.6(0.8,4.8)	1.6(0.2,12.9)	31/1896(1.6)	1.1(0.3,4.6)	0.5(0.1,2.1)
Driver	1/222(0.5)	0.5(0.03,8.5)	1.9(0.1,31.4)	1/222(0.5)	0.3(0.03,3.3)	0.3(0.02,2.8)
Student	12/4079(0.3)	0.6(0.7,4.5)	1.8(0.2,14.5)	14/4079(0.3)	0.2(0.05,1.0)	0.2(0.04,0.8)****
Private employed	12/1259(1.0)	1.1(0.1,8.3)	0.9(0.1,7.4)	5/1259(0.4)	0.7(0.2,3.3)	0.2(0.03,0.9)****
Other *	4/757(0.5)	0.5(0.1,4.7)	1.9(0.2,17.9)	8/757(1.1)	3.9(0.7,20.1)	0.4(0.08,2.0)
Unemployed	1/132(0.8)	1		2/132(1.5)	1	1
Donor type						
Mobile	29/6376(0.5)	0.7(0.3,1.7)		82/6376(1.3)	0.9(0.5,1.6)	1.3(0.7,2.5)
Replacement	28/4089(0.7)	1.1(0.4,2.5)		28/4089(0.7)	0.5(0.3,0.9)	0.3(1.6,6.7)***
Voluntary	6/917(0.7)	1		13/917(1.4)	1	1

**Others: merchant, teacher, NGO, dailylaboreer, factory, housewife, other.*

The prevalence of HBV was higher among male (4.8%), those in 26-35 age group (4.8%), unemployed (8.3%) and replacement donors (5.1%). The difference was statistical difference for sex and occupational status of blood donors ($p<0.05$). Male (4.8%) were 2 times more likely (AOR=1.9; 95% CI: 1.4, 2.5) than female (3.6%). Government employed (3.4%) were 60% less likely (AOR=0.4; 95 CI: 0.2, 0.7) and students (3.5%) were 60% less likely (AOR=0.4; 95% CI: 0.2, 0.8) than unemployed (8.3%). The prevalence of HCV was higher among male (0.5%), in the age group >46 (1.8%), farmer (1.4%) and replacement donors (1.0%). But it is only statistically significant difference among age group ≥46 ($p<0.05$). Those in the age group ≥46 (1.8%) were more than 2 times more likely to be infected with HCV than in the age group 17-25 (0.6%) (AOR= 2.7; 95 CI: 1.2, 6.2) (**Table 5**).

Table 5. Characteristics of blood donors associated with Hepatitis B and C virus seropositivity from 2008-2015 in Harari regional state blood bank in Eastern Ethiopia.

Characteristics	Hepatitis B positive No(%)	Crude odd ratio 95% CI	Adjusted odds ratio 95% CI	Hepatitis C positive No(%)	Crude odd ratio 95% CI	Adjusted odds ratio 95% CI
Sex						
Male	448/9403 (4.8)	1.9(1.4,2.5)	1.7(1.3,2.3)***	80/9403(0.9)	1.4(0.8,2.5)	1.1(0.6,2.2)
Female	52/1979 (2.6)	1	1	12/1979(0.6)	1	1
Age						
17-25	267/6555 (4.1)	0.9(0.6,1.3)		40/6555(0.6)	1	1
26-35	144/2934(4.9)	1.1(0.7,1.6)		28/2934(1.0)	1.6(1.0,2.6)	1.5(0.8,2.7)
36-45	66/1402(4.7)	1.0(0.6,1.6)		15/1402(1.1)	1.8(1.0,3.2)	1.6(0.8,3.2)
≥ 46	23/490(4.7)	1		9/490(1.8)	3.1(1.5,6.3)	2.7(1.2,6.2)***
Occupation						
Farmer	57/1081(5.3)	0.6(0.3,1.2)	0.6(0.3,1.1)	15/1081(1.4)	1.8(0.8,3.9)	1.5(0.7,3.5)
Military	104/1956(5.3)	0.6(0.3,1.2)	0.6(0.3,1.1)	17/1956 (0.9)	1.1(0.5,2.4)	1.3(0.5,3.0)
Government employed	64/1896(3.4)	0.4(0.2,0.8)	0.4(0.2,0.7)***	12/1896(0.6)	0.8(0.3,1.8)	0.8(0.3,1.9)
Driver	11/222(5.0)	0.6(0.2,1.4)	0.5(0.2,1.3)	3/222(1.4)	1.7(0.5,6.3)	1.7(0.5,6.4)
Student	144/4079(3.5)	0.4(0.2,0.8)	0.4(0.2,0.8).***	24/4079(0.6)	0.7(0.4,1.6)	1.1(0.5,2.7)
Private employed	59/1259(4.7)	0.5(0.3,1.1)	0.5(0.3,1.0)	10/1259(0.8)	1	
Other	50/757(6.6)	0.8(0.4,1.5)	0.8(0.4,1.6)	11/889(1.2)*	1.6(0.7,3.7)	1.5(0.7,3.7)
Unemployed	11/132(8.3)	1	1		1	1
Donor type						
Mobile	251/6376(3.9)	0.9(0.6,1.2)		44/6376(0.7)	1.1(0.5,2.5)	1.3(0.5,3.1)
Replacement	207/4089(5.1)	1.1(0.8,1.6)		42/4089(1.0)	1.6(0.7,3.7)	1.4(0.6,3.4)
Voluntary	42/917(4.6)	1		6/917(0.7)	1	1

**others: merchant, teacher, NGO, dailylaboreer, factory, housewife, unemployed and other.*

4. Discussion

The overall prevalence of transfusion transmitted infection was 6.6% in this study. This was higher than report from Eritrea (3.8%) (Fessehaye et al, 2011) and India (0.6%) ((Fernandes et al., 2010) but lower than Sudan (13.1%)(Abdallah and Ali, 2012),in Jijiga, Ethiopia(11.5%) (Mohammed and Bekele,2016), Gondar ,Ethiopia (9.5%)(Tessema et al., 2010) and India (16.7%) (Patel et al.,2013tee et al,2006). The difference might be due to difference in study area, time of the study (as there might change in the awareness of donors), difference socio demography of the study participants and difference in rigorous of preliminary screening of donors. Almost all TTIs occurred in this study in the first time donors. This, similar to other study (Tessema et al., 2010). The reason might be, those repeated donors know their status and less likely to positive for TTIs at repeated donations. The most common coinfection was detected in those with HBV-syphilis and HIV-HBV. However, in Gondar study HIV –syphilis and HIV-HBV were the most common co infection detected. (Tessema et al., 2010). The above overlap in co infection might indicate, they are following similar transmission.

The highest TTI in this study was HBV (4.4%). This is slightly lower than in Gondar, Ethiopia (4.7%) (Tessema et al., 2010). This was lower than report of study conducted in Jijiga (10.9%) (Mohammed and Bekele,2016) and in Bahir Dar Hospital (6%)(Baye and Yohannis ,2007) in Ethiopia and other African countries like Tanzania(8.8%) (Matee et al, 2006) and Congo, Kinshasa (5.4%) (Batina et al.,2007). This result is higher than a report from China (1.16%)(Ji et al., 2013), in India (1.27%) (Pallavi,2011), in Pakistan(2.68%) (Attaullah et al.,2012), in Eritrea (2.58%) (Fessehaye et al, 2011).) an in Dessie and Mekelel, Ethiopia (3%) (Baye and Yohannis ,2007).The difference might be due the above factors and difference risky behaviors at different study area. HBV infection was the most common reason for donor disqualification from donating blood in this study. This is similar to study conducted in china (Ji et al., 2013). The current prevalence categorized the study area as high intermediate endemic transmission area (WHO,2015)

Males were more likely to be infected with HBV. This is similar to study conducted in Gondar (Tessema et al., 2010) and in Jijiga (Mohammed and Bekele,2016), Ethiopia. Those males might more participated in risk behavior which can responsible for the transmission of the diseases. However, government employed and students less likely to be infected with HBV than unemployed. In study conducted in Gondar (Tessema et al., 2010) showed, those farmers were more likely to be infected with HBV. Farmer is also listed among those with high prevalence in this study. The basic difference in prevalence might be due to difference in exposure information about HBV by occupation

The second most TTIs in this study was syphilis (1.1%). This was higher than a report from China (0.31%) (Ji et al., 2013)), in India (0.11% -0.28%) (Pallavi, 2011, Patel et al., 2013, Fernandes et al., 2010), in Pakistan (0.43%) (Attaullah et al., 2012) and in Eritrea (0.49%)(Fessehaye et al, 2011), in Jijga,Ethiopia (0.1%) (Mohammed and Bekele, 2016). This was slightly lower than study conducted in Gondar, Ethiopia (1.7%) (Tessema et al., 2010), in Tanzania (4.7%) (Matee et al, 2006) and in Congo, Kinshasa (3.7%) (Batina et al., 2007). The basic difference might be due to one explained for general TTIs difference.

The prevalence of syphilis was more likely to be increased with age. This is similar to report from Tanzania (Matee et al,2006). But it is not consistent with the study conducted in Gondar (Tessema et al., 2010) and Jijga(Mohammed and Bekele,2016),Ethiopia. Those Students were also less infected with syphilis in this study. This is similar to report from Gondar (Tessema et al., 2010). The main reasons might be due to student might acquire information about sexually transmitted infection through their school and might follow different prevention methods. Replacement donors were less likely to be infected with syphilis than voluntary donors. This is not true a report from Tanzania (Matee et al,2006).

HCV was detected at 0.8% in this study. This is slightly higher than report from Gondar (0.7%) (Tessema et al., 2010),This was higher than a report from China (0.51%) (Ji et al., 2013), India (0.23%) (Pallavi,2011), Eretria (0.57%) (Fessehaye et al, 2011), Jijiga (0.4%)(Mohammed and Bekele,2016). This was lower than report from Tanzania (1.5%) (Matee et al,2006) and Pakisatn (2.46%) (Attaullah et al., 2012).

The prevalence of HCV was lower as compared to HBV, since HBV is considered as most infectious. Those study participants in the age group ≥46 were more e likely to be infected with HCV than in the age group 17-25. This was similar to study conducted in Gondar, Ethiopia (Tessema et al., 2010). It is better to give emphasis about HCV prevention for those higher age groups.

The seroprevalence of HIV was detected at 0.6% in this study which was lower than 2.8 % reported in the general population in the Harari Region (Ethiopia Demographic and Health Survey,2011) This was higher than a report from Jijga (0.1%)(Mohammed and Bekele,2016), China (0.02%)(Ji et al., 2013), India(0.44%) (Pallavi,2011), Pakistan (0.06%)(Attaullah et al.,2012), Eretria (0.18%) (Fessehaye et al, 2011).), This lower than reported from Gondar, Ethiopia by Diro et al (4.5%) (Diro et al.,2008) and Tessema et al(3.8%)(Tessema et al., 2010) and other studies conducted in Tanzania (3.8%) (Matee et al, 2006),Congo, Kinshasa (4.7%) (Batina et al.,2007). The basic difference might be due to, difference in risk of transmission by study areas and awareness of HIV transmission and preventions of people at different time.

The prevalence of HIV was higher among female. This was similar to study conducted in Gondar (Tessema et al., 2010) and Jijga (Mohammed and Bekele,2016). It is also higher among the age group 26-35 and private employed. This is not similar with the study conducted in Gondar which showed the highest prevalence among the age 36-45 and housewife. Replacement donors were more affected by HIV than voluntary. This is similar to report from Tanzania (Matee et al, 2006). But the above identified factors for high magnitude of HIV was not statistically significant.

The prevalence of HCV and syphilis declineed significantly. The prevalence of HBV and HIV declined, but the decline was not statistical significant in this study. In the Gondar study significantly declining trends of HIV, HCV, and syphilis seropositivity were observed over the five years of the study period (Tessema et al., 2010). But on Chinese study, there was a significant decrease in the trend for HBV and HCV infections, while a significant increase was found for syphilis (Ji et al., 2013). The overall decline in TTs in this study was not significant. There is a need for more intervention on

screening and other measures on the blood donors and the community for further the reduction all TTIs.

5. Conclusion and Recommendation

The problem TTIs is lower in this study as compared to previous study conducted in Ethiopia. An overall of 6.6% donor harbors one or more TTIs and 0.2% of donors with double infection. Almost all TTIs were occurred among first time donors. There was significantly decline in the prevalence of HCV and Syphilis infection, but not for HIV and HBV. Factors associated with different TTIs are variable in this study. The prevalence of syphilis increases with age. Those Students, privately employed groups replacement donors were less likely to be infected with syphilis. Male were more likely to be infected with HBV. Government employed and students were less likely to be infected with HBV. Blood donors in the age group ≥46 were more likely to be infected with HCV. Therefore, it should follow strictly the preliminary blood donor selection criteria and screenings of the collected blood using standardized techniques are recommended to increase the safety of the blood to recipients and to reduce the number of blood disqualified from transfusion after collection and screening. It is also important to increase the number of repeated voluntary donors through promotion of blood bank activity. In addition, health information should be provided to reduce the risky behaviors of community and further study should also be conducted to identify the gaps in the failure of initial screening of the donor before blood donation.

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11. Lean Season Coping Strategy and Childhood Wasting among PSNP Beneficiary and non-beneficiary Households of Eastern Ethiopia: Cross Sectional Study

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Abstract: Despite implementation of nutrition sensitive intervention such as PSNP and Household Asset Building Programme (HABP), wasting is declining very slowly in Ethiopia. Hence, it is worthwhile to study as it indicates the resilience of a system to shocks and identify severe wasting that will not otherwise captured by measuring stunting Therefore, the objective of this study was to determine differences in coping strategy and childhood wasting among PSNP beneficiary and non-beneficiary households of eastern Ethiopia. Community based cross-sectional study was conducted in Kombolcha district of Eastern Ethiopia from July 8 to 28, 2015. Children aged 6-59 months from PSNP (n=657) and Non-PSNP (n=654) households were assessed. Difference in mean and prevalence of wasting and reduced CSI was calculated. Multiple linear regression model was used to determine predictors. The study revealed that district agriculture is predominantly rain fed and has repeatedly stricken by drought. Hence, nine of 19 kebeles are beneficiaries of government transfer (PSNP). The primary outcome was childhood wasting. There was significant difference in the means WFH Z score with small (cohen's d 0.22) effect and RCSI with medium effect (cohen's d 0.733) among PSNP and non-PSNP households. The overall wasting prevalence was 16.6% (95% CI, 14.57% to 18.67%). The prevalence was significantly higher among PSNP households (21.5% (95%CI, 18.4% to 24.8%) compared to non-PSNP households (11.6% (95%CI, 9.2% to 14.3 %). PSNP makes the strongest contribution to explain child wasting (β =-0.145), followed by low wealth index (β= -0.121). The levels of coping and childhood wasting indicates PSNP fault lines to adequately prevent vulnerable households from drought related short-term adverse nutrition outcomes. This result suggests a need for additional conditionalities, as transfer alone is not sufficient to achieve nutrition security resilient for climatic shock.

Keywords: Childhood wasting; social protection; PSNP; Coping strategy; Ethiopia, food insecurity; drought

Abbreviations

CI	Confidence Interval
EDHS	Ethiopia Demographic and Health Survey
GDP	Gross Domestic Product
HABP	Household Asset Building Programme
IHRERC	Institutional Health Research Ethics Review Committee
M	Mean
MAM	Moderate Acute Malnutrition
MDG	Millennium development goals
NNP	National Nutritional Programme
PSNP	Productive Safety Net Programme (Ethiopia)
RCSI	Reduced Coping Strategy Index
SAM	Severe Acute Malnutrition
SD	Standard Deviation
WFH Z-Score	Weight for Height Z-Score

1. Introduction

In the last two decades despite global good advance on poverty reduction, progress on nutrition remains slower than expected. For example, most countries achieved MDG (Millennium development goals) income poverty target while only few achieved the non-income poverty target of halving underweight. This inconsistency affirms that economic growth is important but not sufficient to improve malnutrition (The World Bank, 2006; Vollmer et al., 2014; World Bank, 2013). Wealth of evidence shows high return of investing on nutrition. But governments prefer to capitalize on the growth and expansion of middle class to conceal widening inequality (African Union, n.d.; Watkins, 2014; World Bank, 2013).

Ethiopia's economy depends on the agricultural sector dominated by smallholder farmers that support 85 percent of work force characterized by high prevalence of poverty, seasonality of food production and large productivity gap (FDRE Ministry of Agriculture and Rural development, 2010; FDRE Ministry of Health, 2010; Ferro-Luzzi, Morris, Taffesse, Tsegaye Demissie, & D'Amato, 2002). This increases risks of health problems that accumulate and continue poverty through generation (Barrientos & DeJong, 2006; Bezanson & Isenman, 2010; Frenk & Moon, 2013). Ethiopia Productive Safety Net Program (PSNP) is a food or cash transfer program meant to achieve resilience for these commotions through equity, social protection and inclusive poverty reduction to 12 percent of rural population (Devereux & White, 2010; FDRE Ministry of Agriculture and Rural development, 2010; Hoddinott & Adato, 2008; Solon, 2006).

However, PSNP has limited scale and short-term capacity as it demands massive resources that the country cannot afford domestic funding. For instance, the government of Ethiopia is expected to achieve 2.9 to 4.5% of GDP (Gross Domestic

Product) for social protection, which achieved only 0.7 but it lose 16.5% of GDP to malnutrition (Cost of Hunger in Ethiopia, .n.d.). This limited coverage affect addressing vulnerability among poor and near-poor households and focus mainly on short- to medium-term changes than intergenerational graduation that best achieved by nutrition (Gentilini, 2009; Roelen, 2015).

Social protection contributes to adaptive capacity of the poor to overcome shocks, and smooth transitions (Wood, 2011). The potential of PSNP to benefit maternal and child nutrition is yet to be unleashed. Hence there remains a need to ensure that PSNPs are designed to protect those most nutritionally vulnerable during shocks (Ruel, Alderman, & the Maternal and Child Nutrition Study Group, 2013; World Bank, 2013). Undeniably, PSNP has targeting effectiveness issues where eligible poors are excluded from the program and leakage of transfer (Devereux, 2015; Fan & Habibov, 2008). Increasing investment and harmonization of nutrition-specific and nutrition-sensitive interventions can ultimately accelerate reductions in undernutrition (Haddad, 2013). Nevertheless, unlike conditional cash transfers in Brazil, Chile and Mexico, PSNP transfer in Ethiopia is unconditional and dependent only on meeting eligibility criteria (S. Soares, Osório, Soares, Medeiros, & Zepeda, 2007).

The global nutrition targets for 2025 endorsed by the World Health Assembly includes to reduce and sustain childhood wasting to less than 5% (WHO, 2012). By the same token, Ethiopia National Nutritional Programme (NNP) primary impact objectives was to reduce the prevalence of wasting from 9.7% to 3% by 2015 through considering multisectoral and multidimensional aspect of nutrition (Government of the Federal Democratic Republic of Ethiopia, 2013). Despite implementation of nutrition sensitive intervention such as PSNP and Household Asset Building Programme (HABP), wasting is declining very slowly in Ethiopia. Hence, it is worthwhile to study as it indicates the resilience of a system to shocks and to identify severe wasting that will not otherwise captured by measuring stunting (Black et al., 2008; Haddad, 2013). Therefore, the objectives of this study were to determine how PSNP households differ from non-beneficiaries in terms of coping strategies, child wasting and factors associated with child wasting following extended 2015 drought. Comparison of the two groups should indicate residing in non-beneficiary geographic area does not mean non-eligibility (food secure) and eligibility not sufficient for resilience that need to be addressed with alternative targeting approach and making PSNP more nutrition sensitive.

2. Methods and Materials

2.1. Study Design, Setting and Participants

A Community based cross-sectional study was conducted in Kombolcha district of Eastern Ethiopia from July 8 to 28, 2015. The district has nine PSNP *kebeles* (smallest administrative unit of Ethiopia) with cash transfer and 10 non-PSNP *kebeles*. Five PSNP and six non-PSNP *kebeles* were selected randomly. Mothers of children aged 6-59 months were included in the study systematically using their list obtained from district PSNP office and respective kebele health extension workers. Information of the

sampling frame was ascertained by consulting social network leaders called "gare" (containing 25-30 women) of each kebeles.

Ethical clearance was obtained from the Haramaya University, college of health and medical science, Institutional Health Research Ethics Review Committee (IHRERC). The objective of the study, known benefits and risks of participant involvement in the research was communicated. Informed written and signed consent was obtained from mothers before commencing the study.

2.2. Data Sources

The primary outcome variable of this study was child wasting. Child sex, sex of head of household, RCSI, PSNP, family size, child age, mothers age, and wealth index were predictor variables. A structured pretested questionnaire was used to assess socio economic and demographic characteristics of the households. Reduced coping strategy index was used to assess how households adopt to various mechanisms to cope with declining access to food. Nursing students who can speak a local language collected data. The tool was pre-tested on 20 households to determine how good it conforms to local accent, format, wording and order.

To determine the nutritional status of the children, weight and height measurements were taken using correct technique, standardized procedures and regular equipment checking. For weight measurement, Seca Digital Scale with precision of 100 grams was used. For length/height UNICEF's recommended wooden measuring board that accommodates children up to 130 centimeters were used.

2.3. Reduced Coping Strategy Index (RCSI)

This is a fourth-generation —simple, direct, valid, multidimensional measures that are also cross-culturally comparable. This measure of food insecurity focuses on the vulnerability and response to adverse events or shocks. It is based on short list of 5 food-related coping strategies applied during the past 7 days prior to the study. The maximal RCSI is 28 during the past 7 days (i.e. all 5 strategies are applied every day). Regarding the thresholds for RCSI, the higher the RCSI the more severe the coping is applied by a household. Based on this, the total CSI score was the basis to determine and classify the level of coping: into three categories: No or low coping (CSI= 0-3), medium (CSI = 4-9, high coping (CSI ≥10) (Maxwell & Caldwell, 2008; Teng, Cullen, & Ivers, 2015).

2.4. Study Size

The parameters used to estimate the sample size was based on prevalence of wasting for it indicate resilience of a system to climatic shock. G*Power 3.1.9.2(Faul F, Erdfelder E, Lang A-G, & Buchner A, 2007) was used by considering finding from Northern Ethiopia where 15.5% of children from PSNP and 23% of children from non-PSNP households were wasted (Debela, Shively, & Holden, 2014). Using two population proportion formula, desired precision of 95% and power of 80% and 5% for non-

response, and design effect of 1.5, 682 children were recruited from PSNP and non PNSP *kebeles* yielding total sample size of 1364 children. Child from PSNP households graduated from the program or, children from non-beneficiary households residing in beneficiary *kebele* were excluded from the study. Before commencing interview, efforts were made to get reliable information by explaining and convincing participants not to exaggerate their responses expecting handouts.

2.5. Data Processing and Analysis

Wasting was determined using WHO Anthro version 3.22("WHO Anthro. Software for assessing growth and development of the world's children. Geneva: WHO, 2007 ", 2007). The data were then exported to SPSS version 23 (IBM corporation, 2015) to conduct range of analysis including frequencies, means, standard deviation and proportions. In addition, independent sample t-test was run to determined extent to which outcomes are interrelated and significance level was set at $P < 0.05$. A chi-square test was performed. Cohen's d was calculated to determine the magnitude of the difference among groups. Principal components analysis (PCA) was run using thirty-eight items comprising productive assets, livestock, household goods and consumer durables. Standard multiple regression was used to determine whether RCSI, PSNP membership and other variables were the best predictors for wasting. Analysis was restricted to participants with complete data on all variables.

3. Result

3.1. Socio demographic Characteristics

Out of the total 1364 children recruited for the study, 1311 of them provided complete information. Overall, 657 PSNP and 654 children from non-PSNP households were participated. The mean age of children was 25.86 ± 14.64 months, and 686 (51.9 percent) were males. Table 1 shows detail of socio demographic characteristics. As can be seen from the Table, it is apparent that both groups have large family size (M= 6.23± 2.2). The mean number of under five children was 1.73±0.69.

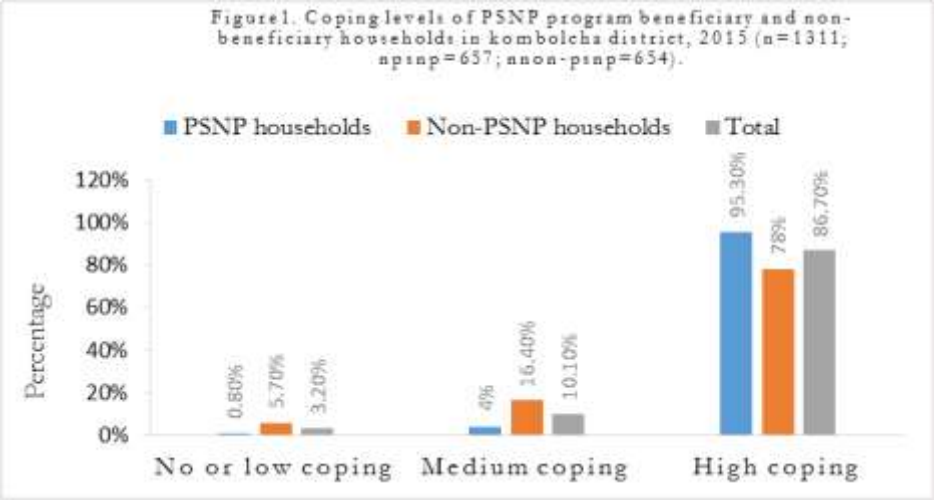
Table 1. Demographic and health characteristics of children and their households in Kombolcha district, 2015 (n=1311; nPSNP=657; nNon-PSNP=654).

Variables	PSNP		Non-PSNP	
	Frequency	*cent*	Frequency	Percent
Child sex				
Male	338	51.4	34	52.3
Female	319	48.6	31	47.7
Child age				
6-17 months	215	32.7	26	40.5
18-29 months	172	26.2	18	28.

30-41 months	128	19.5	11	17.6
42-53 months	114	17.4	69	10.6
≥54 months	28	4.3	19	2.9
Head of household				
Male	571	86.9	59	90.2
Female	86	13.1	64	9.8
Number of under-five children				
One	253	38.5	27	42.7
Two	309	47	29	45
≥three	95	14.5	81	12.4
Family size				
≤4	136	20.7	18	28
≥5	521	79.3	471	72
Wealth index				
Low	360	54.8	77	11.8
Medium	234	35.6	203	31
High	63	9.6	374	57.1

3.2. Reduced Coping Strategy Score (RCSI)

In situations households did not have enough food, or money to buy food (Fig. 1), substantial proportion of households implemented high level of coping 86.7 percent (95%CI 84.7-88.4%). Proportion of non-PSNP households using low or no coping was much lower than expected. A chi-square test of independence also showed difference in coping strategy levels for PSNP and non-PSNP households, and significant interaction was found (χ^2 (2) =85.55), P<0.001). Hence, PSNP households are more likely to use higher coping levels.



The overall mean± SD RCSI was 21.49±11.44. A two-sample Student's t-test showed RCSI of non-PSNP households (M = 17.54, SD = 10.66, N = 653) was significantly different from that of PSNP households (M = 25.42, SD = 10.82, N = 657), t (1308) = – 13.27, $p < 0.001$, two tailed). The magnitude of the differences in the means (mean difference = -7.88, 95% CI: –9.04 to -6.71) was medium (Cohens d = .733). Similarly, summary of difference (Table 2) in mean coping strategy for gender of head of household and family size showed significant difference but with small effect size.

Table 2. Difference in mean scores of RCSI among PSNP program beneficiary and non-beneficiary households of in Kombolcha district, 2015 (n=1311; PSNP=657; Non-PSNP=654).

Variable		Total		PSNP		Non-PSNP	
		mean ± SD	t (Cohens d)	mean ± SD	t (Cohens d)	mean ± SD	t (Cohens d)
Sex of HH †	Male	21.11 (11.46)	-3.324*** (0.29)	24.92 (10.97)	-3.05** (0.38)	17.42 (10.7)	-0.842 (0.11)
	Female	24.4 (10.86)		28.72 (9.15)		18.6 (10.32)	
Family size	≤4	19.92 (11.26)	-2.827*** (0.8)	24.95 (10.96)	-.574 (0.05)	16.19 (9.98)	-2.027* (0.18)
	≥5	22. (11.46)		25.54 (10.79)		18.07 (10.88)	

**P<0.05, **P<0.01, ***P<0.001.† HH: household* .

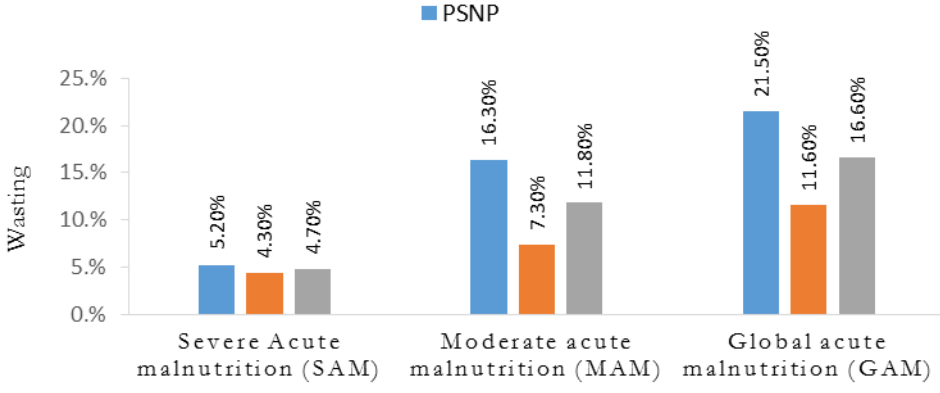
3.3. Weight for Height Z-Score

The basis to classify the level of childhood wasting was based on Global Acute Malnutrition (WHZ <-2), Moderate Acute Malnutrition (WHZ between -2 and -3) and Severe Acute Malnutrition (WHZ <-3).

The overall mean Wight for Height Z score (WHZ) was -0.67±1.32. There was significant difference in mean WHZ among non-PSNP (M=-0.38, SD=1.31, N=650) and PSNP (M=-0.95, SD=1.27, N=657) households, t (1308) =-7.99, p<0.001. However, the magnitude of the differences in the means (mean difference= 0.57, 95% CI 0.43 to 0.71) was small (Cohen's d=0.22).

The overall wasting prevalence was 16.6% (95%CI, 14.57% to 18.67%) and (figure 2). The prevalence was significantly higher among PSNP households 21.5% (95%CI, 18.4% to 24.8%) compared to non-PSNP households 11.6% (95%CI, 9.2% to 14.3 %), (χ^2 (1) =22.97), P<0.001). Concerning the severity proportion, 71.4% (95%CI, 65.4 to 77%) children had moderate acute malnutrition (MAM), 28.6% (95%CI, 23% to 34.6 percent) and the rest had severe acute malnutrition (SAM). Overall 40.9% (95%CI, 33.5% to 46.9%) of wasted children had diarrhea.

Figure 2. Magnitude of child wasting among PSNP program beneficiary and non-beneficiary households in kombolcha district, 2015 (n=1311; psnp=657; non-psnp=654).



3.4. Predictors of Wasting

A multiple linear regression was conducted to determine (Table 3) best child wasting predictors. A significant regression model was found (F (9, 1300) = 10.76, p < .001), with an R^2 of 0.069. This result demonstrated variables that positively influence (reduce) child wasting was child sex and age, and RCSI, PSNP, and wealth levels were negative predictors.

Table 3. Result of multiple regression Analysis to assess the nature of relationship between attributes and child wasting among PSNP and non-PSNP households in Kombolcha district.

Variable	SE	β
RCSI	0.003	-0.058*
PSNP	0.088	-0.145***
Family size	0.018	-0.002
Child age (months)	0.003	0.065*
Mothers age (years)	0.007	-0.021
Wealth index		
Low	0.106	-0.121**
Medium	0.094	-0.079*
High *(ref)*		
Gender of household head	0.113	0.030
Sex of under five children	0.071	0.077**

**p<0.05, **P<0.01, ***p<0.001 PSNP 0=NO, 1=Yes; Sexof HH 1=Male, 2=Female; Sex U5 children 1=Male, 2=Female.*

4. Discussion

The general aim of this study was to assess ranges of issues, milder but chronic food insecurity to severe food insecurity among PSNP and non-PSNP households. This has achieved by using reduced CSI that captures food insecurity from the less severe end of the continuum assessing acceptability (preferences) and quantity (sufficiency) dimensions, and wasting that pick severe acute food shortage

It is evident from the results that while the overall coping severity was high, there was substantial coping strategy difference among PSNP and non-PSNP households. Childhood wasting was also considerably higher for PSNP households. This result is in good agreement with failed spring rains from El-Niño that extend the lean season, increased the price of food staples and reduced livestock value to ultimately constrain farmers purchasing ability(Ethiopia Humanitarian Country Team (EHCT), 2015 (accessed January 2 2017)). There was also higher prevalence of wasting than 2014 mini EDHS (Central Statistical Agency [Ethiopia], 2014) where the magnitude was similar both for non-PSNP and PSNP households (9 percent). This considerable difference is also related to extended drought that affect food utilization, and poor water quality and quantity that lead to high prevalence of diarrheal and other diseases(Ebi & Bowen, 2015). Provided the average duration of enrollment to PSNP (4.27 years), and expected duration to achieve food security (5 years), magnitude of this key indicator that surpass threshold of 10 percent calls for special attention including the need for urgent lifesaving actions.

There was negative and significant relationship between childhood wasting and PSNP beneficiary. This strongest unique contribution to child wasting by 0.145 points is far from intended objective of PSNP, which is to prevent households from falling into hunger through public work income(Vaitla, Devereux, & Swan). According to Berhane and Prowse,(Weldegebriel & Prowse, 2013) PSNP transfers did not increase farm or

non-farm income hence fail to facilitate income sources diversification in a positive manner for climate adaptation. There was similar negative and significant relation of Bolsa Familia of Brazil on childhood wasting of beneficiaries(F. V. Soares, Ribas, & Osório, 2010; S. S. D. Soares, 2012). A recent PSNP move of providing pregnant women with temporary direct support from time of registration of pregnancy until child reach 12 months is good nutrition initiative but not sufficient(Ministry of Agriculture, 2014).

Going from high to lower wealth index increase childhood wasting. According to Porter, rural Ethiopia households have difficulty of protecting themselves from cyclic rainfall failure and its consequences such as collapse in farm income and consumption (Porter, 2012). With food price inflation, financial consequences lead to health shock and high elasticity in weight for height z-score. This suggests adjustment in food prices policies and facilitating minimum preventive health care in PSNP transfers to bring actual change on children's nutritional status (Bonfrera & Gustafsson-Wright, 2016; Skoufias, 2003).

Even if the gender equity is the core principle of PSNP that consider the productive and reproductive work of females, participant male-headed households had lower mean RCSI with small effect than female-headed households. This is related to demographic and gender vulnerability that stream from ill health and poverty (Devereux, Baulch, Macauslan, Phiri, & Sabates-Wheeler, 2006). Nevertheless, gender of head of households was not found to be significant predictor for childhood wasting. In addition to this, in contrast to finding from Ghana where there are no significant differences in the prevalence of wasting between boys and girls, males have higher childhood wasting(Malapit & Quisumbin, 2015).

Reduced CSI is useful to compare food insecurity related same set of behaviors across geographic area. But, it may not flag significantly increased levels of food insecurity like childhood wasting. Hence, the observed coping strategy and childhood wasting should be interpreted in terms of adverse climatic conditions and it can be applied beyond this population but with similar scenarios. Other limitation of this findings is attributed to onetime data collection, which could have been improved by capturing changes during main harvest season, limiting tracking of changes over time.

5. Conclusion and Recommendation

Generally, looking at the levels of coping and wasting, PSNP has limitations in preventing households from short-term adverse nutrition outcomes, which inevitably affect resilience and future vulnerability. Equally important, the program has excluded food insecure households in non-PSNP *kebeles* due to the current targeting system. Hence, PSNP should use a rights-based approach to vulnerable people to break vicious cycle of wasting and morbidity. Hence, this demand thinking nutrition beyond seasonal malnutrition interventions for sustained progress toward childhood wasting of less than 5%. This demands comprehensive nutrition and health related behavioral change that capitalize role of climatic change adaptation in the program.

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7. Authorship

Asnake Ararsa and Dr. Gudina Egata designed research from its conception, development of overall research plan, data collection, and performed statistical analysis. Asnake Ararsa wrote manuscriptand and a corresponding author of the final content.

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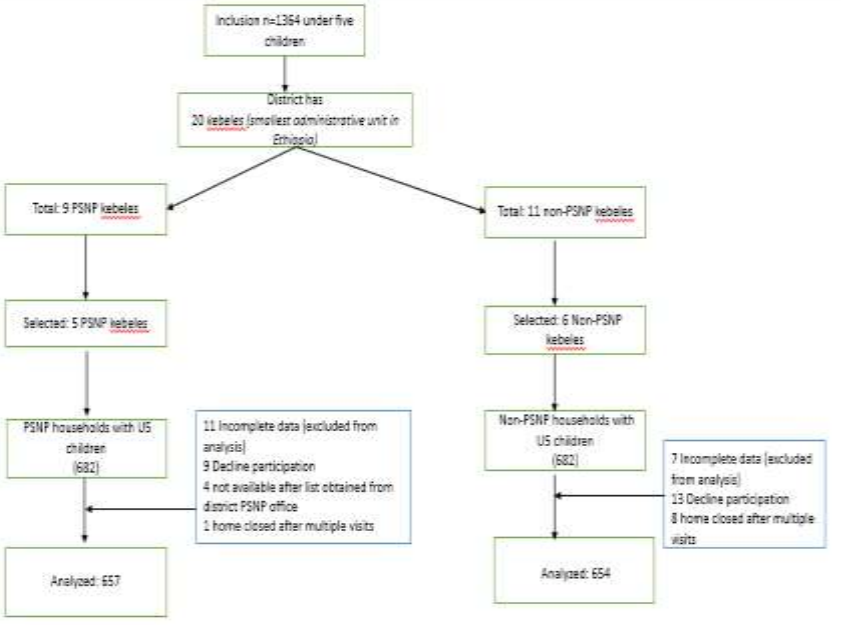
Supplementary Material



OSM1: Flowchart of participating children and their households in coping strategy and childhood wasting study of Kombolcha district of eastern Ethiopia, 2015.

12. Predictors of Mortality among Patients under Multi-Drug Resistant Tuberculosis in Multi-Drug Resistant Tuberculosis Treatment Centers in East Harerghe Zone and Dire Dawa City Administration, Eastern Ethiopia

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Abstract: The emergence of drug resistant Tuberculosis (TB) is a major public health problem in Ethiopia. The objective of this study was to assess predictors of mortality among patients on multidrug resistance TB (MDR-TB) in Eastern Ethiopia. A cross sectional study was conducted by using secondary data in Eastern Hararghe Zone and Dire Dawa Administrative council. All completely documented data on MDR-TB cases were extracted from December 1 to 30/2016. Structured checklist was used for recording information from patients' cards and TB registration book. Socio demographic characteristics, clinical characteristics of MDR-TB patient and treatment outcome (mortality) were extracted. Epi-Data version 3.1 was used for data entry. Descriptive statistical methods were used to summarize the socio-demographic characteristics of the study participants. multiple logistic regression analysis with forward method was performed to identify risk factors associated with mortality. In all the analyses, confidence level at 95% and $P < 0.05$ was used for statistical significance. The mean age was 30.34 + 1.06 years, and the proportion of males was 91(60.7%), 77(53%) and urban resident were 114(76 %). Almost all 148(99.3%) were smear positive pulmonary patients. The majority102 (68.9%) patients were retreated category and about 29 (19.6%) of them had at least one co-morbidity where, the most common co-infection was HIV 24(82.7%). Overall the mortality rate was 11.3% (17/150) during time of follow-up treatment initiation. The multivariate logistic regression analysis indicated that patients who received previous TB treatment (retreated) [AOR=16.7, 95% CI=1.59 - 175.15, P= 0.019], hospitalization [AOR=19.55, 95% CI=6.234-543.037, P=0.001], and co-infection [AOR=65.9, 95% CI = (2.98- 145.0), P= 0.008] were independent predictors of mortality among MDR-TB patients. Mortality rate was significant in the present study. Retreatment, history of current hospitalization, and co-infection were independent predictors of MDR-TB patient mortality. The identified risk factors should be given priority by TB

control programs in the region and more investigation is essential to provide concrete evidence and finding on predictors of mortality among MDR-TB patients.

Keywords: Multidrug Resistance Tuberculosis; mortality; Ethiopia

1. Introduction

Multidrug-resistant tuberculosis (MDR-TB) is a type of tuberculosis (TB) that is resistant to at least the first line anti-TB drugs, Rifampacin and Isoniazid (Hirpha *et al*.,2013). It is a man-made problem, largely due to human error as result of poor supply management and anti-TB drugs, and inadequate or improper treatment (Biadglegne *et al*., 2014).

The emergence of drug-resistant tuberculosis, particularly MDR and extensively drug-resistant (XDR) TB, is a major public health problem (Biadglegne *et al*., 2014). Moreover, the accelerated spread of occurrence of MDR-TB is becoming a major challenge to effective tuberculosis control (Gebeyahu *et al.,* 2001). Despite the availability of effective therapy, TB is one of the main problems (Moosazadeh *et al.,* 2014). This is mainly due to long duration of therapy (Jerry *et al*., 2011) and MDR-TB patients respond poorly to short course chemotherapy (Getachew *et al*., 2012).

Although progress has been made to reduce global incidence of drug-susceptible tuberculosis, the emergence of MDR and XDR tuberculosis during the past decade threatens to undermine these advances. However, countries are responding far too slowly (Tulu *et al*., 2014).

By 2015, African region is not on track to achieve the mortality and prevalence targets (reduce deaths by 50%) due to resource constraints, conflict and instability and generalized HIV epidemics (Senbeta *et al*., 2014). In addition, drug-resistant tuberculosis is emerging as health challenge in areas of sub-Saharan Africa where there is a high prevalence of HIV infection (Andrews *et al*., 2007). For instance, Ethiopia is one of the 27 high MDR-TB countries; it is ranked 15th with more than 5000 estimated MDR-TB patients each year (Biadglegne *et al*., 2014). MDR-TB is becoming a challenge because of poor adherence to treatment and an increase in the use of illegal and unapproved treatment regimens for MDR-TB in the country (Hirpha *et al*., 2013).

According to the WHO report, the prevalence of MDR-TB has been 2.8% in newly diagnosed patients; it was reported even higher in patients who have previously received anti-TB treatment 21%. The magnitude is smaller for Ethiopia with MDR-TB was also reported in about 1.2% of new cases and 12% of re-treatment cases (Tulu T et al., 2014). The problem of drug resistant TB exists in different parts of Ethiopia, and data on patterns of resistance among Ethiopian isolates is ranging from 2%-21% for isoniazid, 2%-20% for streptomycin and 14%-15% for any of the drugs tested (Tulu T et al., 2014).

Study in Ethiopia showed that there is a significant difference in the probability of surviving between co-morbidities including HIV status, smoking status, therapeutic delay, number of first line resistant drugs at initiation, previous exposure to TB

treatment, exposure to a known MDR-TB case, history of using poor quality TB drugs, treatment in a poorly-performing control program, treatment not directly observed by a health worker, being male, and failure of first-line short-course chemotherapy (Hirpa et al., 2013, Biadglegne *et al.,* 2014,Getachew *et al*., 2012). Published studies on MDR-TB are increasingly available worldwide (Biadglegne et al., 2014). However, precise data on predictors of mortality in Ethiopia is scarce. Therefore, this study was aimed to assess predictors of mortality among patients under MDR-TB treatment in Multi-Drug Resistant Tuberculosis Treatment Center in Eastern Ethiopia.

2. Materials and Methods

2.1. Study Area and Period

The study was conducted in MDR-TB treatment center in Eastern Hararghe Zone (Dedar) and Dire Dawa City Administrative (Dire Dawa) from December 1 to 30/2016.

2.2. Study Design and Study Population

Cross sectional study was conducted by reviewing documents among all cases of MDR-TB patients who were registered and started treatment in the treatment period from June 1, 2014 to December 30, 2016. Patients who had been on DOTS regimen of MDR-TB drug at TB clinic in the study area were considered. TB patient resistant to at least the first line anti-TB drugs, Rifampacin and Isoniazid having complete record of treatment outcomes were included in the study. Whereas, MDR TB with incomplete recorded on TB registration book were excluded.

2.3. Data Collection and Processing

A structured check list was used for recording information extracted from patients' cards and MDR-TB registration book. Three trained data collectors (Nurses from TB clinic) and supervisors (TB focal persons) were involved in data collection. For quantitative method MDR-TB patients registered treatment from January 1, 2014 to December 30, 2016 in Eastern Hararghe Zone and Dire Dawa Administrative council MDR-TB treatment center were taken and some socio demographic characteristics of MDR-TB patient (age, sex, and address), treatment outcome (mortality), treatment period (intensive and continues phase), types of resistance, and co-morbid illness were collected from patient registration book. The patients' identification numbers were used to generate the necessary sample from the records of the hospitals for extracting data.

2.4. Data Analysis

Epi-Data version 3.1 was used for quantitative data entry. After the data entry, the data base information was cross checked with the data collection forms. Descriptive statistical methods were used to summarize the socio-demographic characteristics of the study participants. The chi-square test or Fisher's exact test was performed to compare categorical variables. Binary logistic regression analysis with forward method was

performed to identify risk factors associated with mortality. In all the analyses, confidence level at 95% and $P < 0.05$ was used for statistical significance.

2.5. Ethical Consideration

The study protocol was reviewed and approved by Haramaya University, college of Health and Medical Sciences Institutional Health Research Ethics Review Committee (IHRERC). Permission was obtained from respective regional Health Bureau, district health offices, head of the Hospital and MDR-TB treatment center. To ensure their confidentiality, study participants were represented by codes.

3. Results

3.1. Socio demographic Characteristics of the Study Population

Data from a total of 150 patients MDR-TB cases, 120 from Dire Dawa MDR-TB treatment center and 30 from Deder Hospital MDR-TB treatment center were recorded. The mean age was 30.34 $\pm$ 1.06 years, and the proportion of males was 91(60.7%), 77(53%) were age 15 to 30 years and 106(74.1 %) were urban resident (Table 1). The majority 98(65.5%) of them were on treatment, whereas about 52(34.5%) had completed their treatments. Almost all 148(99.3%) were pulmonary, smear positive patients. Among, 150 patients, 29 (19.6%) MDR TB patients had at least one co-morbidity while, 119(80.4%) patients were not developed co infection. The most common co-infection was HIV 24(82.7%), followed by DM 4(13.7%) (Table2). The majority102 (68.9%) patients were retreated category, followed by new category 44(29.8%) and defaulter cases 2(1.3%). **Table 1**

Table 1. Demographic and clinical characteristics of MDR- TB patients, in Eastern parts of Ethiopia, 2017.

Variable	Variable Category	Number	Percent
Name of health facility	Dire Dawa	120	80.0
	East Hararghe	30	20.0
Gender	Male	91	60.7
	Female	59	39.3
Age category	< 15 years	12	8.39
	15 -44years	106	74.13
	45-64 years	22	15.38
	≥65	3	2.10
Residence	Urban	114	76.0
	Rural	36	24.0
Level of Education	uneducated	30	20.0
	Read and write	14	9.3
	1-4 grade	13	8.7
	5-8 grade	49	32.7
	9-12 grade	36	24.0
	Higher Education	8	5. 3

Treatment status	Completed	52	34.7
	On treatment	98	65.3
Patient category	New	44	29.73
	Retreated	102	68.92
	Return after default	2	1.35
Types of TB	Smear Pos ,pulmonary	148	99.33
	Smear Neg ,pulmonary	0	0
	EPTB	2	0.67
Co-infection	No	119	79.3
	HIV	24	16.22
	DM	4	2.70
	Other	1	0.68
Housing condition	Private	89	61
	Rent house	49	33.5
	Homeless	6	4.1
	Prisoner	2	1.4
History of smoking	Yes	6	3.4
	No	143	96.6
History of MDR contact	Yes	6	3.4
	No	143	96.
History of Alcohol consumption	Yes	29	19.3
	No	121	80.7
History of hospitalization	Yes	6	4.1
	No	142	95.9

3.2. Mortality and Censored Events

Overall the mortality rate was 11.3% (17/150) during time of follow-up treatment initiation. However, the proportion of death reported among urban resident MDR TB patients was significantly higher than rural MDR TB cases (11.4% vs 11.1%, X^2=13.89, P=0.000). Moreover, the proportion of mortality rate was significantly higher among patients with history of hospitalization (100%vs7.7%; X^2=11.083, P=0.001) and co-infection (5.3%Vs 33.3%, X^2=22.18, P=0.000) compared to MDR patients with no history of hospitalization and no co-infection respectively.

The proportion of mortality rate during treatment was higher among patients previously treated with second-line drugs (14/17) compared to new patient category (2/17) of and defaulter (1/17) (X^2 =19.8833, P = 0.000)(Table2).

Table 2. Descriptive results of mortality and censored events versus demographic factors among MDR-TB patients, in Eastern Ethiopia, 2017.

Variables		Yes, N (%)	No, N (%)	X^2(p-value)
Mortality		17(11.3)	133(88.7)	
Health facility	Dire Dawa	15(12.5)	105(87.5)	0.813(0.526)
	East Harerghe	2(6.7)	28(93.3)	
Gender	Male	13(14.3)	78(85.7)	3.049(0.081)
	Female	4(6.8)	55(93.2)	

Age of the patient	<15 years	0(0.00)	12(100.0)	6.0598 (0.109)
	15-44 years	13(12.5)	93(87.5)	
	45-64years	4(18.2)	18(81.8)	
	65	0(0.00)	3(2.4)	
Residence	Urban	13(11.4)	101(88.6)	13.89(0.000)
	Rural	4(11.1)	32(88.9)	
Level of education	uneducated	3(10.0)	27(90.0)	8.180(0.085)
	Read and write	2(14.3)	12(85.7)	
	1-4 grade	0(0.0)	13(100.0)	
	5-8 grade	5(10.2)	44(89.8)	
	9-12 grade	7(19.4)	29(80.6)	
	Higher Education	0(0.0)	8(100.0)	
Patient category	New	2(6.1)	42(93.9)	19.8833 (0.000)
	Retreated	14(12.3)	88(87.7)	
	Defaulted	1(50.0)	1(50.0)	
Housing condition	Private	11(12.4)	78(87.6)	1.96(0.384)
	Rented	5(10.2)	44(89.8)	
	Homeless	1(16.7)	2(83.3)	
Co-infection	No	10 (33.3)	19(66.7)	22.18(0.000)
	Yes	7 (5.9)	112(94.1)	
History of hospitalization	No	11(7.7)	131(92.3)	
	Yes	6(100.0)	0(0.0)	11.0813(0.001)
Alcohol use	No	12(10.0)	109(90.0)	
	Yes	5(17.3)	24(82.7)	5.495(0.019)
History of smoking	No	16(11.2)	127(88.8)	1.722(0.247)
	Yes	1(16.7)	5(83.3)	
History of MDR contact	No	16(11.2)	127(88.8)	0.171(0.523)
	Yes	1(16.7)	5(83.3)	

3.3. Predictors of Mortality among Patients under MDR-TB Treatment

Univariate analysis indicated that treatment outcome was significantly associated with residence [COR= 0.084,95% CI= 0,02-0.34 ,P= 0.001], co-infection[COR=56,95%CI=6.06-516.8,P=0.001] ,hospitalization[COR=6.25,95% CI,P=0.000], educational status [COR =56, 95%CI, =6.06-516.8), P 0.001], history of missed treatment [COR =0.14,95% CI=0.02-0.84,P= 0.031], previous TB treatment [COR = 31.2,95% CI=5.27-184.42,P =0.000], and alcohol consumption [COR= 0.14,95%CI= 0.02-0.84,P= 0.031](table3).

However, on multivariate logistic regression model analysis only the patient category, hospitalization and co-infection were significantly identified as independent predictors of mortality; that patient category with previous anti-Tb treatment history [AOR=16.7, 95% CI=1.59 - 175.15), P= 0.019] ,[AOR=19.55,95% CI= 6.234-543.037,p=0.000],and co-infection [AOR=65.9, 95% CI = (2.98- 145.0), P= 0.008] were significant risk factors for mortality (table3).

Table 3. Multivariable logistic regression analysis and predicators of mortality among MDR-TB patients in eastern Ethiopia, 2017.

Variable category	Bivariable model COR (95%CI)	p-value	Multivariable model AOR (95% CI)	p-value
Gender				
Male	1 (Reference)			
Female	0.33(0.95-1.16)	0.086		
Residence				
Urban	1 (Reference)			
Rural	0.084(0,02-0.34)	0.001	0.199 (0.0165- 2.39)	0.204
Educational level				
Illiterate	1 (Reference)			
1-4 grade	5(0.49-50.83)	0.174	1.3(0.035 - 54.65)	0.88
5-8grade	1.66(0.12-22.00)	0.698	1.53 (0.06- 36.05)	0.79
9-12 grade	6(1.07-33.37)	0.041	1.05 (0.07- 13.87)	0.97
Higher education	8.75(1.52-50.11)	0.015	1.55 (0 .100- 24.11)	0.75
Patient category				
New	1 (Reference)			
Retreated	31.2(5.27-184.42)	0.000	16.7(1.59- 175.15)	0.019
Defaulter	5.2(0.27-97.61)	0.270	2.86(.022- 373.4)	0.671
Missed history treatment				
Yes	1 (Reference)			
No	0.14(0.02-0.84)	0.031	0.027(0.001-2.28)	0.071
History of MDR contact				
Yes	1 (Reference)			
No	0.55(0.07-4.35)	0.576	0.386(0.030-4.85)	0.462
Housing condition				
Private	1 (Reference)			
Rented	2(0.47-8.40)	0.344	2.63(0.46-14.78	0.272
Homeless	4(0.32-49.08)	0.278	4.65(0.24-87.56)	0.305
History of smoking				
Yes	1 (Reference)			
No	0.54(0.13-2.22)	0.395	0.58(0.107-3.22)	0.54
Alcohol consumption				
Yes	1 (Reference)			
No	0.14(0.02-0.84)	0.031	3.20 (0 .120- 85.35)	0.487
Co-infection				
No	1 (Reference)			
Yes	56(6.06-516.8)	0.001	65.9 (2.98- 1457.0)	0.008
Hospitalization				
No	1 (Reference)			
Yes	6.25(6.332-551.46)	0.000	19.55(6.234-543.037)	0.000

4. Discussion

Previous studies conducted in Ethiopia and different region of Africa focused on different factors associated with the development MDR-TB patients. In Ethiopia, most of them were conducted at St. Peter Hospital, Addis Ababa. However, the present study was aimed to assess the predictors of mortality among MDR-TB patients in Eastern parts of Ethiopia.

It was found that the mortality rate among all cases is 11.3%. This result is lower than study conducted in Ethiopia to determine survival and predictors of mortality among patients under MDR-TB treatment, where the total death rate was 15.43% for the cohort (Getachew *et al., 2013*) and observational cohort study on achieving high treatment success for MDR-TB in Africa: initiation and scale-up of MDR TB care, showed that 85 (13.9%) patients were died (Meressa D, *et al.*2015). But the present mortality rate is higher than the study conducted on the assessment of MDR Treatment outcome in St. Petre's Hospital, Ethiopia which indicate the death rate was 9.1%(Tulu T et *al.*, 2014) and other study done on risk factors of mortality in patients with MDR-TB revealed that the total death rate for the cohort was 10.8 %(Molalign S and Wencheko E, 2015)

Some studies in Ethiopia identified that having clinical complications, tuberculosis type, category of patients, smoking, smear negative pulmonary TB, HIV seropositive, therapeutic delay more than one month, extrapulmonary TB, body weight and age were associated with increased risk of mortality among MDR-Tb patients(Molalign S and Wencheko E; 2015, Getachew *et al.*, 2013, Biruk M,*et al* ;2016). However, in the present finding only residence, patient level of education, patient category, history of missed anti-MDR-TB, alcohol use and co-infection were found to be independent predictors of mortality among MDR-TB patients on univariate analysis. Further analysis was carried out using multivariate logistic regression model. In multivariate regression model, factors independently associated with mortality after adjusting for other characteristics were patient category and co-morbidity (co-infection) [Table 3].

In the present study, it was also indicated that the most common co-infection was HIV 24/150(16.22%), which is lower than study conducted in Ethiopia where133 (21.7%) were HIV co-infected (Meressa D, et al.2015). It was revealed that co-infected patients were 65.9 times at greater risk of dying as compared to patient with no co-infection. Similar finding was observed in Ethiopia, HIV seropositive individuals have a higher hazard of death (HR 5.94, 95% CI 2.40 - 14.72, $P < 0.0001$) compared to HIV negative individuals (*Getachew et al.,2013*) and HIV co-infection (adjusted HR (AHR):2.60, $p<0.001$), was predictive of death(Meressa D, et al.2015). Similarly, another study conducted in Ethiopia showed that Patients who were being treated for HIV positive TB had unsuccessful treatment outcome compared to patients being treated for HIV negative TB(AOR = 1.988, 95% CI: 1.393–2.838)(Biruk M,et al,2016).

Patients who had previous history of hospitalization in the last 12 months 19.55 times more likely to die compared to patients who had no history of hospitalization. This could be attributed to the fact that patients during prolonged hospital stay may develop

other nosocomial infections that can enhance the complication of MDR-TB and results in the death of patients.

Our study revealed that the mortality rate was significantly different among MDR –TB patients who were retreated (with previous history of anti-Tb treatment) compared to new MDR-TB patients [AOR=16.7, 95%CI=1.59- 175.15, P= 0.019]. This finding is comparable with the study conducted to assess the Treatment Outcomes of Tuberculosis and Associated Factors in an Ethiopian University Hospital revealed that the likelihood of unsuccessful treatment outcome was more frequent (AOR = 6.733, 95% CI: 3.235–14.013) in retreatment than in newly treated cases (Biruk M, *et al*,2016).

5. Conclusion and Recommendation

The mortality rate was considerable (11.3%) in this study. Retreatment, hospitalization, and co-infection were independent predictors of MDR-TB patient mortality. The identified risk factors should be given priority by TB control programs in the region and more investigation is essential to provide concrete evidence and finding on predictors of mortality among MDR-TB patients.

6. Limitation of the Study

We obtain secondary data from public health institutions and some of the information might not be consistently recorded. Therefore, using data from incompletely recorded information might have also introduced bias.

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8. Author Contributions

NH and AS participated in study design, analysis, and write-up, and critically revised the manuscript. All the authors read and approved the final manuscript.

9. Disclosure

The authors report no conflicts of interest in this work.

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13. Assessment of Nutritional Status and Associated Factors among Adult People Living With HIV/AIDS in Hiowt Fana Specialized University Hospital, Eastern Ethiopia

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Abstract: Malnutrition among people living with HIV/AIDS remains a major challenge to achieve the full impact of intervention. The relationship between HIV and nutrition are intertwined in a vicious cycle that increase the vulnerability to, and worsens the severity of, each condition. HIV can cause or worsen malnutrition due to increased energy requirements, reduced food intake and poor nutrient absorption. Malnutrition, in turn, further weakens the immune system, increases susceptibility to infections and worsens the disease's impact. The objective of the study was to assess the magnitude of malnutrition and associated factors among adult people living with HIV/AIDS at Hiowt Fana Specialized University Hospital, Eastern Ethiopia. Institutional based cross-sectional study was conducted from November 1 to December, 30 2016. Five hundred two respondents were participated in the study. The target sample was selected by simple random sampling method from pre-ART and ART sample frame. The questioner was administered by clinical nurses working in the hospital. The data was analyzed based on specific objectives. Descriptive statistical analysis was used to determine the prevalence of malnutrition and the frequencies of independent variables anonymously using SPSS software. Bivariate analysis was done to see the association of the independent variables with nutritional status. The findings of the study indicated that the magnitude of under nutrition among Adult people living with HIV/AIDS is 26.5% (95% CI, 23.2-29.6). Patients who got dietary counseling were more than 3 times less likely undernourished than those who did not get dietary counseling AOR=3.464, 95%CI (1.787 - 6.715) and those patients who were develop opportunistic infection also about 2 times more likely to be undernourished than those with no opportunistic infection AOR=1.56, 95%CI (1.1-3.318). This study indicated the magnitude of under nutrition among adult people living with HIV/AIDS is 26.5% (95% CI, 23.2-29.6). Factors like counseling/advice, opportunistic infection and partners' occupational status were associated with malnutrition. Integrating and strengthening nutritional assessment and counseling to the routine chronic care services for PLHIV should be direction for both clinicians and program planners.

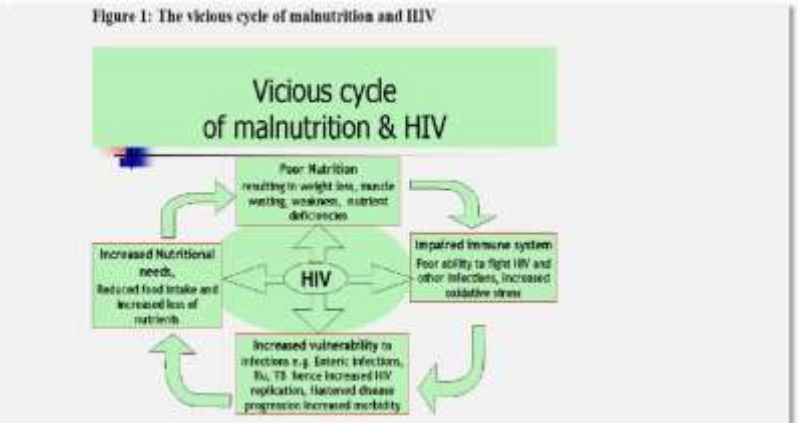
Keywords: Assessment; Nutritional Status; HIV/AIDS; Ethiopia

1. Introduction

The Human Immunodeficiency Virus [HIV] pandemic continues to have a pronounced global impact particularly among the world's resource limited settings. According to Global HIV/AIDS epidemic Report of 2012, globally 34 million people were live with HIV, whereas 2.5 million new infection and 1.7 million people were dying from AIDS related cause at the end of 2011. Sub-Saharan Africa remains most severely affected, with nearly 1 in every 20 adults (4.9%) living with HIV and accounting for 69% of the people living with worldwide. An estimated 1.8 million people was newly infected with a total of about 23.5 million and 1.2 million people were dying of HIV/AIDS and related cause at the end of 2011 [UNAIDS 2012]. An estimate of the Ethiopian HIV epidemic indicate there are 1,116,216 million people living with HIV, which is one of the largest populations HIV-infected people in the world resulting in 44,751 HIV related deaths and 131,145 new infections per year [HAPCO, 2010]. In Ethiopia, adult HIV prevalence was 1.5% at the end of 2010 [EDHS, 20113]. By the end of 2011, a total of 333,434 people had ever started ART. Of those there were 249,174 adults currently on treatment [HAPCO, 2012]

During the HAART era, HIV infection has become a chronic, manageable disease. Nutrition-related complications remain a challenging issue for HIV-infected patients and for those involved in their care. Involuntary weight loss is associated with disease progression and death, even where access to HAART is not limited. HIV-associated weight loss and wasting were among the most frequently occurring AIDS-defining conditions during the pre-HAART era, but the expectation was that viral control with therapy and prophylaxis for opportunistic infections would eliminate nutritional concerns in HIV infected individuals [Tang A.M., et.al, 2002].

Malnutrition among adults living with HIV (PLHIV) remains a major challenge to achieve the full impact of interventions aimed improving their quality of life, productivity and survival. At its advent, HIV was commonly referred to as "slim disease" because of the commonly associated wasting with it. In Sub-Saharan Africa the prevalence of wasting among adults living with HIV/ AIDS is estimated to be 20-40% [Dannhau A., et al, 1999]. Ethiopia is also affected by long standing food insecurity and malnutrition. PLHIV require more nutrients to compensate for poor absorption, adverse drug effects, frequent diarrhea, nausea and recurrent opportunistic infections. The Government of Ethiopia, in collaboration with the World Food Programme (WFP), is providing food and nutrition assistance to an estimated 110,000 PLHIV. A survey to review the outcomes of this intervention comparing values between 2006 and 2008 revealed that an increased proportion of PLHIV reported improving health status from 64% to 81.6% [HAPCO, 2010].



This problem is exacerbated in persons infected with HIV. The relationship between HIV and nutrition are intertwined in a vicious cycle that increase the vulnerability to, and worsens the severity of, each condition. HIV can cause or worsen malnutrition due to increased energy requirements, reduced food intake and poor nutrient absorption. Malnutrition, in turn, further weakens the immune system, increases susceptibility to infections and worsens the disease's impact.

Federal Democratic Republic of Ethiopia and endorsing nutrition care and support in the management of HIV/AIDS but there is little information about the current magnitude of malnutrition and associated factors among people infected with HIV [8]. There is little evidence in Ethiopian context in general and in the study area in particular regarding to the nutritional condition of peoples' living with HIV/AIDS whether they are in pre- ART or ART care. Therefore, the finding of this study will be important for implementers to address the problem of malnutrition among people living with HIV/AIDS. The finding on factors associated with malnourished HIV positive adults will give good knowledge for the health professionals working in comprehensive care clinic that will enable them to detect these conditions at an early stage and/or to prevent them. The main objective of this study was to assess the magnitude of malnutrition (under nutrition) among adult living with HIV/AIDS and to determine factors associated with malnutrition among adults living with HIV/AIDS.

2. Methods

Study setting: The study was conducted in Harari region at Hiowt Fana Specialized University Hospital which is located 526 kilometers away from the capital city, Addis Ababa. The hospital provides medical services for about six million populations in Eastern Ethiopia where majority of the cases are referral and also the center for training of undergraduate medical and other health science students.

Study design: Institutional based cross sectional study design was used.

Study Participants: All people aged 18 years and older who were actively taking ARV

drugs, and/or those who followed HIV/AIDS chronic care but not yet started ART during study period in Hiowt Fana Specialized University Hospital participated in the study.

Data collection procedure: An English version questionnaire was prepared based on literatures and previously used tool, then it was translated in to Amharic. The Amharic version was back translated into English to check for its consistency. The Amharic version questionnaire was pretested on 5% of the sample. BMI was calculated as weight in kilogram divided by height in $m.^2$ The data was collected by trained nurses working in ART clinic.

Independent variables: Socio demographic characteristics of adult HIV/AIDS positive Patient's patient factors: CD4 count, ART status, eating problem, other chronic illness, opportunistic infection, depression, WHO clinical stage, house hold food security and nutrition intervention.

Dependent variable: Nutritional status among adult HIV/AIDS positive patient

Data analysis: The data was analyzed based on specific objectives. Descriptive statistics was computed. Bivariate analysis was done to examine the association between independent variables and nutritional status. Those variables that were significant in bivariate analysis entered into multivariate analysis; that is variables with p-value <0.2 in the bivariate analysis were selected and entered into multivariate analysis. Then multivariate logistic regression analysis was done to determine factors that are predictors of under nutrition by controlling for confounders. P value and OR with 95% CI were used to ascertain statistical significance.

Operational definitions

BMI is the ratio of weight in kg divided by height in m. Using the calculated BMI from the BMI machine the respondent's nutritional status was classified as follows:

BMI < 16.0 = Severe malnutrition

BMI ≥ 16.0 and < 17.0 = moderate malnutrition

BMI ≥ 17.0 and < 18.5 = mild malnutrition

BMI ≥ 18.5 and < 25.0 = normal weight

Ethical consideration

Ethical approval and clearance was obtained from the Haramaya University, College of Health and Medical Science IHRERC. The objective and purpose of the study were informed to the sample population in order to give genuine information. Based on the written and signed informed consent, participants were informed that they have the right to withdraw or refuse to participate in the study at any time. A letter explaining the need for and benefit of the study, the method of questing, confidentiality, privacy and others were attached to the cover page of the questioner.

3. Result

3.1. Socio-demographic Characteristics of the Respondents

A total of 502 respondents participated in the study giving a response rate of 100%. The mean age of participants was 23.98± (4.4) years. Two hundred eighty six (57%) of respondents were in the age range of 30-44 years. Most (60.8%) of the study participants were females. The distribution of respondents by religion showed that the majority 320 (63.7%) were Orthodox followed by Protestant 164 (32.7%). The major ethnic groups were Oromo constituting 351 (69.9%) and followed by Amhara 122 (24.3%). Concerning marital status of the study subjects, the majority 289 (57.6%) of them were currently married while 73 (14.5) never married (single).

Regarding respondents educational status, 195 (38.8%) of respondents had secondary education & above and 186 (37.1%) were primary education but 109 (21.7%) cannot read & write (has no education).Two hundred seventy eight (55.4%) and 220 (44.6%) of study participants were employed and unemployed in occupation respectively.

The distribution of occupation of respondents' partners, 153 (52.9%) were employed while 136 (47.1%) were unemployed. In terms of monthly constant family income, 35 (7.0%) of respondents have no constant income, and 467 (93%) have monthly constant income, (Table 1).

Table: 1. Socio demographic characteristics of adult People living with HIV in Hiwot fana Specialized University Hospital, Harar, Ethiopia, 2016, n = 502

Variable	Frequency		
	Pre-ART	ART	Total
Sex			
Male	78 (39.6%)	119 (60.4%)	197(39.2%)
Female	113 (37.0%)	192 (63.0%)	305(60.8%)
Age			
18-29	48(41.0%)	69(59.0%)	117(23.3%)
30-44	108(37.8%)	178(62.2%)	286(57.0%)

45+	35(35.4%)	64(64.6%)	99(19.7%)
Religion			
Orthodox	155(35.9%)	205(64.1%)	320(63.7%
Protestant	64(39.0%)	100(61.0%)	164(32.7%)
Muslim	12(66.7%)	6(33.3)	18(3.6%
Ethnicity			
Oromo	133(37.9%)	218(62.1%)	351(69.9%)
Amhara	45(36.9%)	77(63.1%)	122(24.3%)
Others(harari,gurage,silt)	13(44.8%)	16(55.2%)	29(5.8%)
Marital status			
Single	45(61.6%)	28(38.4%)	73(14.5%)
Married	104(36.0%)	185(64.0%)	289(57.6%)
Separated/Widowed/Divorced	42(30.0%)	98(70.0%)	140(27.9%)
Educational status			
Not read and write	33(30.3%)	76(69.7%)	109(21.7%)
Read and Write	2(16.7%)	10(83.3%)	12(2.4%)
Primary school	48(25.8%)	138(74.2%)	186(37.1%)
Secondary and above	108(55.4%)	87(44.6%)	195(38.8%)
Marital status			
Single	45(61.6%)	28(38.4%)	73(14.5%)
Married	104(36.0%)	185(64.0%)	289(57.6%)
Separated/Widowed/Divorced	42(30.0%)	98(70.0%)	140(27.9%)
Educational status			
Not read and write	33(30.3%)	76(69.7%)	109(21.7%)
Read and Write	2(16.7%)	10(83.3%)	12(2.4%)
Primary school	48(25.8%)	138(74.2%)	186(37.1%)
Secondary and above	108(55.4%)	87(44.6%)	195(38.8%)

3.2. Nutritional Status of the Respondents

The mean of BMI of the respondents was 20.3 with SD $\pm$ 2.7. As it is presented on Figure 2, sever and moderate malnutrition was detected in 4.6% and 5.6% of the respondents, respectively and the remaining 16.3% had mild nutrition. Most of the respondents 67.7% had normal nutritional status. Figure 2

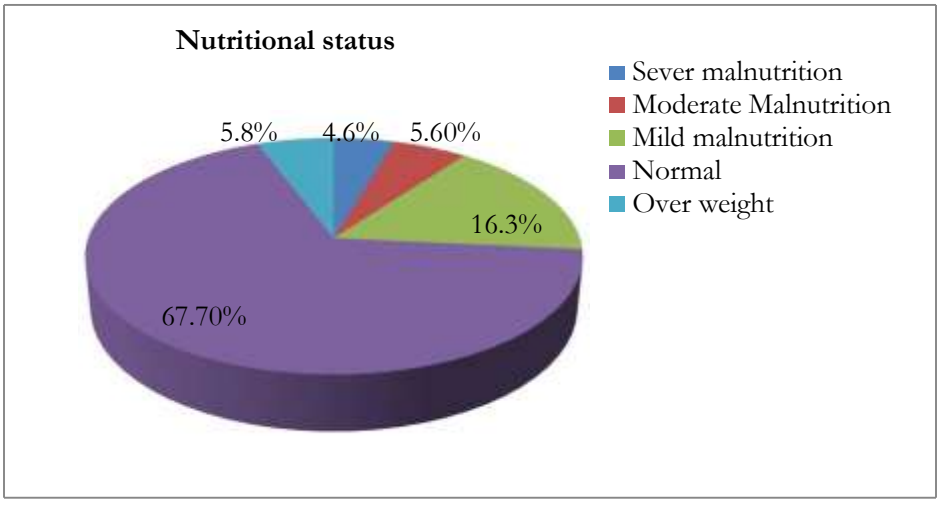
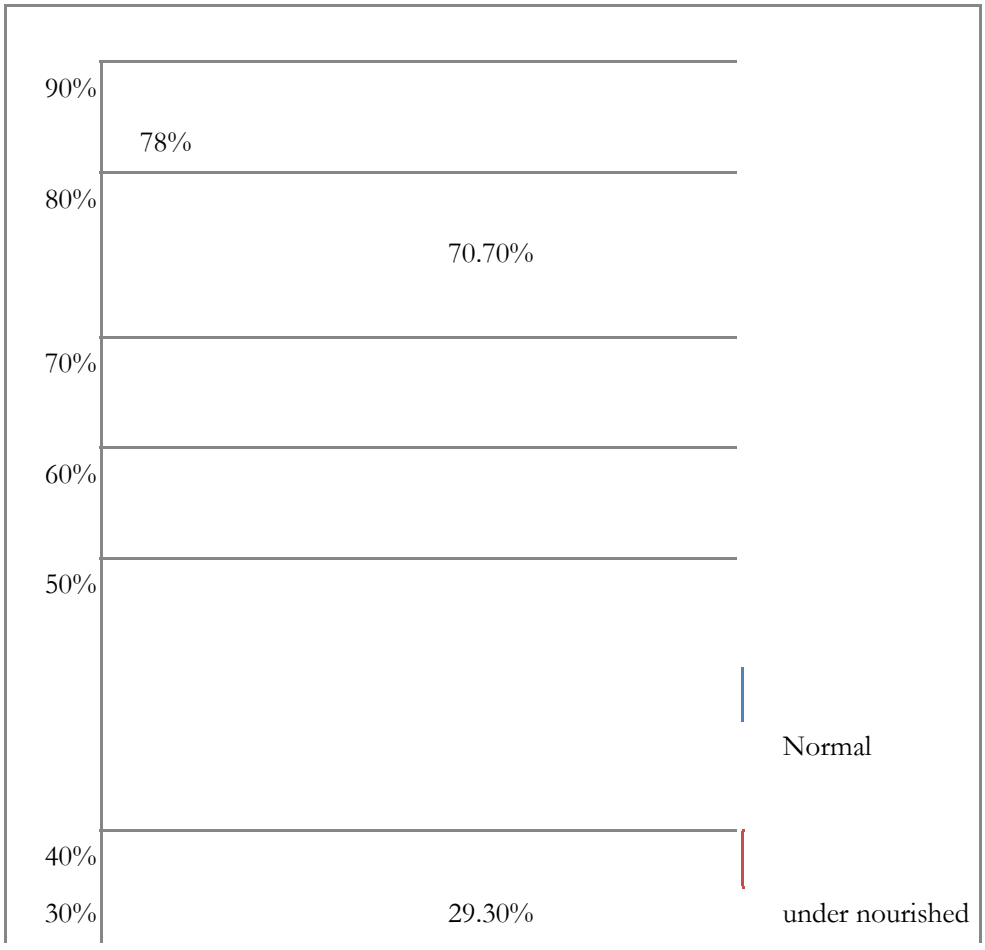


Figure: 2. Nutritional status of adult People living with HIV in Hiwot fana specialized university Hospital Harar, Ethiopia, 2016, n = 502

Concerning proportion of malnutrition from the total 133 (26.5%) under nourished, 91(29.5%) were on ART and 42(22%) were on Pre-ART.



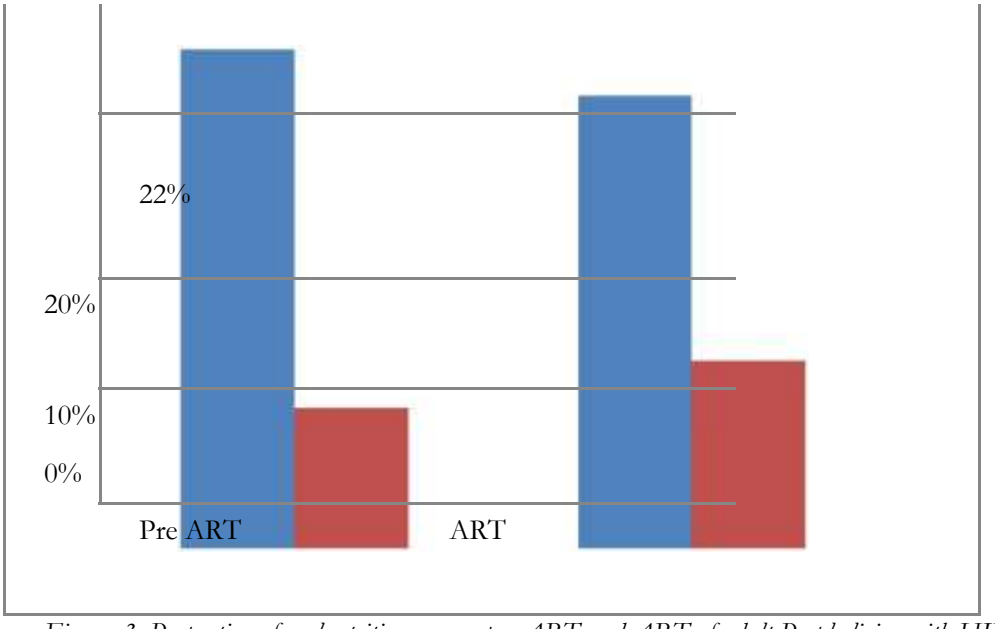


Figure: 3. Proportion of malnutrition among pre-ART and ART of adult People living with HIV in Hiwot fana specialized university Hospital, Harar, Ethiopia, 2016, n = 502

Factors associated with malnutrition of adult People living with HIV/AIDS

Sex, partner occupation, eating frequency, ate smaller meal, opportunistic infection, WHO clinical stage, current CD4 count, functional status, and dietary counseling were entered into bivariate analysis with independent variables. All of these variables were associated with malnutrition in the bivariate analysis.

Those variables associated with malnutrition in the bivariate analysis were entered to multivariate analysis. A few variables were significantly associated with malnutrition in multivariate analysis. Occupational status of the partner was showed statistically significant association among the respondents. Out of the total respondents, 50 (36.8%) of unemployed participants' partner were undernourished while 33 (21.6%) of employed participants were undernourished. **AOR=0.223, 95%CI (0.106-0.468).** The presence of opportunistic infection was about 2 times more likely to be undernourished than those with no opportunistic infection **AOR=1.56, 95%CI (1.1-3.318)**

Dietary counseling /advice was also associated factors in this study, that is those patients who got dietary counseling/advice were more than 3 times less likely undernourished than those who did not get dietary counseling/advice **AOR=3.464, 95% CI (1.787-6.715)**.(Table 2)

Table 2. Factors associated with nutritional status of adult People living with HIV in Hiwot fana specialized university Hospital, Harar, Ethiopia, 2016, n = 502.

Variable	Under nutrition		COR (95% CI)	AOR (95% CI)
	Yes/BMI<18.5 No. (%)	No/BMI≥18.15 No. (%)		
Sex				
Male	31(15.7%)	166(84.3%)	0.372(0.237-0.584)	0.52(2.75-10.328)
Female	102(33.4%)	203(66.6%)		1.00
Partner occupation, n = 289				
Unemployed	50(36.8%)	86(63.2%)		1.00
Employed	33(21.6%)	120(78.4%)	0.473(0.281-0.795)	0.223(0.106-0.468)*
Eating frequency				
< 2 meals/day	64(32.8%)	131(67.2%)	1.685(1.128-2.518)	0.872(0.433-1.753)
≥ 3meals/day	69(22.5%)	278(77.5%)		1.00
Ate smaller meal				
Never	43(20.3%)	169(79.3%)		1.00
Rarely	71(31.8%)	152(68.2%)	0.545(0.352-0.844)	0.27(0.027-2.730)
Sometimes	16(28.1%)	41(71.9%)	0.652(0.334-1.271)	0.229(0.24-2.228)
Often	3(30.0%)	7(70.0)	0.594(0.147-2.391)	0.331(0.028-3.909)
Opportunistic Infection				
No	74(21.8%)	266(78.2%)		1.00
Yes	59(36.4%)	103(63.6%)	0.86(0.722-0.932)	1.56(1.1-3.318)*
WHO Clinical stage				

Stage-I	72(22.4%)	249(77.6%)		1.00
Stage-II	31(27.9%)	80(72.1%)	0.746(0.457-1.219)	0.515(0.239-1.108)
Stage-III	25(39.1%)	39(60.9%)	0.451(0.256-0.795)	0.391(0.149-1.027)
Stage-IV	5(83.3%)	1 (16.7%)	0.058(0.007-0.503)	0.357(0.028-4.482)
Current CD4 count				
≤ 200 cell/mm^3	31(52.5%)	28(47.5%)	0.248(0.140-0.440)	0.597(0.235-1.519)
201-350 cell/mm^3	28(28.0%)	72(72.0%)	0.707(0.426-1.174)	0.973(0.454-2.089)
>350 cell/mm^3	74(21.6%)	269(78.4%)		1.00
Functional status				
Working	118(24.6%)	361(75.4%)		1.00
Ambulatory	15(65.2%)	8(34.8%)	0.174(0.072-0.422)	0.376(0.093-1.526)
Dietary counseling/advice				
No	52(21.1%)	195(78.9%)	1.746(1.166-2.614)	3.464(1.787-6.715)*
Yes	81(31.8%)	174(68.2%)		1.00

4. Discussion

Malnutrition and HIV/AIDS effects are interrelated and exacerbate one another in a vicious cycle. Both HIV/AIDS and malnutrition independently cause progressive damage to the immune system and increased susceptibility to infection [Mangili A., et.al, 2006]. Malnutrition (under nutrition) is more common in developing countries, where patients are often not diagnosed or do not commence ART until they have advanced disease. Ominously, the HIV epidemic itself may be contributing to food insecurity at a population level. This study has found 26.5% undernutrition prevalence among adult infected with HIV with (95% CI, 23.2-29.6). This prevalence was much lower than study conducted in France, Paris 37.9% [Niyongabo.T, et.al 2000], in India 73% [Sat B., et.al, 2004], Malawi 57% [Zacharia.R. et.al, 2002] and Burundi, Bujumbura 47.3% [Niyongabo T, et al, n.d.] but higher than study conducted in Boston 18% [Olalekan A.U., 2008], [Molla Daniel, et al, 2013] 25.5% and Dilla University referral hospital 12.3% [Solomon Hailemariam, et al, 2013]. The difference of the prevalence may be due to the duration of the study, residence and socio-economic difference. These findings have important implications for nutrition programs considering theraupatic feeding strategies among HIV-infected adults initiating ART and on ART.

The prevalence of undernutrition varied based on client's ART status (pre-ART and on ART). In this study, the prevalence of undernutrition was higher on ART 29.3% than pre-ART 22% clients. Both pre-ART and ART finding is disagreement with [Molla Daniel, et al, 2013]. the difference may possibly be due to poor adherence to ART and/or to the counseling services. Those who were on Pre-ART care possibly might get committed to the counseling given and they might also get committed to consume balanced diet in order to lengthen their life. Howevre, they may be possibly at this stage; might consider themselves healthy so more of the attention would be given and should be counseled to consume better food sources to maintain their nutrition.

The prevalence of under nutrition among patients on ART may be due to their low commitment to adhere to ARV treatment, and/or to the counseling given or in adequate counseling. Those who were on Pre-ART care should get attention on what to eat, how frequent to eat, what precaution to take regarding on feeding as they may consider themselves healthy as other community groups and also counselors should tell them what to and not to do to pre-ART clients than those who were on ART care. But who were on ART were those enrolled to take ARV drugs as they were with low CD4 count, could improve their nutritional status as they may adhere better to ART treatment and to the counseling they were given by counselors. Therefore, counseling should focus on both Pre-ART clients and ART clients being done regularly and possibly the enrollment criteria may need also be seen and revised so that problem of malnutrition could be better addressed and reduced.

The median body mass index of the study participant was 20.3kg/m^2 which was almost similar with study done in South Africa 20kg/m^2 [Lategan R. et al, 2010] and Behirder, Felege Hiwot referral Hospital 20.5kg/m^2 [Molla Daniel, et al, 2013] but a little bit higher than study conducted in Dilla University referral hospital 19.5kg/m^2 [Solomon Hailemariam, et al, 2013].

Malnutrition could occur in different forms and degrees. When we consider the degree of malnutrition, it varies in different settings and circumstance. In this study for example, from the total undernourished (26.5%): 16.3%, 5.6% and 4.6% were in mild, moderate and severe malnutrition respectively which almost similar with study done in Behirder, Felege Hiwot referral Hospital 16.4, 4.9 and 4.2 mild, moderate and severely respectively [Molla Daniel, et al, 2013]

Even though the sex of respondents was not significantly associated with malnutrition, it was higher in females 102 (33.4%) compared to their male counterpart 31 (15.7%). Similarly, the Helsinki and Ghanaian study identified that nutritional status was significantly associated with female gender, [Souminen M., et al, 2005 and Dodor E. n.d.]. Where unemployment promotes poverty, which in turn limits the ability of individual to expend money for food consumption. The less likelihood of developing undernutrition among respondents in the moderate economic status implies improved income level insures food security at household level. As it is confirmed by findings from previous study in Ethiopia, food insecurity is a significant problem for PLWHAs with low household income. The implication is improving household income and creating employment opportunities for PLWHA might be among the tenets of comprehensive continuum of care.

In contrary to study done in Dilla, the proportion of malnutrition was higher (23.7%) in unemployed group compared to those employed (8.1%) (Solomon Hailemariam, et al, 2013) and Ghana (Souminen M., et al, 2005 and Dodor E. n.d). This study revealed that there is no association between employment status and malnutrition; however, occupational status of the partner showed statistically significant association among the respondents 50 (36.8%) of unemployed participants' partner were undernourished while 33 (21.6%) of employed participants' were undernourished.

Malnutrition was higher (36%) in those who developed opportunistic infection than that of their counterpart (21.8%). Being having OI had a higher likely hood of developing malnutrition. HIV-induced immune impairment and heightened subsequent risk of opportunistic infection can worsen nutritional status. This necessitates the importance of managing patients with opportunistic infection promptly. This finding was similar with the study done Dilla university referral hospital (Solomon Hailemariam, et al, 2013).

Functional status of patients is usually related with their underlying medical condition in which patients with deteriorated functional status could have a compromised health status. This condition may result in reduced intake of food which may in turn result in malnutrition. The finding of this study showed that patients with ambulatory functional status were more likely to be malnourished compared to those who had working functional status.

Dietary counseling/advice was significantly associated factors in this study that is those patients who got dietary counseling/advice were more than 3 times less likely undernourished than those who did not get dietary counseling/advice**.** This finding agrees with the study [Tabi M. et al, 2005].

Strength of the study

- ✓ Bias was minimized by training of data collectors and regular supervision during data collection.
- ✓ Confounders controlled by the use of multivariate analysis.
- ✓ Data collectors were health professionals.

Limitation of the study

- ✓ The factors expected to influence malnutrition may not be exhaustive. There could be other influencing factors which this study did not reveal.

5. Conclusion

The findings of this study indicated that the magnitude of malnutrition among adult people living with HIV/AIDS is 26.5%. Dietary counseling, current partner occupation and opportunistic infection were factors associated with malnutrition among adult PLHIV.

6. Recommendation

- ✓ The nutritional intervention should aim at identified local factors influencing nutritional status in order to decrease the prevalence of malnutrition in the area.
- ✓ Harari regional health bureau in collaboration with Hiwot fana specialized university hospital have to provide regular health education on the importance of adequate nutrition for PLHIV.
- ✓ Hiwot Fana Specialized University Hospital should have to conduct dietary counseling to encourage patients to increase diversity of dietary intake focusing on a variety of recommended food groups.

7. Acknowledgements S

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14. Prevalence of Gestational Diabetes Mellitus and its Association with Maternal and Neonatal Adverse Outcomes among Mothers who Gave Birth in Hiwot Fana and Dilchora Hospitals, Eastern Ethiopia

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Abstract: Gestational diabetes mellitus is any degree of glucose intolerance with onset or first recognition during pregnancy. The aim of this study was to assess the prevalence of gestational diabetes mellitus and its association with maternal and perinatal adverse outcomes among pregnant mothers who gave birth in Hiwot Fana and Dilchora Specialized Referral Hospitals. Unmatched case control study design was used to conduct the study in Hiwot Fana and Dilchora hospitals from December 2015 to April 2017. This study recruited the total of 1834 delivering mothers (47 diabetic and 1787 nondiabetic pregnant women). Structured and pretested questionnaire was used to collect the socio demographic data. Mothers who have a risk factor for gestational diabetes mellitus has undergone oral glucose tolerance test to confirm the diagnosis. The collected data was entered into EPI-info version 3.5.1 and then exported to SPSS version 20.0 software for analysis. From a total of 1834 mothers 47 (2.6%) of them were found to have gestational diabetes. Among the maternal adverse outcomes preeclampsia and premature rupture of membrane were found to have an association with gestational diabetes with AOR= 3.44[95% CI = 1.69-6.97] and AOR = 4.15[95% CI = 2.16-7.95], respectively. From neonatal adverse outcome, Macrosomia had an association with gestational diabetes with AOR = 5.66[95% CI = 2.76-11.54]. This study revealed that there were Preeclampsia, PROM Preterm delivery were the major maternal and neonatal adverse outcomes while preeclampsia PROM and Macrosomia were more prevalent among mothers with gestational diabetes and significantly associated with the GDM. Family history of diabetes, pre-pregnancy BMI and increased parity were identified as the risk factors for gestational diabetes. Providing necessary equipments, strictly following the checklist and counseling women with GDM were recommended.

Acronyms or Abbreviations

ANC	Antenatal Care
BMI	Body Mass Index
CS	Cesarean Section
DM	Diabetes Mellitus
GDM	Gestational Diabetes Mellitus
IGT	Impaired Glucose Tolerance
OGTT	Oral Glucose Tolerance Test
PROM	Premature Rupture of Membrane
WHO	World Health Organization

1. Introduction

The number of people with diabetes is increasing due to population growth, aging, urbanization and increasing prevalence of obesity and physical activities. As the incidence of diabetes continue to rise and increasingly affects individuals of all age, including young adults and children, women of childbearing age are at increased risk of diabetes during pregnancy (Kelly et al, 2016).

Gestational diabetes mellitus is defined by the World Health Organization as being "any degree of glucose intolerance with onset or first recognition during pregnancy" and should therefore include glucose readings that fall within the impaired glucose tolerance (IGT) diagnostic range, as well as those within the diagnostic range for diabetes (Heuck et al. 2002), (Alberti & Zimmet 1998).

Metabolic changes occur in normal pregnancy in response to the increase in nutrient needs of fetus and the mother. There are two main changes which are seen during pregnancy, progressive insulin resistance that begins near mid - pregnancy and progresses through the third trimester to the level that approximates the insulin resistance seen in individuals with type 2 DM. The second change is the compensatory increase in insulin secretion by the pancreatic beta cells to overcome the insulin resistance of pregnancy. If there is a maternal defect in insulin secretion and glucose utilization, then GDM will occur as diabetogenic hormones rise to their peak levels (Abourawi 2006)

Poor outcomes in pregnancies among women with diabetes are in most cases preventable by optimizing glycemic control. By early screening of those mothers who have a risk factor we can diagnose mothers with GDM and treat them; by doing so we can minimize the complications of GDM on the mothers and their neonates. Addressing GDM will also constitutes a window of opportunity for early intervention and reduction of the future burden of type 2 diabetes (Dabelea 2007).

Mothers who have risk factors for GDM will undergo selective screening during ANC visit with OGTT. The definitive diagnosis of GDM is made by the 100 gram oral glucose tolerance test (OGTT) conducted on those with an abnormal screening test result. Two abnormal results of the four total warrant the diagnosis of GDM (Alberti & Zimmet 1998).Diabetes mellitus is the most common medical complication of

pregnancy and it carries significant risk to the fetus and the mother. Gestational diabetes mellitus (GDM) represents approximately 90% of these cases and it affects 2-5% of all pregnancies and varies in direct proportions to type 2 diabetes mellitus in the background population (Abourawi 2006).

A diabetic pregnant women and their unborn children are at increased risk of pregnancy complication such as preeclampsia, infections, obstructed labor, post partum hemorrhage, preterm births, still births, macrosomia, miscarriage, intrauterine growth retardation, congenital anomalies, birth injuries and death in worst case scenarios (Mintz et al. 1978) (Dabelea, 2007).

In addition, babies born from diabetic pregnancies have an increased risk of developing obesity in childhood, metabolic disturbances in adolescence and type 2 DM in adulthood, linked to the metabolic imbalances experienced in utero (Dain, 2011).

In some of the poorest areas of the world difficulties in accessing and receiving both maternity and general medical care increase the risks pregnant women face from the complication of diabetes in pregnancy. It is estimated that women with type 1 DM face a 5-20% risk of dying in pregnancy compared to non diabetic pregnant women if adequate care is not provided (Leinonen et al. 2001).

In Ethiopia the screening done for pregnant women who have a risk factor for GDM is very low and thus the complication and risk factors associated with GDM is not well known. In our study area also the prevalence of GDM, maternal and neonatal complications and its association with GDM were unknown so this study was conducted in intention of assessing the pregnancy the prevalence of GDM and its association with maternal and neonatal adverse outcome. The objective of this study was to assess the prevalence of gestational diabetes mellitus and its association with maternal and neonatal adverse outcomes among mothers who gave birth in Hiwot Fana and Dilchora hospitals, Eastern Ethiopia.

2. Methods and Materials

Study Area

This study was conducted in Hiwot Fana specialized hospital, Harar town, Eastern Ethiopia. Harar town is located 526km from Addis Ababa to the Eastern part of Ethiopia. According to the central statistics authority of Ethiopia 2007, Harari regional state has population of 183,415 of these 92,316 were male and 91,099 were female. Hiwot Fana specialized hospital was established in 1941. It is referral hospital in Harar town and its surroundings which has been delivering health care services.

Dilchora Referral Hospital is found in Dire Dawa city administration council and located 501 km to East of Addis Ababa. The hospital is serving an estimated 2 million population found in Dire Dawa City administration and nearby Oromiya and Somali regions having total beds of 268 distributed in medical, pediatrics, surgical, gynecology, and obstetrics ward. Monthly, an estimated 582 clients visit antenatal clinic found in the hospital. In addition, monthly an estimated 194 clients visit the clinic for ANC.

Duration of the Study

The study was conducted from December 2015 to April 2017

Design of the Study

Unmatched case control study design was used to conduct this study.

Source Population

The source population was all delivering mothers and their neonates who gave birth in Hiwot Fana and Dilchora hospitals.

Population of the Study

The study population was mothers with their neonates who gave birth (delivered) in Hiwot Fana and Dilchora hospitals during data collection period.

Inclusion and Exclusion criteria

Inclusion Criteria

- Pregnant mothers who gave birth in Hiwot Fana and Dilchora hospitals during study period.

Exclusion Criteria

- Those mothers who had diabetes mellitus before pregnancy.
- Pregnant mothers who had other medical illnesses.
- Who were severely ill during data collection period were exc;uded from the study

Sample Size Determination

The required sample size of the study population is calculated using the formula for single population proportion based on the following assumption;

n = the required sample size

Z = standard error corresponding to 95% confidence interval level = 1.96

P = proportion of mothers with GDM in Tigiray (3.7%) (Mengesha et al. 2017).

d = the margin of error (0.9%)

$n = Z^2 P (1-P) d2 \;/$

$n = (1.96)^2(0.037)^* (1-0.037)/ (0.009)^2$

n = 1687 (by adding 10% non response rate)

$\mathbf{n_f =}$ 1855

Sampling Technique

All mothers who came to Hiwot Fana and Dilchora hospitals during the study period were interviewed by using the structured interview questions until the required sample size was obtained.

Variables of the Study

The dependents variables are maternal adverse outcomes and neonatal adverse outcomes whereas age, parity, income, gestational diabetes, Body Mass Index (BMI), and family history of diabetes are the independent variables.

Data Collection Procedure

Sociodemographic data of the pregnant women was obtained during the face-to-face interview. During the study, pregnant women who were attending the antenatal clinics were tested for GDM by a selective screening procedure based on the risk factors.

Data Management and Statistical Analysis

The collected data entered into EPI-info version 3.5.1 and then exported to SPSS version 20.0 software for analysis. After cleaning the data for internal consistency, descriptive statistics like frequencies and percentages were calculated. P value less than 0.05 was considered to decide statistical significance. Moreover, multivariate logistic regression analysis was employed to control confounders.

Ethical Consideration

The protocol was approved by the Haramaya University Institutional Health Research Ethics Review Committee. Written and signed informed consent was obtained from each study participant prior to interview as it is stated in participant information sheet. The data collection procedure was anonymous in order to keep the confidentiality of any information provided by the study participants.

Data Quality Assurance

The pretest was performed before actual data collection started and it was conducted in Jugal hospital with 5% of the sample size for modifying the questionnaires. To ensure the quality of data, training was given for two days for data collectors by the principal investigator. All data were checked for completeness, clarity and consistency by principal investigator immediately after data collection.

Operational Definitions

- **Adverse Maternal outcomes** – pregnancy induced hypertension, increased rates of C/S and induction, perineal laceration, polyhydramnios and ante partum hemorrhage.

- **Adverse neonatal outcomes –** macrosomia, prematurity, Admission to NICU, respiratory distress, congenital anomalies and birth traumas.
- **Oral Glucose Tolerance Taste (OGTT) –** is a provocation test to examine the efficiency of the body to metabolize glucose and it distinguishes metabolically healthy individuals from people with impaired glucose tolerance and those with diabetes.
- **Macrosomia-** babies whose birth weight was greater than 4000gm.

3. Result

Socio-demographic Characteristics

A total of 1834 pregnant women in Hiwot Fana and Dilchora hospitals were included in the study making the response rate 98.7%. The mean age of mothers was 25.6 (SD ± 4.8) and majority of them 1744 (95.1%) were married. The majority of mothers were Oromo 1204 (65.6%) in ethnicity and Muslim 1275 (69.5%) by their religion. More than one third of mothers 738 (40.2%) had no formal education and almost half of the mothers 861 (46.9) were housewives. The mean monthly income of mothers was 1776.8 (SD ± 1051.3) (Table 1)

Table 1. Socio demographic characteristics of women who gave birth in Hiwot fana and Dilchora hospitals during June 2016 to April 2017 G.C.

Variables	Number (N=1834)	Percent
Age of mothers		
<18	21	1.1
18-24	718	39.1
25-29	660	36.0
30-34	324	17.7
>35	111	6.1
Marital status		
Single	19	1
Married	1744	95.1
Divorced	36	2
Widowed	29	1.6
Separated	6	0.3
Ethnicity		
Oromo	1204	65.6
Amahara	359	19.6
Adare	148	8.1
Others	123	6.8
Religion		
Muslim	1275	69.5
Orthodox	430	23.4
Protestant	117	6.4

Others	12	0.7
Educational status		
Unable to read and write	738	40.2
Grade 1-8	533	29.1
Grade 9-10+2	419	22.8
Grade 12+	144	7.9
Occupation		
Government employee	194	10.6
Private employee	209	11.2
Housewife	861	46.9
Merchant	248	13.5
Farmer	219	11.9
Others	103	5.6
Income		
<1200	638	34.8
1200-4999	1164	63.5
>5000	32	1.7

Prevalence of Gestational Diabetes

From a total of 1834 mothers those who fulfilled the criteria (532) were screened by using random blood sugar. According to this screening ,109 women had blood glucose level of 140 ml/dl and above. All 109 women underwent the oral glucose challenge test and only 47 (2.6%) of these women were diagnosed with gestational diabetes.

Obstetrics Characteristics and Maternal Adverse Outcomes

From a total of 1834 mothers, only 58 (3.2%) of them had family history of diabetes mellitus. The majority of women 1295 (70.6) were multigravidas and more than half 1023(55.8) were multipara (who give birth more than once). Most of the mothers 1162(63.4%) had normal body mass index (BMI). From the total of 1834 mothers who delivered in both hospitals, 107 (5.8%) and 169 (9.2%) of them had ante partum hemorrhage and preeclampsia, respectively. Most of them 1753 (95.6%) were not diagnosed with polyhydramnios and 146(8%) and 128 (7%) of them underwent Induction and augmentation, respectively. The proportions of mothers who develop premature rupture of membrane (PROM) were 234 (12.8). From the total sample, 410 (22.4%). of the mothers underwent cesarean section to deliver their babies and only 121 (6.6%) of the mothers who gave birth vaginaly had perineal laceration. (Table 2)

Table 2. Obstetrics characteristics and adverse maternal outcome among women who gave birth in Hiwot Fana and Dilchora hospitals during June 2016 to April 2017.

Variables	Number (N=1834)	Percent
Family history of DM		
Yes	1776	96.8
No	58	3.2

Gravidity		
Primigravida	539	29.4
Multigravidas	1295	70.6
Parity		
Primipara	659	35.9
Multipara	1023	55.8
Grand multipara	151	8.2
Body Mass Index (BMI)		
Under Weight	426	23.2
Normal	1162	63.4
Over weight	242	13.2
Obese	4	0.2
Ante partum Hemorrhage (APH)	1727	94.2
Yes	107	5.8
No		
Preeclampsia		
Yes	169	9.2
No	1665	90.8
Polyhydramnios		
Yes	81	4.4
No	1753	95.6
Induction		
Yes	146	8.0
No	1688	92.0
Augmentation		
Yes	128	7.0
No	1706	93.0
Premature Rupture of Membrane (PROM)		
Yes	234	12.8
No	1600	87.2
Caesarean section		
Yes	410	22.4
No	1424	77.6
Perineal laceration		
Yes	121	6.6
No	1713	93.4

Neonatal Adverse Outcomes

The proportion of preterm and macrosomic babies were 140 (7.6%) and 88(4.8%) respectively. The proportion of malpresentation in this study was 250(13.6%). The proportion of congenital anomaly and still birth were 55(3%) and 59(3.2%), respectively. Figure (1).

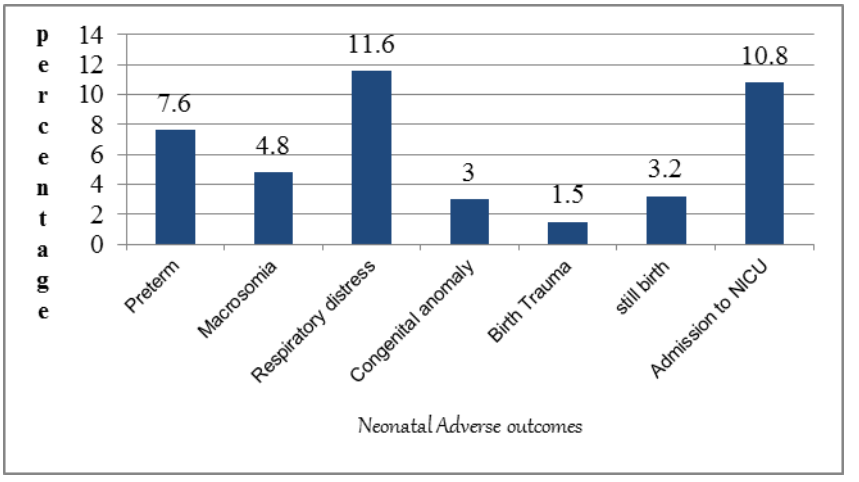

Figure 1. Adverse neonatal outcomes among mothers delivered in Hiwot Fana and Dilchora Hospitals during June 2016 to April 2017 G.C.

Association of Gestational Diabetes Mellitus with Maternal and Neonatal Adverse Outcomes

Adverse Maternal Outcomes among Mothers with Gestational Diabetes

In this study, we found that preeclampsia among mothers with gestational diabetes is more common than those who were not with GDM. The odd of preeclampsia was 3.4 times more likely among mothers with GDM, AOR = 3.44[95% CI = 1.69-6.97]. In this study, we found that age was also independent predictor of preeclampsia. The mothers whose age was less than 18 years old develop preeclampsia 2.8 times more likely than those whose age were between 19 to 29 years with AOR = 2.83[95%, CI = 1.51-5.30]. (Table 3)

Table 3. Bivariate and multivariate logistic regression analysis showing relation between preeclampsia and selected variables of women who gave birth in Hiwot fana and Dilchora hospitals during June 2016 to April 2017.

Variables	Preeclampsia		COR [95% CI]	AOR[95% CI]
	No (%)	Yes (%)		
Age				
<18	86 (84.3%)	16 (15.7%)	2.13[1.21-3.77]	2.83[1.51-5.30]
≥35	386 (88.7%)	49 (11.3%)	1.47[0.79-2.70]	1.24[0.85-1.79]
19-29	1193 (92.0%)	104 (8.0%)	1	1
Gravidity				
Primigravida	498 (92.4%)	41(7.6%)	1	1
Multigravidas	1167 (90.1%)	128 (9.9%)	1.33[0.92-1.92]	0.78[0.33-1.85]
Gestational Diabetes				

No	1631	156 (8.7%)	1	1
Yes	(91.3%)	13 (27.7%)	3.99[2.07-	3.44[1.69-
	34 (72.3%)		7.73]	6.97]
Parity				
Primipara	611 (92.7%)	48 (7.3%)	1	1
Multipara	1053	121	1.46[1.03-	2.01[0.9-
	(89.7%)	(10.3%)	2.07]	4.49]
Body Mass Index (BMI)				
Normal	1453	135 (8.5%)	1	1
Over weight	(91.5%)	34 (13.8%)	1.73[1.15-	1.45[0.94-
	212 (86.2%)		2.58]	2.23]

Premature rupture of membrane found to be was more common among gestational diabetic mothers than non-gestational diabetic mothers. The odd of PROM was 4.15 times more likely among gestational diabetes with AOR = 4.15[95% CI = 2.16-7.95]. (Table 4)

Table 4. Bivariate and multivariate logistic regression analysis showing relation between PROM and selected variables of women who gave birth in Hiwot fana and Dilchora hospitals during June 2016 to April 2017.

Variables	PROM		COR [95% CI]	AOR[95% CI]
	No (%)	Yes (%)		
Age				
<18	92 (90.2%)	10 (9.8%)	0.73[0.37-	0.89[045-1.8]
≥35	379 (87.1%)	56 (12.9%	1.43]	0.87[0.62-
19-29	1129	168	0.99[0.72-	1.22]
	(87.0%)	(13.0%)	1.37]	1
			1	
Gestational Diabetes				
No	1572	215	1	1
Yes	(88.0%)	(12.0%)	4.96[2.72-	4.15[2.16-
	28 (59.6%)	19 (40.4%)	9.04]	7.95]
Parity				
Primipara	589 (89.4%)	70 (10.6%)	1	1
Multipara	1010	164	1.37[1.01-	1.37[0.99-
	(86.0%)	(14.0%)	1.84]	1.89]
Body Mass Index (BMI)				
Normal	1395	193	1	1
Over weight	(87.8%)	(12.2%)	1.45[1.0-2.08]	1.07[0.71-
	205 (83.3%)	41 (16.7%)		1.6]
Polyhydramnios				
No	1540	213	1	1
Yes	(87.8%)	(12.2%)	2.53[1.51-	1.97[1.14-
	60 (74.1%)	21 (25.9%)	4.24]	3.4]

The Neonatal Outcome of Mothers with Gestational Diabetes on Adverse Neonatal Outcome

In this study, we found that macrosomia is the one of the outcome of gestational diabetes. Those babies born from mothers with gestational diabetes become macrosomic 5.7 times more likely than those babies born from mothers who were normal, AOR = 5.66[95% CI = 2.76-11.54]. The body mass index of mothers was also independent predictor of macrosomia. The odd of macrosomia was 3.5 times more likely among overweight women with AOR = 3.45[95% CI = 2.11-5.63]. (Table 5)

Table 5. Bivariate and multivariate logistic regression analysis showing relation between Macrosomia and selected variables of women who gave birth in Hiwot fana and Dilchora hospitals during June 2016 to April 2017.

Variables	Macrosomia		COR [95% CI]	AOR[95% CI]
	No (%)	Yes (%)		
Age				
<18	100 (98.0%)	2 (2.0%)	0.44[0.1-1.8]	0.47[0.11-2.05]
≥35	406 (93.3%)	29 (6.7%)	1.55[0.98-2.46]	1.53[0.92-2.53]
19-29	1240 (95.6%)	57 (4.4%)	1	1
Gestational Diabetes				
No	1714 (95.9%)	73 (4.1%)	1	1
Yes	32 (68.1%)	15 (31.9%)	11[5.71-21.2]	5.66[2.76-11.54]
Parity				
Primipara	629 (95.4%)	30 (4.6%)	1	1
Multipara	1116 (95.1%)	58 (4.9%)	1.1[0.69-1.71]	0.87[0.53-1.44]
Body Mass Index (BMI)				
Normal	1535 (96.7%)	53 (3.3%)	1	1
Over weight	211 (85.8%)	35 (14.2%)	4.8[3.06-7.54]	3.45[2.11-5.63]

In this study, we found that gravidity, parity, family history of diabetes and body mass index were significantly associated with gestational diabetes. Multigravidas develop gestational diabetes 1.45 times more likely than Primigravida with AOR = 1.45 [95% CI = 0.77-13.13]. In this study, we found that being multigravidas (delivering two and more) reduces the risk of gestational diabetes. The odd of gestational diabetes was less likely among multiparous with AOR = 0.38[95% CI = 0.15-1.00].The odd of gestational diabetes was 12.8 more likely among women who had family history of diabetes with AOR =12.8[95% CI =5.96-27.76]. Overweight mothers develop gestational diabetes 9.9 times more likely than mothers who had normal body weight with AOR = 9.9[95% CI = 5.15-19.1]. (Table 6).

Table 6. Bivariate and multivariate logistic regression analysis showing relation between gestational diabetes and selected variables of women who gave birth in Hiwot fana and Dilchora hospitals during June 2016 to April 2017.

Variables	Gestational diabetes mellitus		COR [95% CI]	AOR[95% CI]
	No (%)	Yes (%)		
Age				
< 30	1367 (97.7%)	32 (2.3%)	1	1
≥ 30	420 (96.6%)	15 (3.4%)	1.52[0.82-2.86]	1.39[0.68-2.89]
Parity				
Primipara	644 (97.7%)	15 (2.3%)	1	1
Multipara	1142 (97.3%)	32 (2.7%)	1.2[0.65-2.24]	0.38[0.15-1.00]
Family history of DM				
No	1745 (98.3%)	31 (1.7%)	1	1
Yes	42 (72.4%)	16 (27.6%)	21.4[10.9-42.18]	12.8[5.96-27.76]
Body Mass Index (BMI)				
Normal	1572 (99.0%)	16 (1%)	1	1
Over weight	215 (87.4%)	31 (12.6%)	14.2[7.62-26.33]	9.91[5.15-19.1]

4. Discussions

This study assessed the maternal and neonatal outcomes among mothers with gestational diabetes and associated factors in Hiwot Fana and Dilchora hospitals, Eastern Ethiopia. The major maternal adverse outcomes considered in this study were those that have an association with gestational diabetes in different literatures.

In the current study, prevalence of ante partum hemorrhage is 5.8% which is in line with study done in Jimma Ethiopia where the prevalence of APH was 5.1 percent; however, it was greater than what was reported from Nigeria (3.5%). The difference could be the difference in the study population and time (Chufamo et al. 2015), (Adegbola & Okunowo 2010).

It is well known that preeclampsia is one of the major causes of maternal mortality and in this study the prevalence of preeclampsia is 9.2 percent. This finding is higher than the study done in North (8.5%) and South (2.23%) Ethiopia (Tessema et al. 2015), (Vata et al. 2015). The difference might be due to the difference in study subjects and setting.

In the current study, 12.8% of mothers had premature rupture of membrane which is similar with study done in Sweden (12.9%) (Ladfors et al. 2000). These days, different studies are reporting that the prevalence of C/S is increasing. Currently, 18.6% of all births occur by CS, ranging from 6% to 27.2% in the least and most developed regions, respectively (Betrán et al. 2016). 22.4 percent of mothers in this study gave birth by C/S

which is almost in line with what was reported from study done in Addis Ababa (19.2%) (Bayou et al. 2016). In the current study, the proportion of women who had second degree tear and above was 6.6% which is less than what was reported from Taiwan (10.9%). This might be due to the difference in study population and area (Hsieh et al. 2014).

In our study, 4.8% of babies were macrosomic which is less than the prevalence of macrosomia reported from Iran (9%). This difference could be due to the difference in study population and place. However, our finding is in line with the study conducted in Northern Ethiopia (6.68%) (Najafian & Cheraghi 2012),(Mengesha et al. 2017).

The prevalence of preterm delivery in this study was 7.6%, which is in line with the findings of the study done in Iran (5.1%) but slightly less than what was reported from southwestern Nigerian (15.4%) (Alijahan et al. 2014), (Oluwafemi & Abiodun 2016).

In this study the proportion of women with gestational diabetes was 2.6% which was in line with the study done in Northern Ethiopia which was 3.7% (Seyoum et al. 1999). However, it is comparatively higher than the study done in Tikur Anbesa hospital, Ethiopia(0.38%) (Getu et al. 2009). This difference might be due to the difference in study design and study period. On the other hand the proportion of women with GDM in this study was lower than the study done in Qatar which was 16.3% (Bener et al. 2011). This difference could be due to the difference in the study population.

In the current study preeclampsia was found to be the adverse maternal outcomes among mothers with gestational diabetes. This study revealed that the mothers with gestational diabetes were 3.44 times more likely to develop preeclampsia than women who did not develop gestational diabetes. This finding was supported by the study done in Saudi Arabia, Qatar and Addis Ababa Where the incidence of preeclampsia was higher among mothers with GDM than nondiabetic mothers (Gasim 2012), (Bener et al. 2011), (Getu et al. 2009).

According to this study, premature rupture of membrane was also found to be one of the adverse maternal outcomes of mothers who have an association with gestational diabetes. The current study showed that the mothers diagnosed with gestational diabetes were 4.15 times more likely to develop premature rapture of membrane than the normal mothers. This study was in line with study done in India where PROM was the most common complication of labor (OR = 1.66, P = 0.04) (Mamta & Sarma 2012).

In our study, parity was significantly associated with gestational diabetes. Multigravidas develop gestational diabetes more likely than Primigravida. This finding is similar with the report from systemic review in Iran, where parity was among the factors affecting gestational diabetes (Jafari-Shobeiri et al. 2015). In the current study, we found that body mass index is significantly associated with diabetes mellitus. This finding is similar with the study done in Italy where pre pregnancy BMI were significantly correlate with GDM diagnosis (Di Cianni et al. 2003).

Our study revealed that family history of GDM is strongly associated with GDM diagnosis. Those who had family history of GDM had 12.8 times more likely to develop GDM than those who had no family history of GDM. This finding is supported by what

was reported from Yemen where the family history of diabetes was the independent risk factor for developing GDM among study participants (Ali et al. 2016).

5. Conclusion

This study assessed the maternal and neonatal adverse outcomes and its association with GDM and risk factors associated with gestational diabetes mellitus.

In our study, we found that the Preeclampsia, PROM, more than recommended CS delivery and perineal laceration were the common adverse maternal outcome among mothers delivered in Hiwot Fana and Dilchora hospitals.

Malpresentation and preterm were the main adverse neonatal outcome among Hiwot Fana and Dilchora hospitals.

Preeclampsia, PROM and Macrosomia were more common among mothers with gestational diabetes than mothers who had no gestational diabetes and found to have significant association with the diagnosis of gestational diabetes.

Family history of diabetes mellitus, Pre- pregnancy BMI and parity were found to be the independent risk factors of gestational diabetes.

6. Recommendation

Providing necessary equipment, strictly following the checklist and counseling women with GDM

7. Acknowledgements

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15. Prevalence and Determinants of Common Mental Illness among Adult Residents of Harari Regional State, Eastern Ethiopia

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Abstract: Common mental disorders, which include depression, anxiety and somatoform disorders make a significant contribution to the burden of disease and represent a psychiatric morbidity with significant prevalence, affecting individuals in different age groups and cause suffering to the individuals, their family and communities. Despite this fact, little information about the prevalence of common mental illness is available from low and middle-income countries including Ethiopia. Comparative cross-sectional, quantitative community-based survey was conducted From February 1, 2016 to March 30, 2016 in Harari Regional State using multi-stage sampling technique. A total of 968 residents were selected using two stage sampling technique. Of this, 901 were participated in the study. Validated and Pretested Self reported questionnaire (SQR_20) was used to determine the maginitude of common mental disorders. Data were entered and analyzed using Epi-info version 3.5.1 and SPSS-17 for windows statistical packages. Univirate, Bi-variate and multivariate logistic regression analysis with 95% CI was employed in order to infer associations. The prevalence of common mental illnesses among adults in our study area was 14.9%. The most common neurotic symptoms in this study were often head ache (23.2%), sleep badly (16%) and poor appetite (13.8%). Substance use like Khat (48.2%), tobacco (38.2%) and alcohol (10.5%) were highly prevalent health problems among study participants. In multivariate logistic regression analysis, respondents age between 25 – 34 years, 35 – 44 years, 45 – 54 years and above 55years were 6.4 times (AOR 6.377; 95% CI: 2.280– 17.835), 5.9 times (AOR 5.900; 95% CI: 2.243– 14.859), 5.6 times (AOR 5.648; 95% CI: 2.200– 14.50) and 4.1 times (AOR 4.110; 95% CI: 1.363– 12.393) more likely having common mental illnesses than those age between 15- 24years, respectively. The occurrence of common mental illness was twice (AOR: 2.162;95% CI 1.254 - 3.728) higher among respondents earn less than the average monthly income than those earn more than average monthly income. The odds of developing common mental illnesses were 6.6 times (AOR 6.653; 95% CI: 1.640– 26.992) higher among adults with medically confirmed physical disability than those

without physical disability. Similarly, adults who chewed Khat were 2.3 times (AOR 2.305; 95% CI: 1.484– 3.579) more likely having common mental illnesses than those who did not chew Khat. Adults with emotional stress were twice (AOR 2.063; 95% CI: 1.176– 3.619) higher chance to have common mental illnesses than adults without emotional stress. This study revealed that common mental disorders are major public health problems. Advancing age, low average family monthly income, Khat chewing, having medically confirmed physical disability, and emotional stress were independent predictors of common mental illnesses. Whereas sex, place of residence, educational status, marital status, occupation, family size, financial stress, taking alcohol, tobacco use, and family history of mental illnesses were not statistically associated with common mental illnesses.

1. Introduction

Common mental disorders (CMDs), which include depression, anxiety and somatoform disorders make a significant contribution to the burden of disease [Goldberg & Huxley1972,Lazarus R & Freeman M 2009] and represent a psychiatric morbidity with significant prevalence, affecting individuals in different age groups, cause suffering to the individuals, their family and communities [Saulo et al 2010].

The WHO estimates that about 450 million people worldwide suffer from neuropsychiatric conditions (WHO, 2001). Mental and behavioural disorders are found in all countries, in women and men at all stages of life, among the rich and poor and among rural and urban people. Worldwide it is estimated that lifetime prevalence ranges from 12.2–48.6% and 12-month prevalence between 8.4 and 29.1% (WHO, 2008).

The burden of chronic noncommunicable disease is emerging as a major public health challenge worldwide, especially in developing countries where these diseases have been assumed to be less common (Abula &Worku 2000). Five of the ten leading causes of disability and premature death worldwide are related with psychiatric conditions. About 25% of the world's population develop mental illness at some stage in their lives. In low-income countries, mental disorders contribute 12% to the Global Burden of disease as compared to 8.1% in the developed world (David et al2006).

At least 40 million people in the world suffer from severe forms of mental disorders such as schizophrenia and dementia 200 million are incapacitated by less severe mental and neurological disorders such as neuroses and peripheral neuropathy (Cramer JA & Rosenheck 1998). At least one in four people are affected by a mental health problem at some point in their lives (Golin & Liu 2002).

Mental illness comprised 13% of the total global burden of disease in 2000 – a figure that is expected to rise to 15% by the year 2020. Depression is the third leading cause of disease burden worldwide; representing 4.3% of total disability adjusted life years, and predicted to become the second leading cause of the global disease burden by the year 2020. Furthermore, depression is currently the leading cause of non-fatal burden when considering all mental and physical illnesses, accounting for approximately 10% of total

years lived with disability (YLD) in Low and Middle Income Countries (LMIC) *(FMOH, 2012)*. Mental illness is a public health problem in developed as well as developing countries (WHO, 2001). The global burden of disease report revealed that neuropsychiatric conditions such as depression, anxiety and somatoform disorders account for 9.8% of the global burden of diseases and accounted for up to a quarter of all the disability-adjusted life years lost inLMICs (Desjaralais ,1995,Lopez &Mathers 2006).

The Global Burden of Disease study provided international statistics the burden of these disorders throughout the world (T Bedirhan Ustun et al 1999). They affect about 25% of all people in their lifetime, with about equal prevalence in men and women (WHO,2001, Almeida-Filho et al 1997). Though usually non-fatal, mental and neurological disorders are highly disabling. Apart from affecting multiple domains of functioning, these disorders start early in life and often go untreated. When treatment is given, it often is inadequate (Gureje et al 1995).

More recent studies, have suggested that the burden of psychiatric morbidity existing in Africa is very similar to that prevailing in Western countries. In Ethiopia, where malnutrition and preventable infectious diseases are very common, mental health problems which are regarded as non life-threatening problems are not given due attention. However, mental health problems accounts for 12.45% of the burden of diseases in Ethiopia and 12% of the Ethiopian people are suffering from some form of mental health problems of which, 2% severe cases (Uznanski et al 1997,Okasha & Karam 1998).The burden is worse when the person who is mentally ill is the chief source of income for the family (Uznanski et al 1997,Abdulahiet al 2001). Even though it causes this much problem, modern mental health services are profoundly inadequate in Africa. In the regions of Ethiopia, mental health services are provided by psychiatric nurses. Patients usually come to medical services having tried the available local means (O. Gureje and A.Alem.2000).

In low -income countries where malnutrition and preventable infectious diseases are common, mental disorders which are regarded as nonlife-threatening problems are not given due attention. However, it is a well-known fact mental illness leads to poverty, malnutrition, infection and disability, consequently to the increased risk for mortality [Patel V, 2007].

In Ethiopia, mental illness is the leading non-communicable disorder in terms of burden. Indeed, in a predominantly rural area of Ethiopia, mental illness comprised 11% of the total burden of disease, with schizophrenia and depression included in the top ten most burdensome conditions, out-ranking HIV/AIDS. These startling statistics show that mental illnesses have been overlooked as a major health priority in Ethiopia and other LMICs, and underscore the need for public health programs targeting mental illnesses (FMOH, 2012)

The absence or lack of information about the mental health status of populations is a factor that contributes to poor or inexistent mental health care, both in terms of the offer of services and development of policies on health protection and promotion.

The abovementioned information indicates the existence of limited study on the prevalence and factors associated with common mental illness among developing countries. To the knowledge of the present researchers there is no study done on this topic in Ethiopia. Currently no published study is available on community based common mental disorders in Harari Region. Therefore, the present researchers believe that this problem which affects the living condition of the society is really a gap that needs to be addressed. This study is, therefore, intended to determine the magnitude of common mental disorders and its associated factors among residents of Harari Region. In developing country, despite the high prevalence and burden of common mental disorders, mental health care services remain underdeveloped. The absence or lack of information about the mental health status of populations is a factor that contributes to poor or inexistent mental health care, both in terms of the offer of services and development of policies on mental health protection and promotion. Therefore, the result of this study helps Harari regional state health bureaus, woreda health bureaus, hospitals, health centers, and healthposts. Addtionally the ministry of health (MOH), and WHO can use this finding becauseas input for mental health planning. Therefore, the objective of this study was to assess the prevalence and determinants of common mental illnesses among adult residents of Harari Region, Eastern Ethiopia;

2. Materials and Methods

Study area

The study was conducted in Harari People Regional State. The region is one of the nine regions in the country; it is located in the eastern part of Ethiopia. Harar, the capital city of the region, is located on a hill top to the eastern extension of the Ethiopian highlands, about 510 Km away from Addis Ababa. Its altitudes range from 1800 to 2000 meters. The region situated on the area of 342.2 km^2 in which the rural area constitutes 323.7 km^2 while the urban area has about 19.1 km^2 only. It is the smallest region in Ethiopia and surrounded by different districts of Oromia Region, namely Kombolcha and Jarso in Northern side, Gursum and Babile in Northeast, Fedis in south east and Haramaya in the West side. Harar also lies within fertile coffee growing districts and agricultural fields, producing various products particularly chat, fruits/ vegetables, and several kinds of grains (HPRS, 2011).

Based on MOH, Health and Health Related Indicator, the total population of the region is estimated to be 203,834 in 2003 EC, and this makes Harari Region least populous region in the country. About 54% of the population lives in the urban area while the remaining 46% live in rural area. The general level of education has marked influence on the spread of diseases, the acceptability of health practices and utilization of modern health services. In the region, 41% of the population is literate. The people of Harari region earn their livelihood from trade, agriculture and employment by government and the private sector (CSA, 2007).

According to the currently adopted administrative structure, Harari Region is divided in to six urban and three rural administrative districts. These administrative districts are further divided in to 19 kebeles (in urban area) and 17 peasant association (in rural

areas). In the current system, the district is responsible for management of Primary Health Care Unit (Health centre and Health post), while the management of hospitals and training institution are under the RHB. The RHB is organized in to different departments and services, each with specific roles and responsibilities. At district level, there is one health coordinator and two experts. At the health post, level there is one nurse and two female HEWs. With regard to the number of facilities, the region has relatively a higher degree of Health Service Coverage (100%) as compared to the national level (HPRS,2011).

Study Design and Period

This comparative cross-sectional, community- based survey was carried out among adults in five randomly selected woredas using multi-stage sampling technique. This study was conducted from February to March, 2016 (Data collection time).

Population

Source population: All adult population of urban and rural in Harari regional state were the source population.

Study population: All adult population in the selected urban kebeles and rural kebeles of Harari regional state were the study population.

Sample population: All adult population in the selected households were the sample population.

Inclusion and Exclusion Criteria

Inclusion Criteria

- ✓ Age greater than or equal to 18 years old.
- ✓ Lived in the place at for least six months.
- ✓ Should be member of the selected house hold.

Exclusion Criteria

- ✓ Unable to communicate properly.
- ✓ Terminally ill person.

Sample Size Determination

The sample size had been determined by considering the study which was conducted in Oyo state of Nigeria (Amoran et al, 2005). The proportion of the psychiatric morbidities among urban and rural area were 18.4% and 28.4%, respectively. With a precision of 95% and the desired power of 80%, the total sample size was calculated from the following formula which is used for comparing two proportions:

$$n_1 = n_2 = \frac{\left[Z_{\frac{\alpha}{2}}\sqrt{2\bar{p}\bar{q}} + Z_{\beta}\sqrt{p_1 q_1 + p_2 q_2}\right]^2}{(p_1 - p_2)^2}$$

- ✓ Where: n_1 = Sample size in the urban group; n_2 = Sample size in the rural group
- ✓ Z_{β} = the desired power: 80% power => .84
- ✓ $Z_{\alpha/2}$ = the desired level of statistical significance: 95 => 1.96
- ✓ P_1= 0.184; proportion among urban; P_2= 0.284; proportion among rural
- ✓ $\bar{p} = \frac{p_1+p_2}{2}$ = 0.234; measure of variability

$$n_1=n_2=\frac{[1.96(0.599)+0.84(0.594)]^2}{(0.184-0.}$$ = 282

By considering 15 % loss to follow-up and design effect of 1.5, the final sample size for each of urban and rural area were 484 (a total of 968 households were included in the study)

Sampling Procedure

Multistage sampling technique was used to obtain a representative sample of the communities in Harari regional state. The communities where the study carried out was choosen as follows:

Stage 1: A sampling frame of all the woredas in Harari regional state was drawn and stratified into urban and rural areas. Two rural and three urban woredas were obtained by simple random sampling. According to this, Aboker, Amin Nur and Hakim woredas from urban and Erer & Sofi woredas from rural local government areas were selected.

Stage 2: Sampling frame of all the kebeles in the selected woredas were drawn. The kebeles where the study carried out were randomly selected by simple random sampling. The selected kebeles were kebele 02 and 03 from Amin woreda; kebele12 from Aboker woreda; kebele 18 from Hakim woreda; Hawaye from Erer woreda;and Awuberkele and Burka from Sofi woreda.

Stage 3: The total number of households in kebele 02 was 1084, in kebele 03 was 466, in kebele 12 was 1752, in kebele 18 was 1930, in Hawaye kebele was 1130 and in Awuberkele kebele was 1450 & Burka kebele was 1104. Based on proportionate allocation to size, the number of households selected in each kebele were determined. Accordingly, the number of houses selected were 188 in kebele 02; 80 in kebele 03; 303 in kebele 12; 333 in kebele 18; 139 in Hawaye kebele, 178 in Awuberkele kebele; and 135in Burka kebele.

Stage 4: Systematic sampling technique was employed to select the houses that were visited in the chosen communities. The sample fraction was three households in kebele 02, kebele 03,kebele 12 & kebele 18,and 4 households in Hawaye, Awuberkele & Burka kebeles. One resident aged 18 years and above selected by lottery methodsand was interviewed in the households selected. A total of 968 household were recruited into the study.

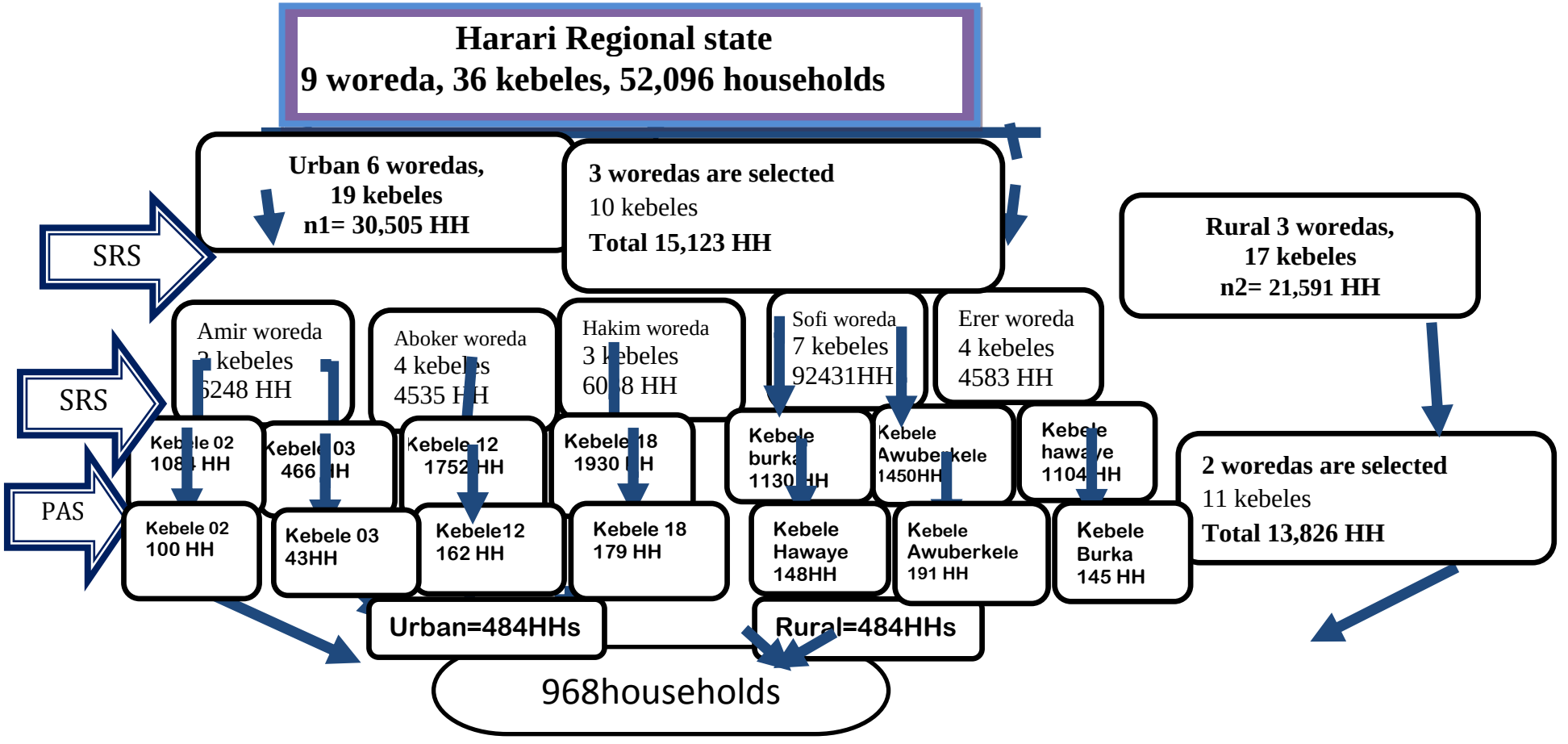

Fig 1. Schematic presentation of sampling procedure, SRS: Simple random Sampling; PAS: Proportional Allocation to Size

Study Variables

Dependent Variables

- ✓ Common Mental disorder

Independent Variables

- ✓ Socio demographic & economic characteristics-age, sex, religion, marital status, ethnicity, employment, education, income, housing, resident, occupation
- ✓ Family history of illness
- ✓ Substance use history
- ✓ Co morbid medical illness
- ✓ Stressful life events

Data Collection Instrument

The data were collected by using a self-reported questionnaire-20 (SRQ-20) which is developed by the World Health Organization (WHO) as a screening tool for common mental disorders. Originally SRQ-20 consists of 25 questions; 20 related to neurotic symptoms, 4 concerning psychosis and 1 asking about convulsions. This study concentrates on the SRQ-20, which (consists of 20 yes/no questions) assesses presence of neurotic symptoms (anxiety, depression, psychosomatic). Mental illness will be measured using the locally validated Self-Reported Questionnaire (score of ≥ six indicating high levels of CMD). The SRQ has previously been translated into Amharic and validated in Ethiopia, and it has been used for community surveys**.**

It is reviewed to suit the local condition and translated to Amharic and Afan Oromo languages and then back to English to ensure its consistency. The survey questionnaire was pre-tested in two randomly selected kebeles (one from urban and one from rural) which was not be involved in the actual data collection and the necessary modifications and correction was made to ensure its consistency. Using the questionnaire, data were collected by twenty (20) trained HEW with experience in data collection and fluent speakers of afanoromoand Amharic languages. The interview was made by house-to-house visit in the presence of strong supervision.

Data Quality Control

To assure the data quality high emphasis was given in designing data collection instrument. The questionnaire was pre tested on 10% of the sample size in two randomly selected kebeles (one from urban and one from rural) which were not involved in the actual data collection to check consistency and length of time each questioners took, sampling method and techniques, as well as the skill of data collectors two weeks prior to the main data collection time. Training was provided for data collectors and supervisors on the objective of the study, the source of bias, method of data collection. Before data collection, the questioner it's the simplicity, clarity and understandability of the questionnaire was checked. Checking and re-checking of the

data were employed to identify whether the data were completely filled or not by double data entry. Daily supervision of data collection process was implemented. To assess the consistency, 25% of the collected data were checked in a daily based.

Data Analysis Procedures

First, the collected data was entered in to Epi Info version 3.5.1 then exported to SPSS ver.20 software package. The entered datawere cleaned, edited, coded and recoded.

Bi-variate and multivariate logistic regression analysis with 95% confidence interval were employed in order to infer associations and predictions. Initially, each variable was entered into a logistic regression model to determine presence of statistical significant association between independent variables and the dependent variable.

Logistic regression model was used to identify independently associated factors. All independent variables that which were associated with the dependent variable in bivariate analyses with a P-value of $\leq$ 0.05 were included in the final logistic model.

Ethical Considerations

Ethical approval and clearance was obtained from the Haramaya University, College of Health and Medical Science IHRERC. An official letter of co-operation was written to Harari Rgion Heal Bureaus in addition to personal communications by the investigators.The objective and purpose of the study was informed to the sample population in order to give genuine information. Based on the written and signed informed consent participants were informed that they have the right to withdraw or refuse to participate in the study at any time. A letter explaining the need for and benefit of the study, the method of questing, confidentiality, and privacy was attached to the cover page of the questioner. A person with characteristics of mental illness was defined as a cut-off point greater than or equal to 6 during SRQ-20 screening wichthen approved by investegators andhad not on treatment were immediately communicated to the psychiatric clinic in order to facilitate the way the person obtain farther investigation and proper management by his/ her own expense.If in case the participant can't pay the medical cost, investigators covered the cost of treatment.

Operational Definitions

- ✓ Adult: an adult is someone whose age is greater than 18 years, who-*acceptsresponsibility, makes independent decisions,*able to differentiate between rational decision making and emotional impulse*, Understanding* that open communication is the key to progression and*becomes financially independent (UNICEF definition of adult).*
- ✓ Common mental disorders include non-psychotic depressive, anxiety, and somatoform disorders
- ✓ A probable case of Mental illness (caseness) in this study is defined as a cut-off point greater than or equal to 6 during SRQ-20 screening.
- ✓ None case of mental illness (none caseness) in this study is defined as a cut-off point less than 6 during SRQ-20 screening.

- ✓ Substance use disorders is a cut of point greater than or equal to two during CAGE screening

Stressful life events; It includes

1. Emotional stress: If a very sick family member had to go into the hospital or someone close to the respondent died.
2. Financial stress: If his/her family lost job, he/she lost her job, or she/he had Experience hunger due to lack of money.

3. Result

Socio demographic Characteristics of Respondents

A total of 901 adults were participated in this study and that made response rate 93.1%. Out of the total number of respondents, 558 (61.9%) were male. The age of the respondents was ranged from 18 years to 83 years with mean (±SD) of 34.04 ±9.31 years. The majority of participants 475(52.7%) were age between 25-34 years followed by age15 – 24 years which accounted 20.9%. Four hundred fifty-six (50.6%) were rural, the rest were urban dwellers. Regarding their marital status, about two third (68.3%) of participants were married. Most of the respondents were Muslim (80.4%) by their religion followed by orthodox Christian (17.6%). Educational level of the respondents comprises from unable to read and write to 12 plus being dominated by primary school 270 (30%) and secondary school and 241 (26.7%). About 2/3(67.4%) of the respondents were Oromo by ethnicity, followed by Amhara (16.0%) and Harari (6.2%). Occupationally, 378 (42%) were farmer, 167(18.5%) were Government employees and 123(13.7%) were merchants.

The respondent's average monthly income was ranging from zero to 3000 Ethiopian Birr with median and mean (±SD) monthly income of 600 (IQR 742.2) and 831.89±643.22 Birr, respectively. About one-third (33.6%) of respondents had monthly income between 401 – 800 birr & 28.6% had monthly income less than 400 Ethiopian Birr. The family size of respondents was ranging from 1 to 12 with mean (±SD) of 3.96 ± 2.13. Majority 482 (53.5%) of respondents were living within family of 3 - 5 members followed by respondents of 1 – 2 family size which accounted 26.3% (table 1)

Table 1. Socio- demographic characteristics of respondents ofcommon mental illnesses among adult residents of Harari Region, Eastern Ethiopia; March, 2016.

	Variables	Frequency	Percent
Sex	Male	558	61.9%
	Female	343	38.1%
	15-24	188	20.9%
Age	25-34	475	52.7%
	35-44	164	18.2%
	45-54	47	5.2%
	55+	27	3.0%
Residence	Urban	445	49.4%

	Rural	456	50.6%
Marital status	Single	149	16.5%
	Married	615	68.3%
	Divorced	55	6.1%
	Widowed	68	7.5%
	Separated	14	1.6%
Religion	Muslim	724	80.4%
	Orthodox	159	17.6%
	Other	18	2.0%
Educational status	Unable to read and write	185	20.5%
	Able to read and write only	138	15.3%
	Primary (grade 1-8)	270	30.0%
	Secondary (grade 9-12)	241	26.7%
	12 + grade	67	7.4%
	Oromo	607	67.4%
Ethnicity	Amhara	144	16.0%
	Harari	56	6.2%
	Somali	29	3.2%
	Gurage	41	4.6%
	Other	24	2.6%
Average Monthly income	<400 birr	258	28.6%
	401-800 birr	303	33.6%
	801-1500 birr	181	20.1%
	>1501 birr	159	17.6%
Occupational status	Farmer	378	42.0%
	Merchant	123	13.7%
	Gov't Employed	167	18.5%
	private employed	56	6.2%
	Student	62	6.9%
	Daily laborer	105	11.7%
	Other	10	1.1%
Family size	1-2	237	26.3%
	3-5	482	53.5%
	6+	182	20.2%

Assessment of Common Mental Illnesses

A locally validated self-reported questionnaire-20 (SRQ-20) was used as screening tool to assess presence of common mental disorders among respondents. This SRQ-20 consists of 20 yes/no questions which can assess of neurotic symptoms (anxiety, depression, psychosomatic). Each yes/no response of each respondent was first summing up. Finally, those respondents who scored more than or equal to six were categorized as having common mental illness and those scored less than 6 categorized as free from common mental illness.

The respondents' score of those neurotic symptoms ranged from 0 to 20. More than half (57.9%) of the respondents reported that they did not have any of those symptoms while 11 (1.2%) reported they had all of neurotic symptoms.

In this study, 134 participants responded as having ≥ six neurotic symptoms, that made the prevalence of common mental illnesses 14.9% (Table 2).

Table 2. Prevalence of Common Mental Disorders among adult living in Harari Regional state, Eastern Ethiopia; March, 2016.

No	Common Mental illness status	Frequency	Percent
	Have common mental illness	134	14.9
	No common mental illness	767	85.1
	Total	901	100.0
	Score of SRQ-20		
	None (0)	522	57.9
	1 - 5.9	245	27.2
	6 – 20	134	14.9
	Total	901	100.0

The most common neurotic symptoms in this study were often head ache (23.2%), sleep badly (16%) and poor appetite (13.8%). In contrary, the least complained symptoms were uncomfortable feeling in the stomach (7.8%), easily freighted (10%) and having shaking hands (10%) (Table 3).

Table 3. Self-reported neurotic symptoms distribution of adults living in Harari Region state, Eastern Ethiopia; March, 2016.

Q. No.	Self-reported neurotic symptoms		Frequency	Percent
1.	Often have head ache	Yes	209	23.2
		No	692	76.8
2.	Have poor appetite	Yes	124	13.8
		No	777	86.2
3.	Sleep badly	Yes	144	16.0
		No	757	84.0
4.	Easily frightened	Yes	90	10.0
		No	811	90.0
5	Have shaking hands	Yes	90	10.0
		No	811	90.0
6	Feel nervous, tens or worried	Yes	116	12.9
		No	785	87.1
7	Have poor digestion	Yes	116	12.9
		No	785	87.1
8	Have trouble thinking clearly	Yes	102	11.3
		No	799	88.7
9	Being unhappy	Yes	114	12.7
		No	787	87.3
10	Cry more than usual	Yes	103	11.4
		No	798	88.6
11	Find difficult to enjoy your daily activities	Yes	105	11.7
		No	796	88.3
12	Find difficult in decision making in	Yes	106	11.8

	day to day life	No	795	88.2
13	Daily work suffering	Yes	107	11.9
		No	794	88.1
14	Unable to play a useful part in life	Yes	106	11.8
		No	795	88.2
15	Lost interest in things	Yes	105	11.7
		No	796	88.3
16	Feeling as worthless person	Yes	94	10.4
		No	807	89.6
17	Thought of ending your life been on your mind	Yes	93	10.3
		No	808	89.7
18	Feeling tired all the time	Yes	110	12.2
		No	791	87.8
19	Uncomfortable feelings in your stomach	Yes	70	7.8
		No	831	92.2
20	Easily tired	Yes	103	11.4
		No	798	88.6

Factors associated with Common Mental Illnesses

Occurrence of stressful life events and substance use

Out of 901 participants of this study, 132 (14.7%) had history of death of someone close to their family, 106 (11.8%) experienced legal issues and 99 (11.0%) were separated from their spouses. Death of someone close to respondent was occurred more commonly among adults with common mental illnesses (11.9%) than adults without common mental illnesses (5.7%)

From those stressful events, the least reported events by the respondents were being violated by other person 5(0.6%), having severely sick, physically abuse or disability close relative (3.2%), loss of job (3.3%). Five (3.7%) of adults with common mental illnesses and 16 (2.1%) of adults without common mental illnesses had family history of mental illnesses. Similarly, 21 (15.7%) of adults with common mental illnesses and 68 (8.9%) of adults without common mental illnesses had emotional stress.

Almost half (48.2%) of respondents were chewing Khat in the last 3 months. In other wards, around two-third (64.2%) of adults with common mental illnesses and 45.4% of adults without common mental illnesses were chewed khats in the last 3months. Similarly, 46.3% of adults with common mental illnesses and 36.8% of adults without common mental illnesses smoke cigarette in the last 3months that madethe prevalence of tobacco use 38.2%. About 8.2% & 11% of adults with common mental illnesses and without common mental illnesses had history of alcohol taking in the last 3 months respectively (Table 4).

Table 4. Stressful life event and substance use history among adults living in Harari Region state, Eastern Ethiopia; March, 2016.

EVENTS WITHIN THE LAST 6 MONTHS		Common mental disorder		Total Frequency (%)
		Yes Frequency (%)	No Frequency (%)	
Experience of sever sickness, physical abuse, or disability	Yes	12(9.0%)	64(8.3%)	76(8.4%)
	No	122(91.0%)	703(91.7%)	825(91.6%)
Death of someone close (father/mother, child) to the respondent	Yes	16 (11.9%)	44 (5.7%)	60 (6.7%)
	No	118(88.1%)	723 (94.3%)	841 (93.3%)
Severely sick, physical abuse, or disability of someone close to respondent	Yes	5(3.7%)	24(3.1%)	29 (3.2%)
	No	129 (96.3%)	743 (96.9%)	872 (96.8%)
Death of someone close to respondent's family	Yes	21 (15.7%)	111(14.5%)	132 (14.7%)
	No	113(84.3%)	656 (85.5%)	769 (85.3%)
Experiencing separation from the spouse	Yes	22 (16.4%)	77 (10.0%)	99 (11.0%)
	No	112 (83.6%)	690 (90.0%)	802 (89.0%)
Experiencing loss of strong relationship or friend-ship	Yes	6 (4.5%)	28(3.7%)	34 (3.8%)
	No	128 (95.5%)	739(96.3%)	867 (96.2%)
Experiencing big problem with close friends	Yes	13 (9.7%)	70 (9.1%)	83 (9.2%)
	No	121(90.3%)	697 (90.9%)	818 (90.8%)
Experiencing big problem due to lack of money	Yes	16 (11.9%)	70 (9.1%)	86 (9.5%)
	No	118 (88.1%)	697 (90.9%)	815 (90.5%)
Lost of valuable property	Yes	5 (3.7%)	29 (3.8%)	34 (3.8%)
	No	129 (96.3%)	738 (96.2%)	867 (96.2%)
Experiencing any legal issues	Yes	20(14.9%)	86(11.2%)	106(11.8%)
	No	114(85.1%)	681(88.8%)	795(88.2%)
Lost of job	Yes	5 (3.7%)	25 (3.3%)	30 (3.3%)
	No	129 (96.3%)	742 (96.7%)	871 (96.7%)
Violated by other person	Yes	2 (1.5%)	3 (0.4%)	5 (0.6%)
	No	132 (98.5%)	764 (99.6%)	896 (99.4%)
Emotional stress	Yes	21(15.7%)	68(8.9%)	89(9.9%)
	No	113(84.3%)	699 (91.1%)	812(90.1%)
Financial stress	Yes	17(12.7%)	80(10.4%)	97(10.8%)
	No	117(87.3%)	687(89.6%)	804(89.2%)
Family history of mental illness of time	Yes	5(3.7%)	16 (2.1%)	21 (2.3%)
	No	129 (96.3%)	751(97.9%)	880(97.7%)
Medically confirmed physical	Yes	4(3.0%)	5 (0.7%)	9(1.0%)

disability of any time	No	130 (97.0%)	762 (99.3%)	892(99.0%)
Taking tobacco for the last 3 months	Yes	62(46.3%)	282 (36.8%)	344 (38.2%)
	No	72 (53.7%)	485 (63.2%)	557 (61.8%)
Taking alcohol for the last 3 month	Yes	11 (8.2%)	84(11.0%)	95(10.5%)
	No	123 (91.8%)	683 (89.0%)	806 (89.5%)
Taking khat for the last 3 months	Yes	86(64.2%)	348(45.4%)	434(48.2%)
	No	48(35.8%)	419(54.6%)	467(51.8%)

Association between common mental illnesses and socio demographic characteristics, stressful life events and substance use

In order to determine the association of common mental illnesses with socio-demographic stressful life events and substance use, both bivariate and multivariate logistic regression were performed.

In bivariate logistic regression analysis, common mental illnesses were significantly associated with advancing age, educational status, and average monthly income of the respondents. In contrary, among socio-demographic variables, sex, place of residence, marital status, occupational status, and family size were not associated with common mental illnesses (Table 5).

Table 5 Bivariate analysis of association between common mental illnesses and socio demographic characteristics among adults living in Harari Region state, Eastern Ethiopia; March, 2016.

Variables		Common mental disorder		p. value	Crude OR
		Yes Frequency (%)	No Frequency (%)		
Sex	Male	81(60.4%)	477(62.2%)	0.702	1.00
	Female	53(39.6%)	290(37.8%)		0.929(0.638 - 1.353)
Age	15-24	24 (17.9%)	164(21.4%)	0.002	1.00
	25-34	66 (49.3%)	409 (53.3%)	0.000	*5.467 (2.287 - 13.069) **
	35-44	23 (17.2%)	141(18.4%)	0.000	*4.958 (2.222 - 11.060)**
	45-54	9(6.7%)	38(5.0%)	0.000	*4.904 (2.039 - 11.798) **
	55+	12(9.0%)	15(2.0%)	0.023	*3.378 (1.181 - 9.660) **
Residence	Urban	59 (44.0%)	386(50.3%)	0.179	1.00
	Rural	75 (56.0%)	381(49.7%)		0.776 (0.537-1.123)
Marital status	Single	17(12.7%)	132(17.2%)	0.116	1.00
	Married	88(65.7%)	527(68.7%)	0.284	2.118 (0.537 -

					8.358)
	Divorced	9(6.7%)	46(6.0%)	0.458	1.633(0.447 - 5.971)
	Widowed	17(12.7%)	51(6.6%)	0.656	1.394 (0.323 - 6.020)
	Separated	3(2.2%)	11(1.4%	0.777	0.818 (0.204 - 3.284)
Educational status	Unable to read and write	41(30.6%)	144(18.8%)	0.021	1.00
	Able to read & write only	13(9.7%)	125(16.3%)	0.003	*2.738 (1.403 - 5.341)**
	Grade 1-8	40(29.9%)	230(30.0%)	0.045	*1.637 (1.010 - 2.653)**
	Grade 9-11	32(23.9%)	209(27.2%)	0.017	*1.860 (1.118 - 3.093)**
	12 + grade	8(6.0%)	59(7.7%)	0.075	2.100 (.929-4.748)
Occupational status	Farmer	65(48.5%)	313(40.8%)	0.300	1.00
	Merchant	14(10.4%)	109(14.2%)	0.127	1.617 (0.872 - 2.997)
	Gov't Employed	18(13.4%)	149(19.4%)	0.057	1.719 (0.985 - 3.001)
	private employed	8(6.0%)	48(6.3%)	0.588	1.246 (0.563 - 2.758)
	Student	8(6.0%)	54(7.0%)	0.402	1.402(0.637 - 3.086)
	Daily laborer	18(13.4%)	87(11.3%)	0.990	1.004 (0.566 - 1.781)
	Other	3(2.2%)	7(0.9%)	0.303	0.485 (0.122 - 1.923)
Average Monthly income	<831.89 birr	297(72.4%)	472(61.5%)	0.017	1.639 (1.092 - 2.458) *
	≥ 831.89 birr	37(27.6%)	265 (38.5%)	0.841	1.00
Family size	1-2	34(25.4%)	203(26.5%)	0.812	1.00
	3-5	75(56.0%)	407(53.1%)	0.670	0.909(0.586 - 1.410)*
	6+	25(18.7%)	157(20.5%)	0.859	1.052 (.603 - 1.836)

Similarly, bivariate logistic regression analysis showed that among stressful life events; death of respondents' close one, experiencing separation from spouse, medically confirmed disability and emotional stress were significantly associated with common mental illnesses.

In addition, substance uses like taking *khat* and tobacco in the last 3 months were also significantly associated with common mental illnesses. However, common mental illnesses were not associated with alcohol use, financial stress, family history of mental

illness, experiencing legal issues, being severely sick, loss of job or valuable property and experiencing big problem with close friends (Table 6)

Table 6. Bivariate analysis of association between common mental illnesses and stressful life events and substance useamong adults living in Harari Region state; March, 2016.

EVENTS WITHIN THE LAST 6 MONTHS		Common mental disorder		p. value	Crude OR
		Yes Frequency (%)	No Frequency (%)		
Experience of sever sickness, physical abuse, or disability	Yes	12(9.0%)	64(8.3%)		1.00
	No	122(91.0%)	703(91.7%)	0.814	1.080 (0.566 - 2.061)
Death of respondent father/mother, child	Yes	16 (11.9%)	44 (5.7%)		1.00
	No	118(88.1%)	723 (94.3%)	0.009	*2.228 (1.217 - 4.078)**
Severely sick, physical abuse, or disability of someone close to respondent	Yes	5(3.7%)	24(3.1%)		1.00
	No	129 (96.3%)	743 (96.9%)	0.716	1.200 (0.450 - 3.202)
Death of someone close to respondent's family	Yes	21 (15.7%)	111(14.5%)		1.00
	No	113(84.3%)	656 (85.5%)	0.717	1.098 (0.661 - 1.824)
Experiencing separation from the spouse	Yes	22 (16.4%)	77 (10.0%)		1.00
	No	112 (83.6%)	690 (90.0%)	0.031	*1.760 (1.053 - 2.943)**
Experiencing loss of strong relationship or friend-ship	Yes	6 (4.5%)	28(3.7%)		1.00
	No	128 (95.5%)	739(96.3%)	0.644	1.237 (0.502 - 3.047)
Experiencing big problem with close friends	Yes	13 (9.7%)	70 (9.1%)		1.00
	No	121(90.3%)	697 (90.9%)	0.832	1.070 (0.574 - 1.994)
Experiencing big problem due to lack of money	Yes	16 (11.9%)	70 (9.1%)		1.00
	No	118 (88.1%)	697 (90.9%)	0.308	1.350 (0.758 - 2.404)
Lost of valuable property	Yes	5 (3.7%)	29 (3.8%)		1.00
	No	129 (96.3%)	738 (96.2%)	0.978	0.986 (0.375 - 2.595)
Experiencing any legal issues	Yes	20(14.9%)	86(11.2%)		1.00
	No	114(85.1%)	681(88.8%)	0.220	1.389 (0.821 - 2.349)
Lost of job	Yes	5 (3.7%)	25 (3.3%)		1.00
	No	129 (96.3%)	742 (96.7%)	0.779	1.150 (0.433 - 3.060)
Violated by other person	Yes	2 (1.5%)	3 (0.4%)		1.00
	No	132 (98.5%)	764 (99.6%)	0.141	3.859 (0.639 - 23.313)
Family history of mental illness of time	Yes	5(3.7%)	16 (2.1%)		1.00
	No	129 (96.3%)	751(97.9%)	0.251	1.819 (0.655 - 5.052)

Medically confirmed physical disability of any time	Yes	4(3.0%)	5 (0.7%)		1.00
	No	130 (97.0%)	762 (99.3%)	0.023	*4.689 (1.243 - 17.69)**
Taking tobacco in the last 3 months	Yes	62(46.3%)	282 (36.8%)		1.00
	No	72 (53.7%)	485 (63.2%)	0.037	1.481 (1.023 - 2.144)*
Taking alcohol in the last 3 month	Yes	11 (8.2%)	84(11.0%)		1.00
	No	123 (91.8%)	683 (89.0%)	0.342	0.727 (0.377 - 1.403)
Taking khat in the last 3 months	Yes	86(64.2%)	348(45.4%)		1.00
	No	48(35.8%)	419(54.6%)	0.000	*2.157(1.474 - 3.157) **
Emotional stress	Yes	21(15.7%)	68(8.9%)		1.00
	No	113(84.3%)	699 (91.1%)	0.016	*1.910 (1.127 - 3.239)**
Financial stress	Yes	17(12.7%)	80(10.4%)		1.00
	No	117(87.3%)	687(89.6%)	0.438	0.801 (0.458 - 1.402)

In multivariate logistic regression analysis, among variable those showed significant association in bivariate analysis, advancing age, low average monthly income, medically confirmed physical disability, taking Khat and emotional stress were retained as independent determinant factors for common mental illnesses.

Respondents age between 25 – 34 years, 35 – 44 years, 45 – 54 years and above 55 years were 6.4 times (AOR 6.377; 95% CI: 2.280– 17.835), 5.9 times (AOR 5.900; 95% CI: 2.243– 14.859), 5.6 times (AOR 5.648; 95% CI: 2.200– 14.50) and 4.1 times (AOR 4.110; 95% CI: 1.363– 12.393) more likely having common mental illnesses than those age between 15- 24years, respectively. The occurrence of common mental illness was twice (AOR: 2.162;95% CI 1.254 -3.728) higher among respondents earn less than the average monthly income than those earn more than average monthly income.

The odds of developing common mental illnesses were 6.6 times (AOR 6.653; 95% CI: 1.640– 26.992) higher among adults with medically confirmed physical disability than those without physical disability. Similarly, adults who chewed Khat were 2.3 times (AOR 2.305; 95% CI: 1.484– 3.579) more likely having common mental illnesses than those who did not chew Khat. Adults with emotional stress were twice (AOR 2.063; 95% CI: 1.176– 3.619) higher chance to have common mental illnesses than adults without emotional stress. In contrary, multivariate analysis of this study showed that common mental illnesses were not association with educational status, death of respondents closed one, experiencing separation from the spouse and taking tobacco (Table 7).

Table 7. Multivariate logistic regression analysis of determinant factors for common mental illnesses among adults living in Harari Region state; Eastern Ethiopia; March, 2016

Variables		Common mental disorder		p. value	ADJUSTED OR
		Yes Frequency (%)	No Frequency (%)		
Age	15-24	24 (17.9%)	164(21.4%)	0.004	1.00
	25-34	66 (49.3%)	409 (53.3%)	0.000	6.377 (2.280 - 17.835)*
	35-44	23 (17.2%)	141(18.4%)	0.000	5.900 (2.343 - 14.859) *
	45-54	9(6.7%)	38(5.0%)	0.000	5.648 (2.200 - 14.500)*
	55+	12(9.0%)	15(2.0%)	0.012	4.110 (1.363 - 12.393)*
Educational status	Illiterate	41(30.6%)	144(18.8%)	0.725	1.00
	Read & write only	13(9.7%)	125(16.3%)	0.747	1.182 (0.427 - 3.270)
	Grade 1-8	40(29.9%)	230(30.0%)	0.322	1.729 (0.586 - 5.104)
	Grade 9-12	32(23.9%)	209(27.2%)	0.879	1.075 (0.424 - 2.724)
	12 + grade	8(6.0%)	59(7.7%)	0.980	1.011 (0.418 - 2.448)
Average Monthly income	<831.89 birr	297(72.4%)	472(61.5%)	0.006	2.162 (1.254 - 3.728) *
	≥ 831.89 birr	37(27.6%)	265 (38.5%)		1.00
Death of respondent father/mother, child	Yes	16(11.9%)	44 (5.7%)	0.780	0.926 (0.538 - 1.593)
	No	118(88.1%)	723 (94.3%)		1.00
Experience separation from the spouse	Yes	22 (16.4%)	77 (10.0%)	0.174	1.478 (0.841 - 2.598)
	No	112 (83.6%)	690 (90.0%)		1.00
Medically confirmed physical disability	Yes	4(3.0%)	5 (0.7%)	0.008	6.653 (1.640 - 26.992)*
	No	130 (97.0%)	762 (99.3%)		1.00
Taking tobacco in the last 3 months	Yes	62(46.3%)	282 (36.8%)	0.456	0.847 (0.548 - 1.310)
	No	72 (53.7%)	485 (63.2%)		1.00
Taking khat in the last 3 months	Yes	86(64.2%)	348(45.4%)	0.000	2.305 (1.484 - 3.579)*
	No	48(35.8%)	419(54.6%)		1.00
Emotional	Yes	21(15.7%)	68(8.9%)	0.012	2.063 (1.176 -

stress				3.619) *
	No	113(84.3%)	699 (91.1%)	1.00

4. Discussion

Mental illness is a public health problem that causes suffering to the individuals, their family and communities in developed as well as developing countries (WHO, 2001, Saulo et al 2010). The global burden of disease report revealed that common mental disorders account for 9.8% of the global burden of diseases (Desjaralais ,1995, Lopez & Mathers 2006). Worldwide, it is estimated that lifetime prevalence ranges from 12.2–48.6% and 12-month prevalence between 8.4 and 29.1% (WHO, 2008). But the magnitude and risk factors of common mental disorders vary among different population.

The prevalence of common mental illnesses among adults in our study area was 14.9%. This finding was consistent with previous studies conducted in Kenya (11%) (Rachel Jenkins et al.2012), Borena Southern Ethiopia (14.6%) (Teferra Beyero et al., 2004) and Addis Ababa (11.7%)(Kebede & Alem 1999). But our finding was lower than many of the previous studies that reported prevalence of CMI among study population 21.9% in Nigeria (Amoran et al, 2005), 22.7% in Jimma Ethiopia (Ermias & Samuel 2003), 24.6% in Britain (Weich et al2001), 25.5% in Chile, Santiago (Ricardoa et al 2001), 27 – 30 % in south Africa **(**Havenaar et al 2012, Allen et al 2009**),** 29.9% in Brazil (Saul et al 2010) and 30.3 % in Britain (Allen et al 2009). This difference might be due to difference in data collection tools (some of those studies use CIS-R or GHQ), or due to difference in target population (urban population, disadvantaged Population) or time elapse between two studies.

Similarly, our finding was lower than the study conducted in four post conflict communities in Algeria (60.5%), Cambodia (53.4%), Ethiopia (23.6%) and Palestine and (29.1%) using the composite international diagnostic interview (Joop T. V. M. de Jong et al 2001). This high prevalence of CMI in those communities might be explained by the effect of conflict before the study conducted. Since serious threats such as conflicts and disasters were among several determinant factors of common mental illnesses, it was expected higher prevalence of CMI among those post conflict communities (Hanlon, C et al 2008).

In contrary, our finding was 3 to 6 times higher than studies conducted in two urban areas (2.3% in Ilala Ilala and 4.1% in Saba Saba) of Tanzania (Rachel Jenkins et al., 2010). This difference could be due to difference in study population and data collection tool. In our study, study population was adult living in both urban and rural kebeles whereas study population of Tanzania study was adults living in two urban areas. Similarly, data collection tool of our study was self-reporting Questionnaire (SRQ -20) whereas Clinical Interview Schedule Revised (CIS-R) was used in Tanzania study.

In current study, 81 (14.5%) male and 53 (15.45%) female had common mental illnesses but there was no statistical significant association between sex and common mental illnesses. This finding was consistent with study conducted in Kenya (Rachel

Jenkins et al. 2012). But a number of previous studies showed that being female associated with higher risk of CMI (Havenaar et al.2012, Rachel Jenkins et al., 2012, Kebede & Alem 1999, Ermias & Samuel 2003 and Awas et al 1999)

Similarly, 13.3% of urban and 16.64% of rural residences had common mental illnesses. But there was no association between place of residence and common mental illnesses. This finding of higher prevalence of common mental illnesses among rural adults than urban was also observed in Nigeria study (18.4% in the urban areas and 28.4% in the rural areas) (Amoran et al, 2005).

In current study, advancing age was associated with increased likelihood of developing or having common mental illnesses. This finding was similar with several previous studies conducted in Brazil [Saulo et al 2010], Kenya [Rachel Jenkins et al., 2012], in Addis Ababa [Kebede & Alem 1999) and Butajira [Awas et al 1999].

Like study conducted in in Addis Ababa [Kebede & Alem 1999), marital status of respondents did not show statistically significant associated with common mental illnesses. But some previous studies reported that marital status had significantly association with common mental illnesses (Vikram Patel et al., 2006 and Rachel Jenkins et al., 2012). This difference might be due to difference in study population, study design and data collection tools. The first study was cohort study conducted on Indianwomen aged 18 to 50 yearsusing RCIS.

Unlike many previous studies, educational status and employment status or occupation of respondent did not show statistical significant association with common mental illnesses (Lazarus & Freeman 2009, Amoran et al, 2005, Ricardoa et al 2001, Saulo et al 2010, Vikram & Arthur, 2003; Rachel Jenkins et al., 2010; and Ermias & Samuel, 2003).

As stated by Scott and Glyn, financial strain is a main predictor of future psychiatric morbidity (Scott and Glyn 1998.]. In our study, average family income was strongly associated with common mental illnesses. Adults with low average family income had two times higher chance of having mental illnesses than adults earned more than average monthly income. This association was also reported by many of the previous studies conducted in Nigeria (Amoran et al, 2005), England, Wales, and Scotland (Ricardoa et al 2001), Brazil (Saulo et al 2010), Indian (Vikram Patel et al., 2006), two urban areas of Tanzania (Rachel Jenkins et al., 2010) and Butajira district rural Ethiopia (Awas et al 1999).

In our study, it was observed that about half (48.2%) of adults chewed khat. This is because Khat chewing is one of common habit practiced among peoples living in the study area. In the other word, 64.2% of adults with common mental illnesses and 45.4% of adults without common mental illnesses were chewing Khat in the last 3 months. This difference was statistically significant that those adults who chewed Khat had 2.3 times higher chance of having common mental illnesses than those who did not chew khat.

But alcohol taking and tobacco use did not show statistical association with common mental illnesses in this study. In contrary to this, other studies conducted in Brazil (Saulo et al 2010) & Indian (Vikram Patel et al., 2006) reported statistical significant relationship between tobacco use and common mental illnesses.

About 3% of adults with common mental illnesses and 0.7% of adults without common mental illnesses had medically confirmed physical disability. This difference in proportion physical disability among adults with and without common mental illnesses was statistically significant. Adults with physical disability were almost 7 times higher chance of having common mental illnesses than adults without physical disability. This finding was also consistent with previous studies (Hanlon, C et al 2008, Amoran et al, 2005, Saulo et al 2010, Vikram Patel et al., 2006 & Rachel Jenkins et al., 2010).

5. Conclusion and Recommendation

5.1. Conclusion

This study indicated that:

- ✓ Significant proportion (one out of seven) adults in Harari Regional state had common mental illnesses.
- ✓ Substance use like *Khat* chewing (48.2%), tobacco use (38.2%) and alcohol use (10.5%) was highly prevalent health problem among study participant.
- ✓ Advancing age, low average family monthly income, *Khat* chewing, having medically confirmed physical disability, and emotional stress were independent predictors of common mental illnesses.
- ✓ Whereas sex, place of residence, educational status, marital status, occupation, family size, financial stress, taking alcohol, tobacco use and family history of mental illnesses were not statistically associated with common mental illnesses.

5.2. Recommendation

Based on our findings, we would like to foreward the following recommendation to all concerned bodies including Harari Regional Health Bureau, Haramaya University, Researchers, mass media, and community at large.

- ✓ Massive health awareness, promotion and education programs should be conducted regularly to the community about common mental illnesses and their risk factors.
- ✓ The negative health effect of substance use should be addressed continuously to the community through mass media
- ✓ Due attention should be given to mental health aspect of those individual with low monthly family income, advanced age and physical disability.
- ✓ Further large-scale research using both qualitative and quantitative approach, analytical design and different data collection tools should be conducted.

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16. Clinical, Biochemical and Hematological Parameters among Occupationally Lead Exposed Garage Workers Compared to Haramaya University, College of Health and Medical Science Teachers and Students in Harar Town, Eastern Ethiopia

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Abstract: Lead causes a wide range of biological effects depending upon the level and duration of exposure. Although occupational Lead exposure is one of the major public health problems, no previous research was conducted on effect of Lead exposure on clinical, biochemical and hematological parameters in Ethiopia. The aim of this study was to assess the differences on clinical, biochemical and hematological parameters among occupationally LeadLead exposed garage workers compared to Haramaya University, college of health and medical science teachers and students in the Harar town, Eastern Ethiopia. A Comparative cross-sectional study was conducted in Hara town, Harari regional state from March to July 2016. For this study, 30 garage workers were selected and compared with 30 age and sex matched comparison group (college of health and medical science teachers and students). Demographic, occupational and clinical data were collected by using structured questionnaire and interviewed by trained data collector. Biochemical and hematological parameters of each samples was measured by automated clinical chemistry and hematology analyzers. Data was analyzed using STATA Version 11. All of the garage workers were males and their age ranged between 18 to 53 years old with mean of 30.4±8.2. Majority of the garage workers 20(60.7%) do not use any kind of protective equipment. The most commonly experienced symptoms of Lead exposure reported by garage workers were headaches 16(53.3%), followed by fatigue 13(43.3%) and irritability 8(26.7%). A statistically significant increase were found in Systolic (128.7±3.3 Vs 105.9 ±1.6 mmHg; P-value<0.0001), Diastolic blood pressure (90.3±2.1 Vs 75.3 ±1.0 mmHg; P-value<0.0001), Total WBC count (7.9±0.3 Vs 6.6±0.4 X 109 cells/L; P-value=0.0058), platelets value (323.2±8.9 Vs 244±8.5 X 109 cells/L; P-value<0.0001), uric acid (7.3±0.3 Vs 5.2±0.2 mg/dl; P-value<0.0001), AST (47.2±4.9 Vs 27.3±1.1 U/L; P-value=0.0001), Total Protein (85.8±1.2 Vs 76.2±0.8 g/dl; P-value<0.0001), glucose (85.1±3.9 Vs 75.8±2.3 mg/dl; P-value=0.0423), Total cholesterol (199.4±13.1 Vs 139.5±3.7 mg/dl; P-value<0.0001) and Triglyceride (143.4±5.8 Vs 110.7±8.5 mg/dl; P-value=0.0027) in garage workers compared to control groups. While

a statistically significant decrease were found in RBC (5.1±0.1 Vs 5.5±0.1 X 1012 cells/L; P-value=0.0003), hemoglobin (14.9±0.1 Vs 15.6±0.2 g/dl; P-value=0.0056), hematocrit (43.9±0.6 Vs 46.7±0.5%; P-value=0.0001), MCV (83.2±0.5 Vs 85.5±0.8 fl; P-value=0.0213), urea (21.6±1.0 Vs 27±1.6 mg/dl; P-value=0.0041) and Albumin (39.4±1.8 Vs 46.4±0.5g/dl; P value=0.0002) among garage workers compared to the controls. The findings of the study clearly indicated that there were significant differences on blood pressure, hematological and biochemical parameters between garage workers and control groups.

1. Introduction

Lead is one of the most widely scattered toxic metals in the world. The sources of Lead in the environment are from natural or anthropogenic. The possible opportunities for Lead and its compounds to enter the environment are, during mining, smelting, processing, use, recycling or disposal. Airborne Lead can be deposited on soil and water thus reaching humans through the food chain and drinking water (ATSDR., 2005; Saryan and Zenz, 1994; Liu *et al.*, 2008; WHO, 1995).

Lead is an element of risk for the environment and human health and has harmful effects that may exceed those of other inorganic ctoxicants. Most of the atmospheric Lead is emitted from two main sources, motor vehicles and industrial sources, such as gasoline station, Lead smelter, battery and auto-radiator repairing (CDC, 2002; OLPPP, 2002). In addition, human activities also have spread Lead throughout water, soil, plants and animals. Lead can be found in everyone's bodies (Flegal and Smith, 1992; Flegal and Smith, 1995).

Lead exposure in the general population occurs primarily through ingestion, although inhalation also contributes to Lead body burden and may be the major contributor for workers in Lead related occupations (CDC, 1991; CDC, 2002; ATSDR, 2000). Food, beverages, soil and dust are the means in which Lead is absorbed in to human gastro intestinal tracts. But the factors which affect its absorption are dietary factors, nutritional status, and chemical form of the metal and patterns of food intake (Gorey, 1994).

On the other hand, many people working for different manufacturing or service rendering organizations such as battery manufacturing workers, gas-station attendants, radiator repair workers, solderers of Lead products, and welders, are involved in jobs which expose them to gradual health risks from exposure to Lead without having any idea about the materials they are handling (Gorey, 1994; Grandjean *et al.*, 1981; Pala *et al.*, 2009). Similarly, a gasoline station workers, construction and demolition workers, jewelers, Lead miners, Lead smelters and refiners, painters, pottery workers, printers and soldering of Lead products (OLPPP, 2002; LANDRIGAN, 1994; Adela *et al.*, 2012a). After absorption, Lead transported to the blood. Then, it builds up in soft tissue; kidneys, bone marrow, liver and brain, and deposited mainly in bone (Gorey, 1994).

Symptoms of Lead poisoning include weakness, excessive tiredness, irritability, constipation, anorexia, abdominal discomfort (colic), fine tremors and wrist drop. Overexposure to Lead may result in anemia, impotence, infertility, and reduced sex drive in both sexes, mild mental impairment and loss of IQ, gastrointestinal problems (Prüss-Üstün *et al.*, 2004). It affects several organs and organ systems including nervous, renal, hepatic, reproductive, hematological and immune system. Lead also affects cardiovascular system and increases systolic and diastolic blood pressure (Dresner, 1982; ATSDR., 2005; Dongre *et al.*, 2010c; Patil *et al.*, 2006; Kocaba *et al.*, 2008;; Dongre *et al.*, 2010a). Lead causes a wide range of biological effects depending up on the level and duration of exposure. The most sensitive organs which can easily be affected by Lead are; the nervous, hematopoietic, gastrointestinal, cardiovascular**,** musculoskeletal, immune system, renal and reproductive systems (Dresner, 1982; ATSDR., 2005; Dongre *et al.*, 2010c; Patil *et al.*, 2006; Kocaba *et al.*, 2008;; Dongre *et al.*, 2010a).

Lead interferes with heme biosynthesis by altering the activity of three enzymes. The anemia induced by Lead is microcytic and hypochromic and results primarily from both inhibition of heme and globin synthesis and shortening of the erythrocyte lifespan(Verrula and Noah, 1990; Papanikoulou *et al.*, 2005).It has also been found that patients groups to have significant decrease in hemoglobin (Hb) and Mean corpuscular volume (MCV) values in the patients with Lead exposure than in the controls. When compared the effects of blood Lead on hematological parameters, Lead had profound effects on red blood cell count, hemoglobin, platelets, and blood cell count (Jesus et al., 2007, Yilmaz et al.,2012, Ahed et al., 2013).

The anemia that accompanies Lead poisoning (plumbism) is in part the result of various inhibitory effects of Lead on heme biosynthesis. Most steps in the heme biosynthetic pathway are inhibited by Lead to varying degrees. Presumably, Lead displaces an essential metal or reacts with active-site thiol groups of the enzymes, but the precise mechanism is not worked out in most cases. The effects of Lead on the production of heme are also interrelated with iron metabolism. In erythroid cells, Lead limits the intracellular delivery of iron to the site of ferrochelatase, and the surrogate metal zinc is inserted into protoporphyrin by ferrochelatase as in iron deficiency so that zinc protoporphyrin accumulates. Lead also impairs globin. With prolonged Lead exposure, erythroid hypoplasia may occur (Greer et al., 2003).

The liver is the largest repository (33%) of Lead among the soft tissues followed by kidney, cortex and medulla (Madipalli, 2007). The liver performs numerous biochemical functions and it is the site of metabolism of different nutrients and detoxification of environmental toxins (Howard, 1999). Therefore, exposure to LeadLead affects the normal liver functions, impairs the metabolism of carbohydrates, lipids and proteins and impairs the detoxification of xenobiotics (environmental toxins and drugs) (Rastogi, 2008).

Lead exposure causes proximal renal tubular damage, characterized by generalized aminoaciduria, hypophosphatemia, with relative hyperphosphaturia and glycosuria accompanied by nuclear inclusion bodies, mitochondrial changes, and cytomegaly of the proximal tubular epithelial cells (Rastogi, 2008). Lead also affects cardiovascular system and increases systolic and diastolic blood pressure (Vupputuri et al., 2003). Studies have

indicated that LeadLead exposure cause lipid abmormalities (dyslipidemia) and risk of atherosclerosis (Newairy et al., 2009). Several reports have shown that both acute and chronic Lead poisoning cause impairment of heart and vessel function (Wojtczak et al., 1989) and that rates of death from cerebrovascular disease are significantly increased in Lead-exposed workers compared with the general population (Dingwall et al., 1963, Malkolm, 1997).

Exposure to hazardous chemicals in developing countries is common (Gomes et al., 2001). That was as a result of negligent of employers, poverty, or lack of knowledge and job skills. Due to lack of regulation, supervision and application of standards by concerned authorities, the activities in small scale industries may be occupationally hazardous (Loewenson, 1998). In Ethiopia garage workers in small scale auto garages are exposed to various chemicals, mainly due to their open space work set up and lack of personal protective clothing. Small scale auto garage owners and employees have a duty to implement the above requirements but was clearly lacking.

Occupational LeadLead exposure in many developing countries is entirely unregulated, often with no monitoring of exposure (Lovei, 1999). In Ethiopia, although there are numerous small-scale and large industries which use Lead-based raw materials that may pose health risks to workers, there are no work place regulations for Lead exposure and no data are available with the labor departments among the workers of small-scale Lead-based units with regard to Lead poisoning (Adela *et al.*, 2012a).

Few studies in Ethiopia showed the difference in the mean blood level among exposed and non-exposed individuals**.** The results of the study showed high blood LeadLead level on exposed workers (Gebriel *et al.*, 2014; Adela *et al.*, 2012a; Ahmed *et al.*, 2005)**.** However, to the best of the investigators knowledge, the effect of LeadLead on clinical, biochemical, hematological parameters were not studied. Hence, this study was carried out to determine the differences on clinical, biochemical and hematological parameters among occupationally Lead exposed Garage workers in Harar town. Determining the effect of Lead on clinical, biochemical and hematological alterations have the significance of insisting the owners of auto garage to introduce appropriate control equipment for workers, raising workers' awareness on the health impact of LeadLead and to use control equipment. This study can be used by Harari Health bureau, and health institutions to formulate necessary rules, regulation, instructions, guidelines of occupational health and safety for planning and intervention, which can be adopted by regulatory authorities and operators of small and large-scale garages in the town. The study results are of great help to garage worker for making informed decisions in selection and use of protective devises. The garages workers are expected to change their health seeking behaviors, if the relevant authorities use these findings to create health awareness among them. The study can provide information that can strategically guide the policy formulation in control and prevention of occupational health hazards in garage workers. The study results can provide an opportunity for other researchers to further study into the topic. The aim of this study was to determine the differences on clinical, biochemical and hematological parameters among occupationally Lead Exposed

garage workers compared to Haramaya University, college of health and medical science teachers and students in Harar town, Eastern Ethiopia.

2. Methods and Materials

Study Area and Period

The study was conducted in Harar town from May to August, 2016. Harar is one of the largest towns in Eastern Ethiopia. There are no major industrial sources of LeadLead emission in the town. There are several smallscale metal workshops, auto-garages for automobile services and LeadLead acid battery repair units of transport service enterprises in the town. There are different types of garages; garages for wood work garages for metal works, auto-garages for automobile services. An auto-garage is part of a home, or an associated building, designed or used for servicing vehicles. There are many licensed and unlicensed small to large scale garages in the town (personal communication with Harari commercial and development office head)

Study Design

A comparative cross-sectional study was used between auto garage workers and comparison groups. A quantitative type of research was used.

Population

Source population

All auto garage workers in the Garages living in Harar town. The source for comparison groups were university students and teachers at college of health and medical sciences, Haramaya University.

Study population

The study population comprised of Garage workers in the Harar town

The comparison groups were university students and teachers at college of health and medical sciences, Haramaya University who matched the experimental group in age and sex. These groups were selected because they are not occupationally exposed to Lead.

Eligibility Criteria

Inclusion criteria

- All auto garage workers and university teachers and students

Exclusion criteria

- Ill auto garage workers and university teachers and students who are unable to communicate and provide blood samples.

Study Variables

Dependent variables

- ✓ Biochemical parameters
- ✓ Hematological parameters
- ✓ Clinical parameters

Independent variables

- ✓ Age
- ✓ Sex
- ✓ Marital status
- ✓ Educational status
- ✓ Residence
- ✓ Exposure history
- ✓ Use of personal protective equipment
- ✓ Work duration
- ✓ Taking shower at work site
- ✓ Personal hygiene practice
- ✓ Habits of smoking, drinking, eating, chewing khat at work place
- ✓ Knowledge regarding routes of Lead entry and effect of Lead on health

Sample Size and Sampling Technique

Sample Size

Sample size calculation was based on sample size for comparison of two sample means. From a study carried out in Bangkok among garage workers [Suwasaksri et al, 2002], we get mean blood LeadLead level of 0.42±0.13 μmol/L in garage workers and 0.32±0.07 μmol/L in control groups. From this we get μ1= 0.42, μ2= 0.32 and sd1= 0.13, sd2= 0.07. Finally we use STATA version 11.0 to estimate the sample sizes with specified significance level (0.05), power (90%) and with proportion of 1:1 using a formula for calculation of a difference between two populations mean. The corrected sample size were n1=30 auto garage workers and n2=30 comparison groups.

Sampling Technique

From the available licensed auto-garages in the town the 30 garage workers were recruited randomly after allocating the number for each auto garage based on the total individuals present in each garage. The comparison groups matching the Garage worker in age and sex were selected by systematic simple random sampling technique.

Data Collection

Collection of demographic, occupational and clinical data

After obtaining the consent from the participants to take part in this study demographic, occupational and clinical data were collected by using structured questionnaire and interviewed by trained data collector (two nurses). The questionnaire was prepared on local language (Afan Oromo and Amharic language) and includes several areas of

questions such as demographic characteristics (age, sex, marital status and educational status), work duration, house location, previous medical checkup history and use of personal protective equipment and data on some risk factors for Lead poisoning such as: addiction to alcohol, smoking, '*khat*' chewing, and eating, drinking habits and/or taking shower at the work-place. Workers were also asked about the common toxicity symptoms of Lead experienced on the preceding 6 months.

Blood Collection and Processing

Prior to blood collection blood pressure was measured in supine position (resting position) by nurses using sphygmomanometer. Systolic and diastolic blood pressure was expressed as mm/Hg.

Blood samples were collected by Nurses using venipuncture techniques into evacuated tubes and EDTA tube from the ante cubital area of the garage workers and controls groups. During collection of the specimen to protect both the sample collector and the participant, appropriate infection prevention mechanisms was employed by of using personal protective equipment. Blood specimen collection was carried out using a separate vacutainer tube and glove for every individual. About 6 ml blood was drawn from each individual. Three ml blood was collected into vacutainer vials containing potassium ethylenediamine tetracetic acid "EDTA (K3)" as anticoagulant for determination of complete blood count. The rest 3ml blood was collected in plastic tube and left for short time to allow blood to clot. Then clear serum sample was obtained by centrifugation at 3000 rpm for 15th min and used for measuring the biochemical profiles(Kidney and liver function tests). The collected blood specimen was transported to laboratory using cold box. To avoid contamination and to ensure safety, all used needles and gloves were packed in appropriately labelled disposable bags and taken to the Hiwot Fana Specialized Hospital waste disposal unit.

Laboratory Investigation

Biochemical tests (ALT, AST, ALP, total protein, Albumin, creatinine, Urea, uric acid, total cholesterol, triglyceride and glucose) were measured on VEGASYS clinical chemistry analyzer on the day of sample collection (Carl et al.; 2008).

Complete blood cell counts were done using Sysmex 2100 (Sysmex Corporation; Kobe Japan). The machine automatically dilutes a whole-blood sample, lyses, counts and gives a printout result of absolute numbers of leucocytes (expressed as number of cells × $[10^9]$ per liter), erythrocytes (number of cells × $[10^{12}]$ per liter), platelets (number of cells × $[10^9]$ per liter), lymphocytes (number of cells × $[10^9]$ per liter), mononuclear cells (number of cells × $[10^9]$ per liter), granulocytes (number of cells × $[10^9]$ per liter) and hemoglobin (grams per decilitre)(Greer et al., 2003).

Operational Definition

Occupational Lead exposure: an exposure where LeadLead levels are unusually high due to their daily activity such as in auto garage worker, gasoline worker, smelters than within general population.

Non-occupational Lead exposure: an exposure where LeadLead levels are minimum (within reference) that occur in general population and occurred without any exposure to conditions/occupations that result in high blood Lead level such as garage worker, gasoline worker, smelters

Biochemical change: change in any of chemical substances (lipid profile, glucose, protein, ALT, AST, urea, creatinine) in blood above or below their reference values

Hematological change: change in any of hematological parameters (WBC, RBC, platelets, hemoglobin, hematocrit, MCH, MCV, and MCHC) in blood above or below their reference values.

Data Processing and Analysis

All the data were cleaned; double entered and analyzed using STATA Version-11. Descriptive summary was presented in terms of mean, range, and proportions depending on the scale of the variable. For quantitative variables, all data were presented as mean ±SE. Statistical analyses between the control and study group were done using the unpaired student's t-test. The level of significance was determined at $p<0.05$.

Quality Assurance

All the collected data using the structured questionnaire were checked for completeness. Data quality was ensured through use of standardized data collection materials. The blood sample was collected, labeled, transported and stored in a proper manner to ensure sample integrity. All reagents were labeled with date of preparation/opening, expiration date and storage requirements. Sample collection time was recorded in the test requisition form. Short term training was provided for the data collectors.

During testing, the trained laboratory personnel followed strictly to the Standard Operating Procedures (SOP) and manufacturer instruction manual in each procedure to ensure the data quality for laboratory tests.

Supervision by the experienced laboratory staffs working in the laboratory was done to verify test results. Log book was used to record problems arisen and their troubleshooting. Finally, the disposal of gloves, needles and blood samples no longer required were done according to bio safety regulations.

Ethical Consideration

The study proposal was approved by Institutional Research and Ethics Review Committee of College of Medical and health Sciences, Haramaya University. All participants were given informed written consent to take part in this study. The purpose of the study was clearly explained to the study participants. Data of each participant was kept confidential. Unauthorized persons don't have access to the data. Only principal investigator and collaborators had access to the data. The collected blood sample was

only used for stated laboratory tests according to the objectives of the study. The participants were provided the result of the laboratory tests. For abnormal results, they were informed by the Nurse and encouraged to refer the nearby health institutions for further follow up and treatment.

3. Results

Socio-demographic Characteristics of Study Population

In this study, a total of 30 garage workers and 30 university students and teachers at college of health and medical sciences were included. All of the garage workers were males. Table 1 summarized the personal profiles of study population. The age of the garage workers ranged between 18 to 53 years old with mean of 30.4±8.2. The highest number of workers 13 (43.3%) was found in the age group between 28 and 37 years old. Twenty-one (70%) of the garage workers were married. Majority of the garage workers were Amhara 19(63.3%) (table 1).

Table 1. Socio demographic characteristics of the garage workers.

Variable	Number (percentage)
Age	
18-27	12(40.0)
28-37	13(43.3)
38-53	5(16.7)
Marital status	
Single	21 (70.0)
Married	9(30.0)
Ethnicity	
Amhara	19(63.3)
Oromo	5(16.8)
Harari	2(6.7)
Tigray	2(6.7)
Other	2(6.7)
Religion	
Orthodox	26(86.6)
Muslim	2(6.7)
Protestant	2(6.7)

Characteristic of Garage Workers by Occupational Data

Half of the garage workers 15(50.0%) were found to be worked in the garage for less than 3 years, whereas 7(23.3%) and 8(26.7%) of them worked for 4-10 and >11 years, respectively. Protective measures during work in the station were poorly followed. Majority of the garage workers 20(60.7%) do not use any kind of protective equipment. The number of workers who mentioned not smoking, not drinking, not eating and not chewing *Khat* at working place were 21(70%), 10(33.3%), 17(56.7%), and 8(26.7%), respectively. Moreover, 14(46.7%) workers take shower at work place. (Table 2)

Table 2. Characteristics of the garage workers by occupational data.

Variable	Number (percentage)
Work duration in years	
1-3	15(50%)
4-10	7(23.3%)
>=11	8(26.7%)
Working hr per day	
4-8 hours	25(83.3)
9-12 hours	5(16.7)
PPE use	
Yes	10(33.3)
No	20(66.7)
Smoking at work place	
Yes	9(30.0)
No	21(70.0)
Drinking at work place	
Yes	20(66.7)
No	10(33.3)
Eating at work place	
Yes	13(43.3)
No	17 (56.7)
Chewing khat at work place	
Yes	22(73.3)
No	8(26.7)
Taking shower at work place	
Yes	14(46.7)
No	16(53.3)

Knowledge of Garage Workers

Regarding possible routes of Lead entry into the body, 16(53.3%) workers mentioned that inhalation is the route of entry, followed by 15 (50%) who reported that ingestion is the route of entry, and 13(43.3%) who claimed that the skin is the route of entry of Lead into the body. A total of 12(40%) workers had knowledge about the health effects of Lead on human health. It was also found that 7(23.3%) knew that Lead is an environmental pollutant. Neither worker attended training courses nor they had health professionals visited their station.

Table 3. Kknowledge of the garage workers.

Variables	Yes # (%)	No # (%)
Rout of Lead entry into body		
Inhalation	16(53.3)	14(46.7)
Through skin	13(43.3)	17(56.7)
Through mouth	15(50.0)	15(50.0)
Lead as environmental pollutant	7(23.3)	23(76.7)
Seeing or hearing Lead poisoning cases	2(6.7)	28(93.3)
Effect of Lead exposure on health	12(40.0)	18(60.0)
Attending Training courses	0	30(100.0)
Health professional visit at work place	0	30(100.0)

Prevalence of Self-Reported Symptoms Related to Lead Exposure

The most commonly experienced symptoms of Lead exposure reported by garage workers were headaches 16(53.3%), followed by fatigue 13(43.3%) and irritability 8(26.7%).

Table 4. Self-reported symptoms related to Lead exposure of the study population (n=30).

Self reported symptoms	Yes	No
Fatigue	13(43.3)	17(56.7)
Irritability	8(26.7)	22(73.3)
Coma	0(0)	30(100)
Convulsion	3(10.0)	27(90.0)
Headaches	16(53.3)	14(46.7)
Concentration difficulties	4(13.3)	26(86.7)
Sleep disturbance	7(23.3)	23(76.7)
Seizure	2(6.7)	28(93.3)
Nausea	5(16.7)	25(83.3)
Dypepsia	5(16.7)	25(83.3)
Constipation	5(16.7)	25(83.3)
Abdominal Pain	7(23.3)	23(76.7)
Renal pain	3(10.0)	27(90.0)

Blood Pressure

The mean values of Systolic (128.7±3.3 Vs 105.9 ±1.6; P-value<0.0001) and Diastolic blood pressure (90.3±2.1 Vs 75.3 ±1.0; P-value<0.0001) were significantly increased in Garage workers compared to the controls (Figure 1).

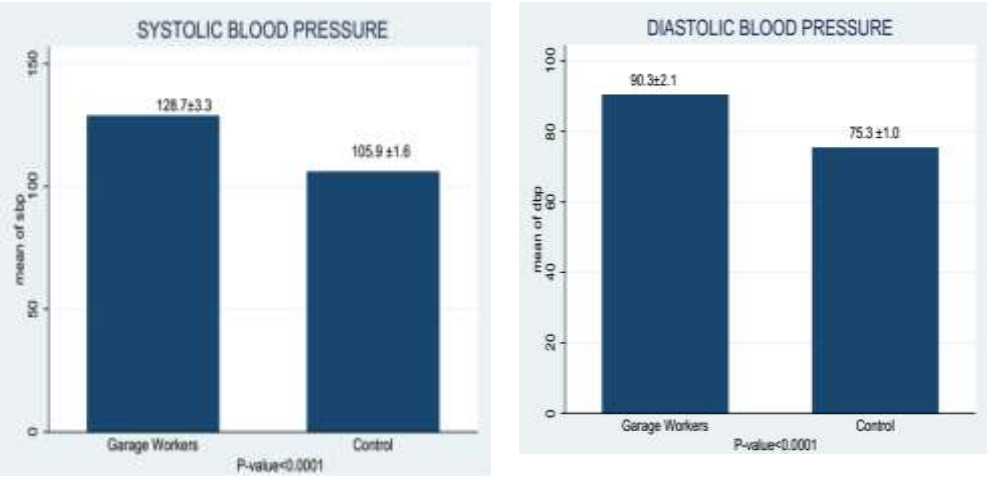

Figure 1. Mean values of systolic and diastolic blood pressure of the garage workers and control groups.

Hematological Parameters

The statistical analysis showed that significant decrease in RBC (5.1±0.1 Vs 5.5±0.1; P-value=0.0003), hemoglobin (14.9±0.1 Vs 15.6±0.2; P-value=0.0056), hematocrit (43.9±0.6 Vs 46.7±0.5; P-value=0.0001) and MCV (83.2±0.5 Vs85.5±0.8; P-value=0.0213) were observed among Garage workers compared to the control groups. In contrast Total WBC count (7.9±0.3 Vs 6.6±0.4; P-value=0.0058) and platelets value (323.2±8.9 Vs 244±8.5; P-value<0.0001) were found to be higher in garage workers than controls. There were no significance in the means of MCH (27.9±0.3 Vs 28.5±0.3; P-value=0.2807) and MCHC (32.9±0.2 Vs 33.3±0.2; P-value=0.0868) value between the two groups.

Table 5.Mean values of hematological parameters of automobile workers and unexposed control group.

Hematology Parameters	Garage Workers (N=30) Mean ±SD	Control (N=30) Mean ±SD	P-value
WBC	7.9±0.3	6.6±0.4	0.0058
RBC	5.1±0.1	5.5±0.1	0.0003
Platelet	323.2±8.9	244±8.5	<0.0001
Hemoglobin	14.9±0.1	15.6±0.2	0.0056
Hematocrit	43.9±0.6	46.7±0.5	0.0001
MCV	83.2±0.5	85.5±0.8	0.0213
MCH	27.9±0.3	28.5±0.3	0.2807
MCHC	32.9±0.2	33.3±0.2	0.0868

Biochemical Parameters

The mean levels serum uric acid in garage workers was significantly higher compared to the control group (7.3±0.3 Vs 5.2±0.2; P-value<0.0001), where as no statistically significant differences was found between the mean level of serum creatinine in both garage workers and control groups (0.8±0.03 Vs 0.8±0.02, P-value =0.3394). The mean level of urea was significantly decreased in workers compared to controls (21.6±1.0 Vs 27±1.6; P-value=0.0041). (Table 6).

The mean serum level of AST (47.2±4.9 Vs 27.3±1.1; P-value=0.0001) and total Protein (85.8±1.2 Vs 76.2±0.8; P-value<0.0001), were significantly increased in garage workers as compared to the controls. Whereas, Serum albumin (39.4±1.8 Vs 46.4±0.5; P value=0.0002), were significantly decreased in garage workers as compared to the controls. There was no significant difference between the two groups on the serum level of ALT (35.6±7.9 Vs 22.6±1.5; P-value=0.0882) and ALP (193.1±12.5 Vs 218.1±9.9; P-value=0.1207).

The mean serum level of glucose (85.1±3.9 Vs 75.8±2.3; P-value=0.0423), total cholesterol (199.4±13.1 Vs 139.5±3.7; P-value<0.0001) and Triglyceride (143.4±5.8 Vs 110.7±8.5; P-value=0.0027) were significantly increased in garage workers as compared to the controls.

Table 6: Mean values of liver and kidney function tests of automobile workers and control group.

Clinical Chemistry Parameters	Garage Workers (N=30)	Control (N=30)	P-value
Glucose	85.1±3.9	75.8±2.3	0.0423
Total Cholesterol	199.4±13.1	139.5±3.7	0.0000
Triglycerides	143.4±5.8	110.7±8.5	0.0027
Creatinine	0.8±0.03	0.8±0.02	0.3394
Urea	21.6±1.0	27±1.6	0.0041
Uric acid	7.3±0.3	5.2±0.2	0.0000
Total Protein	85.8±1.2	76.2±0.8	0.0000
Albumin	39.4±1.8	46.4±0.5	0.0002
ALT	35.6±7.9	22.6±1.5	0.0882
AST	47.2±4.9	27.3±1.1	0.0001
ALP	193.1±12.5	218.1±9.9	0.1207

4. Discussion

Garage workers are occupationally exposed to different chemicals. Lead could be considered to be the most hazardous. Certain people have a greater risk of exposure to Lead, among which garage workers are the most common. Garage workers are prone to Lead exposure due to their routine activities like battery recharging, replacing, welding, spray painting, radiator repairing, brazing etc (Mwatu, 2011; Health and Services, 1999). This exposure can cause abnormal alterations in the functioning of many vital organs and they are associated with increased risks of hematological and biochemical abnormalities(Kim *et al.*, 2015).

Different studies conducted in Ethiopia indicated that auto garage workers are more likely to be exposed to Lead due to occupational incidences than the general population. A study conducted in Jimma showed that the mean BLL of the automotive-garage workers was found to be significantly greater than that of the controls. The difference between the mean BLL of the garage workers, 19.76 µg/d, and that of the controls, 10.73 µg/d is significant(Adela *et al.*, 2012b). Another cross-sectional study carried out in Addis Ababa on Lead exposure among storage battery repair workers by measuring urinary aminolevulinic acid levels, higher levels of urinary aminolevulinic acid were found in the storage battery repair workers and the possible parallel rise in BLLs of the workers was predicted(Ahmed *et al.*, 2008). Similar findings from India (Dongre *et al.*, 2010b), Iran(Kianoush *et al.*, 2013), United Arab Emirates(Bener *et al.*, 2001), and Bangkok(Suwansaksri *et al.*, 2002) indicate auto garage workers are exposed to Lead.

Majority of the workers are not using the protective safety measures and have habit of eating, drinking, smoking, chewing at work place. This makes them more susceptible to those toxic fumes/substances(Mohammed, 2014). As mentioned by workers, the reasons standing behind such poor practices were carelessness, not providing the protective gear, and discomfort to wearing protective gear. It was reported that personal habits at the work place appear to play a major role in facilitating exposure to Lead among Lead smelters, automobile mechanics and gasoline retailers in Ghana(Ankrah *et al.*, 1996). In addition, the appropriate selection and use of personal protective equipments can help prevent or limit exposure to Lead hazards(Blayney, 2001). The owner of the garage workers should provide appropriate protective work clothing and equipment to the workers.

The garage workers were found to exhibit significantly higher levels of the non-specific symptoms which included: headaches, fatigue, irritability, abdomina pain, sleep disturbance, nausea, dyspepsia and constipation. Various research workers have identified different types of effects on workers. In a study conducted in Jimma reported non-specific such as Depression, wrist drop, sleep disturbance, memory impairments, lack of appetite, nausea, concentration difficulty and constipation(Adela *et al.*, 2012b). These results concluded that toxic subs from the garages have severe ill effect on the health of the workers (Khan *et al.*, 2013).

The present study showed that there is a significant increase in workers systolic and diastolic blood pressures compared to control groups. Several studies report association between Lead exposure and elevations in blood pressure. (Dongre *et al.*, 2011; Pagliuca *et al.*, 1990; Schwartz, 1995; Hu *et al.*, 1996). The mean RBC count, hemoglobin level, hematocrit level and MCV value of Garage workers were significantly lower than those of the control group while mean white blood cells (WBCs) and platelets counts were significantly higher among Garage workers. Significantly decreased Hb, MCV, hematocrit, and RBC count in automobile workers may be due to decreased heme concentration or decreased erythropoietin hormone or decreased iron absorption or decreased maturation of RBC by Lead. Significantly increased total WBC count in these automobile workers could be due to more exposure to dust or fumes of Lead.

Regarding biochemical levels, serum AST and ALT were significantly higher in garage workers than controls while ALP was significantly decreased in workers than controls.

This result is in agreement with the other findings(Dioka *et al.*, 2004; Kapaki *et al.*, 1998). Increment of ALT and AST may indicate hepatocellular damage. Lead may accumulate in liver and expert its toxic effect via per oxidative damage to hepatic cell membranes causing transaminase to liberate into the serum (Aziz *et al.*, 2006). This study showed that uric acid level was generally increased in workers compared to controls. In contrast, urea was significantly decreased in workers than controls.

Serum urea reported to be decreased in gasoline station employees compared to controls(Kapaki *et al.*, 1998). This decrease may be referred to impairment of protein metabolism by Lead exposure as the urea is the end product of protein catabolism. Uric acid is the end product of the catabolism of tissue nucleicacid, i.e. purine and pyrimidine bases metabolism. The observed increase in uric acid concentration may be due to degeneration of purines and pyrimidines or to an increase of uric acid levels by either over production of the liver or in ability of excretion. It was shown that occupational exposure of humans subjects to Lead in petrol increases concentrations of uric acid in exposed subjects compared to unexposed groups (Dioka *et al.*, 2004).

5. Conclusion

Majority of the garage workers do not use any kind of Protective measures during work in the station. Substantial numbers of the workers were experienced smoking, drinking and eating at work place. There were many garage workers who have no knowledge regarding the route of Lead entry and health effects of Lead. Neither worker attended training courses nor they had health professionals visited their station.

There is a significant increasing in workers systolic and diastolic blood pressures compared to controls. The means of RBC count, hemoglobin level, hematocrit level and MCV value were significantly lower in garage workers compared to controls. In contrast, mean white blood cells (WBCs) and platelets counts were found to be significantly higher in workers than controls. The mean Serum AST, Total protein, glucose, total cholesterol, triglyceride, uric acid were significantly higher in workers than controls while ALP and Urea were significantly decreased in workers than controls.

6. Recommendation

- ✓ Appropriate protective equipment should be provided to all garage workers by the garage owners.
- ✓ Individuals working in the garage should avoid practice of eating, drinking, smoking, chewing chat at work place.
- ✓ The local health bureau should provide awareness and training to the garage workers about the potential adverse health effects of Lead exposure and the necessity of personal protective measure usage.
- ✓ The local health bureau and different concerned health professionals should develop and enforce strict regulations, instructions, guidelines of occupational health and safety to protect workers.

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17. Acceptance of Human Milk Donation for Banking and Use of Donated Milk for Infants Feeding Among Mothers Attending Public Hospitals in Eastern Part of Ethiopia

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Abstract: Every infant deserves the best possible start of life in terms of nutrition by breastfeeding. World Health Organization (WHO) recommends as second choose use of donated breast milk for infants who cannot receive breast milk from their own mothers. There was no evidence which showed acceptance of human milk banking for infant feeding in Ethiopia. The objective of this study was to assess acceptance of human milk donation for banking and use of donated breast milk for infant feeding among mothers attending four selected Public Hospitals in Eastern part of Ethiopia. Mixed types of study Methods were implemented by using descriptive cross-sectional study which was supplemented with qualitative method. The study was conducted among breast feeding and pregnant mothers who were attending four public hospitals in Eastern part of Ethiopia. To collect data related to Socio-demographic characteristics, maternal health care services use and acceptance of human milk banking for infants feeding, pretested interview based structured questionnaire was used. Qualitative data collection was done through focused group discussion (FGD). Collected data was checked for completes, interred into EPI-Info 7 then transported to SPSS version 20 for analysis. Descriptive statistics such as frequency table, percentage, graph and pie chart were used to report the results. Qualitative data was analyzed by using qualitative thematic data analysis through open coding techniques. This study revealed that, acceptability of donating human breast milk for banking was119 (11%) whereas willingness to use donated breast milk for infant feeding was 165 (15.2%). It also showed that acceptance of donating human breast milk was six times more likely (AOR=6.8; 95% 2.8, 16.8) among mothers who had ever heard about human milk banking than a counterpart. Even though, breast milk was seen as important nutrition for infants feeding, Participants believed that using others' breast milk would not be safe. Generally, this study showed that there was low level of acceptance of human milk donation for banking and use of donated milk for infant feeding. It was recommended that policy maker should introduce the services of human milk banking and further study should be conducted to explore more about acceptability of human milk banking.

Keywords: Human milk Banking; Donated Human breast Milk; Eastern part of Ethiopia

1. Introduction

All infants should start the best possible of life in terms of nutrition by breastfeeding. Evidence showed that donated human milk is the optimal nutrition of choice for the most fragile and vulnerable infants in Neonatal Intensive Care Unit (American 1997; UNICEF *2003;* WHO 2008; WHO 2009). It was indicated that breast milk is very important for the infant's growth, well-being and non-availability of the mother's breast milk should not deprive the infants from these benefits. Newborn infants cannot ingest formulas without undue stress, pain and gastric upset and some mothers were trying to breastfeed their babies with limited success due to surgery or medical illnesses. To enhance the use of breast milk for all babies, there is the need to embark on donated human milk banking (Al-Naqeeb NA ; Pediatrics ; Al-Naqeeb NA 2000; Pérez 2007; Pérez 2007).

Each year, 4 million babies were dying in the first four weeks of period. That was more than 10, 000 deaths a day. The greatest risk of death was at the very beginning of life; three-quarters of all neonatal deaths occurred within one week of birth, and at least one million babies died on their first day of life and the three major causes of neonatal deaths worldwide were identified as sever neonatal sepsis 36%, prematurity 28 % and birth asphyxia 23 % (Mekonnen Y ; Meneses 1016; Mekonnen Y 2013).

The WHO recommended that for infants who cannot get breast milk from their own mothers, the second opted choose should be donated breast milk (WHO 2011). Expressed, pasteurized donor breast milk is not the same with fresh mother's milk, because of pasteurizations and decomposition process. However, still processed human breast milk consists enough bioactivity and immune-logical properties. Particularly, when gestational age of the donor's matched with the recipient infants and donated breast milk is superior to formula (Meneses 1016; Meneses, Oliveira et al. 1016; Springer, Beyreiss et al. 1990; SpringeSpringer 1990; McGuire and Anthony 2001; WHO 2003). Importance of breast milk for infants' growth, development and overall health was widely recognized and it was also stated that, breast milk is very vital for preterm, low birth weight and other vulnerable infants (McGuire and Anthony 2001; WHO 2009).

In Ethiopia, high Neonatal Mortality Rate (NMR) had persisted. In spite of many efforts made by the government and other stake holders, NMR reduction was remained very sluggish in the last 15 years. NMR for the years 1991–1995, 1996–2000, 2001–2005 and 2006–2011 were 46, 42, 39 and 37 per 1000 live births, respectively. Moreover, about 63% of infant deaths in the country occur during the first month of life (Agency 2011; Mekonnen Y 2013).

The country has implemented pro-poor policies and performed better than other Sub-Sahara Africa (SSA) countries. This was achieved through concertedly sound strategies and adequate partnership in support of maternal, newborn and child health (MNCH) services. However, challenges still remain; according to 2011 Ethiopian

Demographic and Health Survey (EDHS) report, NMR was accounted for 42% of Under-five mortality rate (U5MR)(Agency 2011; Mekonnen Y 2013).Therefore, to tackle these problems implementing multiple strategies such as promoting breast feeding and availing donated human breast milk are very vital. In some situations, provision of human breast milk is only feasible by encouraging donated milk. These special situations are encountered when preterm and very–low birth weight infants lost their mothers, if mothers has open pulmonary tuberculosis, on cancer chemotherapy and HIV positive HIV mothers need a substitute for their infants feeding (American 1997; Arnold 2006). To fulfill the need of this population, an establishment of donated human milk bank is very crucial. In Ethiopia, there was no study conducted on this topic. Even in Africa, only limited studies were conducted on acceptance of donated human milk for infants feeding (Eksioglu, Yesil et al. ; Emilie Azema **2003;** Arnold 2006). Hence, these conditions were prompted us to conduct study on acceptance of human milk donation for banking and its use for infants feeding among mothers who were attending selected public hospitals in eastern part of Ethiopia.

2. Methods and materials

Study Setting and Period

This study was conducted from December, 2015–February, 2016 among breast feeding and pregnant mothers who were attending four selected Public hospitals in eastern part of Ethiopia. Specifically, Hiwot Fana Specialized Teaching Hospital and Jugola Hospital which are found in Harari Regional State and situated 517Km away from Addis Ababa, Dil Chora Referral Hospital that is located in Dire Dawa City Administrative which is 527 km away from capital city and Karamara General Hospital which is found in Jigjiga City 635 km away from Addis Ababa.

Hiwot Fana Hospital was established during the Italian occupation of Ethiopia (1936-1941 GC) to serve Italian soldiers. Since then, the Hospital has been serving local people under the administration of Harari regional state. However, starting from 2010 Haramaya University has taken responsibilities of administration and service provision of this Hospital. After that, it was named as Hiwot Fana Specialized Teaching Hospital. With regards to services, this had a total of 210 beds in eight different wards (Obstetrics and gynecology, Surgical, Medical, Pediatrics, and Adults ICU (intensive care unit), Psychiatry, and Nutrition ward offering the service for more than 154,196 patients a year. Jugola Hospital is also one of public Hospital which is located in Harar Jugol Walls and it has total number of 130 beds in different wards, and providing services for more than 90,000 patients a year (Harar ; Harari 2015).

Dil Chora Hospital which is located in Dire Dawa city administrative was established in 1952 GC and since then it has been serving the local community. This hospital has about 190 beds distributed in different wards or Units (Obstetrics and Gynecology, medical, psychiatry, surgical, orthopedic, ophthalmic, and pediatric and ICU wards).The Hospital offer service for more 91,250 patients a year as inpatients and outpatients(Dil Chora ; DilChora 2011).

Karamara Hospital is found in Jigjiga City. The hospital had about 130 beds distributed in different wards such as a surgical, medical; Pediatrics, Obstetrics and Gynecology wards and it also provide service such as MCH service, and NICU in the region. Moreover, the Hospital offer service for more than 90,500 patients per year.

Study Design

A mixed type of study design was implemented by using cross-sectional study design supplemented with qualitative method

Source Population

All mothers who were attending, under-five out patients, Maternal and Child healthcare (MCH), Antenatal Care(ANC), Postnatal Care (PNC), Expanded programme of immunization (EPI), Family planning (FP), Delivery and Neonatal Intensive care unit (NICU) services at four selected public Hospitals in Eastern part of Ethiopia (Hiwot Fana Specialized University Hospital, Dilchora, Karamara and Jugola Hospitals(Wikimapia 2009).

Study Population

All breast feeding or pregnant mothers who were attending under-five outpatient departments, MCH (ANC, PNC, EPI, and FP), Delivery and Neonatal Intensive care unit (NICU) services at four selected public hospitals in eastern part of Ethiopia during the study period.

Study Subject

All breast feeding or pregnant mothers who were selected by systematic random sampling mothed among mothers attending under-five outpatient departments, MCH (ANC, PNC, EPI, and FP), Delivery and NICU services at four selected public Hospitals in Eastern part of Ethiopia during the study period.

Inclusion and Exclusion Criteria

Inclusion criteria

- All breast feeding or pregnant mothers.
- All who were referred from other health facility to selected area during the study period included.

Exclusion criteria

- Critically ill mothers who cannot responds to survey questionnaire.

Sample Size Determination

Study which was conducted in Nigeria in 2014 showed that 59.1% of study subjects strongly agreed that human milk banking would help assist mothers in need, orphans and abandoned babies (Ighogboja, Olarewaju et al. 1995).. Based on this evidence sample required for this study was calculated as follows.

Where:-

- ✓ n=required sample size
- ✓ Z =1.96 (critical value of 95 % CI)
- ✓ P=proportion of getting positive response
- ✓ q=proportion of not getting positive response (1-p)
- ✓ d=possible margin of error (d=3%)

d =3% is considered to get a possible largest sample size for this survey.

$\mathbf{n = \frac{Z^2 \times pq}{d^2}}$: - $\mathbf{n = \frac{1.96^2 \times 0.59 \times 0.41}{0.03^2}} \approx$ 1,033 and by considering 5% non-response rate total sample size required for this study will be about 1,085.

Sample size determination for qualitative study was based on the rule of thumb. Depending on this rule evidence showed that members of focused group discussions (FGDs) vary between 5-10 participants. In addition, by using point of saturation for ideas total of six FGDs were conducted among breast feeding and pregnant mothers attending selected public hospital and this groups were composed of different members. Of total groups, four were composed of five mothers and one group was formed from seven mothers and the rest consisted of six mothers. Thus, a total of 33 mothers were involved in FGDs for qualitative study.

Sampling Procedure

This study was conducted among four public hospitals located in eastern part of Ethiopia. Particularly located in Harari regional state, Dire Dawa administrative city and Jigjiga city. In this area, there were four public hospitals which provided Neonatal Intensive Care Services namely, Dil-Chora, Karamar and Jugola Hospitals and Hiwot Fana specialized Teaching Hospital. These were purposively selected based on the services they provided.

Based on an average monthly patient follow at under-five outpatient departments, MCH, delivery and NICU in these hospitals total sample size of 1,085 was allocated for each hospital based on population proportion formula. Finally, the study subjects were selected by using systematic random sampling mothed for quantitative study considering Calculated K-value of five. Hence, in each hospital every five mother who fulfil the inclusion criterion was interviewed by selecting the first mother to be interviewed by lottery mothed.

For qualitative study purposive types of sampling technique was implemented to select breast feeding or pregnant mothers who were attending selected public Hospital during the study period.

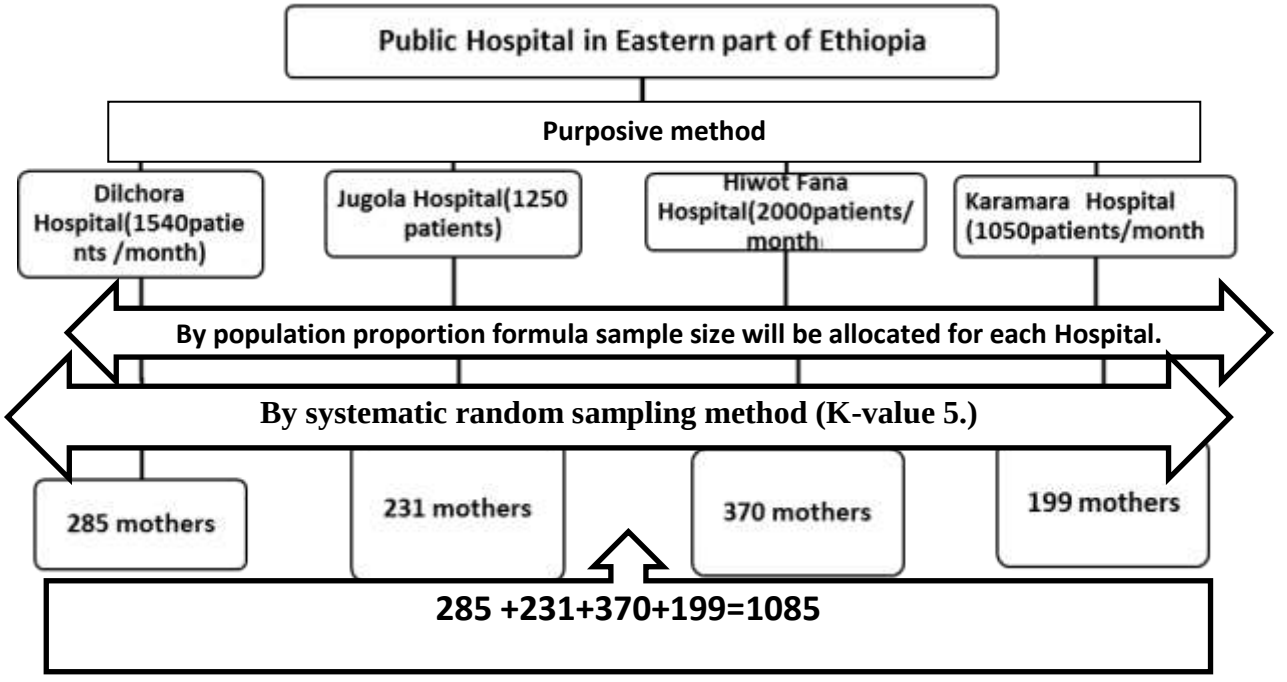

Figure 1. Schematic representation of sampling technique.

Data Collection Methods and Tools

To assess the study subjects' Socio-demographic characteristics, maternal health care services use and acceptance of human milk banking for infants feeding among mothers attending public hospitals as potential donors of breast milk for banking in the study area; pretested interview based structured questionnaire was used. Data was collected by eight trained nurses who were working in four selected public hospitals in eastern part of Ethiopia.

For qualitative study, FGDs method of data collection was used. Key points of discussions were used as open-ended questions to guide the discussions. One trained M.Sc nurses were used as modulator for directing the discussions. During this FGD, data were recorded by using tape recorder and a note was taken by investigator. The length of time for every group discussion was determined by follow on ideas and the maximum length of time for discussion was two hours. The topics or themes which were used to guide the group discussion were; *awareness of mothers towards human breast milk banking*, *importance of human breast milk banking and acceptability of donating human breast milk for banking and use of donated breast milk*. Each group discussion begun with explanation of the purpose of the study and obtaining informed consent for participation. A discussion of every group was structured as; beginning of discussion (getting peoples talking, relating experiences and ideas), middle of the discussion (Helping people to focus by asking them more specific questions on the topics) and ending of discussion (completing group task).

Data Quality Control

Data collectors were given two-day intensive training on the content of data collection tools and how to interview study subjects. Pretest was conducted at Haramaya District hospital on five percent of total sample size. Questionnaire was prepared in English and translated into local language for an interview purpose and back to English language for the data analysis purpose. Daily collected data were checked for completeness and a possible error was returned to the data collectors for correction.

For qualitative data collection, research teams were reviewed the guiding questions for face validity. It was pilot-tested with two individuals and modified based on these pilot discussions to create the final version of guiding question used for discussions. Modulator of group discussion was trained on the topics or themes which guide the discussion. All discussions were conducted in local language (Afan Oromo, Amharic, and Somali). The participants' seats were adjusted as U-shape, with each participant visible to each other's, and the modulator was seated at the head of the table, in front of the participants. For recording purpose, tape recorder was behind the modulator. Qualitative data was mainly obtained through tape recording, which is fundamental to assure the quality of the data. Moreover, during discussion text note was taken by investigator/s.

Data Analysis and Processing

Collected quantitative data were checked for completeness, coded and entered into EPI –Info 7 and transported to SPSS version 20 for analysis. Then, data were cleared, for internal consistency and result was presented by using different statistical summary method such as, frequency tables, graphs, charts, proportion, mean, and standard deviation. Level of acceptance of human milk banking in this study was calculated based on maternal willingness to donate breast milk for human milk banking and/or willingness to use donated human breast milk for infants feeding.

For qualitative data, thematic analysis method was used. Following every group-discussion, tape-recording was transcribed and translated into English language or Verbatim and typed transcripts were created from the digitally recorded interviews. Data (transcripts) was coded by using Open Code software. Finally, all verbatim with same they were collected together and interpreted.

Variables of the Study

Dependent variable

Acceptance of human milk donation for banking

Acceptance of using donated human breast milk for infants feeding

Independent Variable

- Socio-demographic characteristics of mothers.
- Health care service use of mothers
- Awareness of mothers about breast milk banking

Operational Definitions

- **Human Milk Banking: -** Is a service which collects, screens, processes, and dispenses human milk donated by nursing mothers.
- **Acceptance of human breast milk donation for banking: -**Is willingness to donate human breast milk for banking.
- **Acceptance of donated human milk for infant feeding**: -Is willingness to use donated human breast milk for infant feeding.
- **Awareness towards Human milk banking: -**Is Mothers' Knowledge or perception towards human breast milk banking.
- **Breast milk Donation:-** Is the act of lactating mothers to give breast milk for human milk banking
- **Use of donated breast milk:-**Is the act of willing to feed donated breast milk for infants.
- **Eastern part of Ethiopia: -**Is Refers to Dire Dawa Administrative city, Harari and Somale regional states.
- **Wet Nurse**: - Refer a mother who breast feeds and cares for another's child.

Ethical Consideration

Ethical clearance was obtained from Haramaya University, Institutional Health Research Ethics Review Committee (IHRERC). Formal letter was submitted to all concerned bodies in the study area to get their co-operation in facilitating the study. The interviewers were explained about objectives, benefit and risk of the study to obtain oral consent from study participants prior to data collection. The study participants did not get direct benefit from this study but the outcome of this study can give very helpful information to make decision about the establishments of Human Milk Banking in this study area. Risk related with this study was very minimal; study subject who were participated in this study only lost some minute needed for interviews. The information, which the study participants provided us, will be confidential. There was no information that could identify them. The findings of study were general for the study population and not reflect any thing particular of individual person. The questionnaire was coded to exclude showing names; no references were made in oral or written reports that could link participants to the research. Participation in this study was voluntary. The study participants had given the right to declare not to participate in this study and informed the right to with draw from the study at any time.

3. Results

Demographic Characteristics of Participants

Among the total participants, 594(54.7%) were involved from MCH unit. The mean age of study participants was found to be 27.7 years with standard deviation of 4.7 years and 746 (68.8%) of participants were from urban dwellers(Table1).

Table 1. Socio-demographic characteristics of mothers participated in assessment of acceptability of human milk banking in public hospital in eastern Ethiopia, 2016 (n=1085).

Variables	Frequency	Percepts (%)
Resident		
Urban	746	68.8
Rural	339	31.2
Name of visited unit/wards		
MCH	594	54.7
Delivery	164	15.1
Pediatrics	165	15.3
NICU	162	14.9
Ethnicity		
Oromo	428	39.4
Amphora	241	22.2
Somali	218	20.1
Harari	105	9.7
Tigre	35	3.2
Others	58	5.3
Age in years		
18-34years	984	90.7

35-48 years	101	9.3
Religion		
Orthodox	302	27.8
Muslim	711	65.5
Protestant	57	5.3
Catholic	15	1.4
Maternal educational status		
Illiterate	269	24.8
Literate	816	75.2
Maternal occupation		
House wife	584	53.8
Farmer	62	5.7
Trading/merchant	135	12.4
Covent Employed	195	18.0
Private Employed	92	8.5
Daily laborer	17	1.6
marital status		
Married	1037	95.6
Unmarried	23	2.1
Divorced	17	1.6
Widowed	8	0.7
Husband educational status		
Illiterate	156	14.7
Literate	904	85.3
Husband occupation		
Farmer	280	26.6
Government employed	385	56.6
Trading /Merchant	212	20.1
Private employed	122	11.6
Daily laborer	54	5.1
Monthly income in Birr		
=<1000	166	15.3
1001-2500	276	25.4
>=2501	643	59.3
Total	1085	100

Maternal Characteristics and Health Care Services Use

Regarding to maternal characteristics and their health care services use, among total participants, 902 (83.1%) had at least one ANC visit during pregnancy and 913 (84.2%) of mothers give birth at health facilities. Concerning breast feeding counseling, 567(62.9%) were counseled about breast feeding during ANC visits (Table2).

Table 2. Maternal characteristics who participated in assessment of acceptability of human milk banking in public hospital, Eastern part of Ethiopia, 2016 (n=1085).

Variables	Frequency	Percent (%)
Number of pregnancy		
1-3	778	71.7

4-6	257	23.7
7-12	50	4.6
Number of life birth		
1-3	827	76.2
>=4	258	23.8
ANC Visits		
Yes	902	83.1
No	183	16.9
Number of ANC Visits		
1-3 ANC Visits	486	53.9
>=4 ANC Visits	416	46.1
Counseling of BF at ANC Visits		
Yes	567	62.9
No	335	37.1
Birth place of last child		
Home	172	15.9
Health center	235	21.7
Hospital	678	62.5
PNC visits		
Yes	346	31.9
No	739	68.1
Number of PNC visits		
1-2PNC Visits	222	64.2
>=3 PNC visits	124	35.8
Counseled on BF during PNC Follow Up		
Yes	322	92.3
No	27	7.7
Visit under-five OPD during last baby		
Yes	881	81.2
No	204	18.8
Advised about BF at under-five OPD		
Yes	579	65.7
No	302	34.3
Total	1085	100

Awareness and Acceptability of Donating Human Breast Milk for Banking and Use Of Donated Milk

With regard to maternal awareness about human milk banking, from total participants only 108(10%) had ever heard about human milk banking (HMB), concerning the sources of information, from total participants who had ever heard about HMB, 61 (41.8%) were heard it from health professionals and 59(40.4%) heard from media (Fig1).

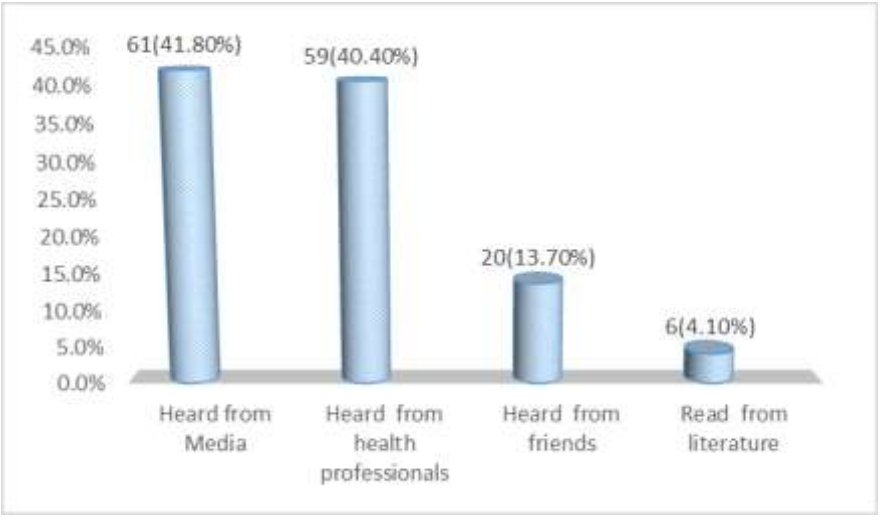

Figure 2. Reported sources of information about Human Breast Milk Banking among mothers attending public Hospitals in eastern part of Ethiopia, 2016.

From the total study participants, 832(76.7%) were currently breast feeding, 242(22.3%) and 108(10%) ever heard about wet nurse and HMB, respectively. With regards to willingness to donate breast milk for banking and use of donated milk for infants feeding, 119 (11%) of the total participants had willingness to donate breast milk for banking whereas 165 (15.2%) of study subjects had willingness to use donated breast milk for infant feeding (Table3).

Table 3. Awareness and Acceptability of donating human breast milk for banking and use of donated milk for infants feeding among mothers attending public Hospital in Eastern Part of Ethiopia, 2016.

Variables	Frequency	Percent (%)
Currently BF		
Yes	832	76.7
No	253	23.3
Any condition that ever limit from BF		
Yes	43	4.0
No	1042	96.0
Condition that limited mothers from BF		
Absences of mothers or Mothers' illness	20	1.8
Lack of breast milk	23	2.1
Alterative feeding used by mothers		
Infant formula was used as option	41	3.78
cow milk was used as option	18	1.65
Soft food made of cereals, porridge	17	1.56
Ever heard about wet nurse		
Yes	242	22.3

No	843	77.7
Ever heard about HMB		
No	977	90.0
Yes	108	10.0
Ever experienced BF to others' baby		
Yes	28	2.6
No	1057	97.4
Reason to BF for others' baby		
Mothers illness	23	82.1
Maternal death /mother not with baby	5	17.9
Willingness to donate breast milk for banking		
Yes	119	11.0
No	966	89.0
Willingness to use donated breast milk for infants feeding		
Yes	165	15.2
No	920	84.8
Total	1085	100

Regarding reasons of willingness to use donated breast milk for infants feeding, from 165 (15.2%) participants who had willingness to use donated breast milk for infant feeding, 134 (35%) had said that they accepted to use donated milk because infant formula is expensive and 79 (21%) of the mothers mentioned reasons of acceptance to use donated breast milk was its' advantage to prevent diseases (Fig 1).

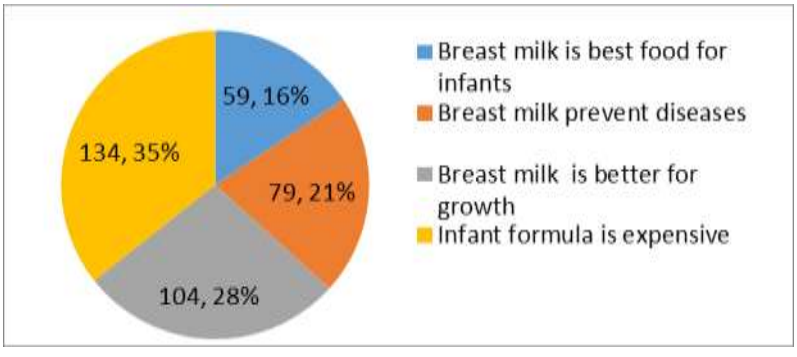

Figure 3. Reported reasons of willingness to use donated human breast milk for infants feeding among mothers attending public Hospitals in Eastern Part of Ethiopia, 2016.

Among mothers who had willingness to donate breast milk for banking ,77 (35%) had said that they accepted to donate breast milk for banking to help infants who are in need of, and 65 (28.3%) of the mothers mentioned that reasons of their willingness to donate breast milk was having excess breast milk (Fig 2).

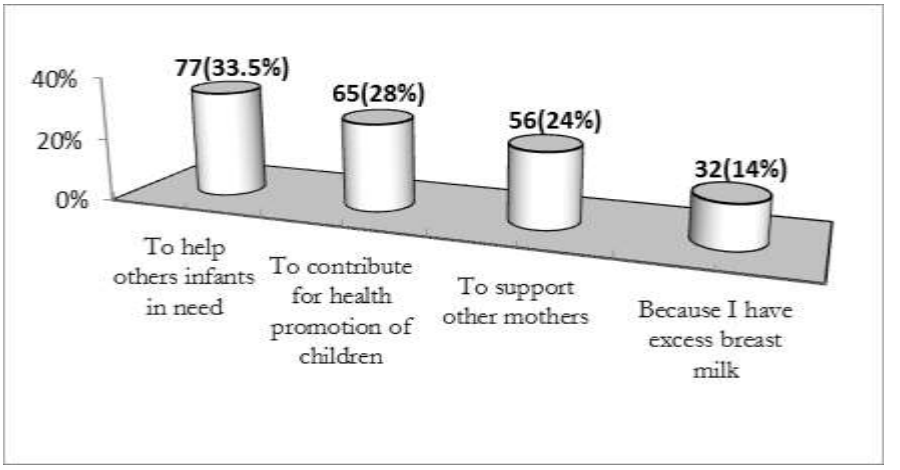

Figure 4. Reported reasons of willingness to donate human breast milk for banking among mothers attending public Hospitals in Eastern Part of Ethiopia, 2016.

With regard to reported reasons of unwillingness to donate breast milk for banking and use donated human breast milk for infants feeding, 746(68.6%) of the participants responded as not to donate or use donated breast milk because they fear transmission of diseases, 476(43.9%) of the respondents reported that the milk collection might be unhygienic(Table 4).

Table 4. Reported reasons of unwillingness to donate and use donated human breast milk for infants feeding among mothers attending public hospitals in Eastern part of Ethiopia, 2016.

Variables	Frequency	Percent (%)
Reasons of unwillingness to donate		
Fear of transmission of diseases to baby		
Yes	746	68.8
No	339	31.2
Fear of genetics mix		
Yes	134	12.4
No	951	87.6
Preference of infant formula		
Yes	137	12.6
No	948	87.4
Unhygienic		
Yes	476	43.9
No	609	56.1
Spouse and family not support it		
Yes	91	8.4
No	994	91.6
Fear of not having enough breast milk for my baby		
Yes	556	51.2

No	529	48.8
Do not like the idea		
Yes	517	47.6
No	568	52.4
Not accepted in our religion		
Yes	207	19.1
No	878	80.9
Not accepted in our culture		
Yes	159	14.7
No	926	85.3
Spouse and family not like it		
Yes	98	9.0
No	987	91.0
Breast sagging		
Yes	9	0.8
No	1076	99.2

Table 5. Bivariate and multivariate multivariate logistic regression analysis showing acceptance of human milk donation and it associated factors among mothers attending public Hospital in eastern Ethiopia, 2016.

Explanatory variables	Outcome variable		COR (95%CI)	AOR(95% CI)
	Acceptance of HBM donation			
	No	Yes		
Maternal educational status				
Illiterate	252	17	1	
Literate	714	102	2.1(1.2,3.6)	3(0.65,13.9)
ANC Visits				
No	174	9	1	
Yes	792.	110	2.7(1.3,5.4)	
Counseling of BF at ANC Visits				
No	305	30	1	
Yes	567	80	1.7(1.1,2.6)	0.88(0.29,2.6)
PNC Visits				
No	670	69	1	
Yes	296	50	1.6(1.1,2.4)	0.9(0.4,1.9)
Number of PNC visits				
1-2 PNC Visits	196	26	1	
>=3 PNC visits	100	24	1.8 (1,3.3)	1.1(0.2,5.2)
Ever experienced BF to others' baby				
No	944	111	1	
Yes	20	8	3.4(1.5,7.9)	1.8(0.7,4.4)
Ever heard about wet nurse				
No	788	55	1	
Yes	178	64	5(3.5,7.6)	1.8(0.73,4.4)
Ever heard about HMB				
No	898	79	1	

Yes	68	40	6.7(4.2,10.5)	6.8(2.8,16.8) *

**Significant at P <0.001, human breast milk (HBM)*

Qualitative Results Extracted from Focused Group Discussion (Fgds)

For this study, qualitative data were extracted from five FGDs which were held at two Hospitals in Harari Regional State (Jugola Hospital and Hiwot Fana Specialized Teaching Hospital). Total of 26 mothers were participated in five different FGDs (Table 4). The participants discussed about *ways of infants feeding*, *importance of breast feeding*, *human breast milk banking*. Moreover, they also discussed about the *importance of Donated human breast milk*, *acceptability of donating breast milk for banking and using donated breast milk for infant feeding*. Most of the discussions focused on the importance of human milk banking or donated breast milk and acceptability of donating breast milk for banking and its acceptability for use.

Table 5. Characteristics of Mothers participated in FGD held in Jugola and Hiwot Fana Specialized University Hospital, 2016.

Sr.	Group (G)	Number of participants	Mean age in years
1.	G-1	5	20
2.	G-2	5	22
3.	G-3	4	23
4.	G-4	5	21
5.	G-5	7	24
Total	5	26	

Ways of Infants Feeding

With regards to ways of infants feeding, majority of the participants stated that,

"*Up to six months of age, infants should feed only breast milk*." Most of mothers also said that, "*during this age baby's hygiene should be kept by giving bathe for baby and washing baby's clothes".*

Particularly, a mother of 20 years old said that,

"Baby must feed only breast milk until six months and after that, baby can start additional food such as Pasta, macaroni, dry milk or powdered milk or cow milk."

On this discussion, one participant said that,

"If my own breast milk is not enough I give to my baby other food such as, dry milk or powdered milk or cow milk using bottle.

They also mention that,

"If Mother Breast milk is not enough to feed baby we can use other product such as formula milk or cow milk to feed infants."(20 and 21 year old mothers)

Other opinion which was raised by 23 years old Mothers from group was,

"We can feed our baby breast milk or cow milk by using bottle, until baby starts other foods."

Importance of Breast Feeding

On the importance of breast feeding, most of participants stated that, breast milk is good for the health and growth of infants. On this point, 20 years old mother said that,

"Baby can get good nutrition from breast milk. For example, baby can get Vitamins from breast milk and it is useful for growth."

They also mentioned that, *"breast milk is useful to prevent hunger."*

A 21 years old mother stated that, *"Breast milk is food for infants."*

With this point, 27 years old mother was stated that,

"Breast feeding is signs of healthy for mothers and it can prevent baby from different diseases."

Awareness about Human Breast Milk Banking

Another remarkable discussion points in this investigation was participants' awareness about Human Breast Milk Bank or Donated Human Breast Milk. On this issue, most of participants stated that,

"We do not know about Human Breast Milk Banking or Donated Human breast milk."

But when they are asked about using other mothers' breast milk for infant feeding, majority of participants claimed that, "*It is not safe to use others breast milk for infants feeding."*

Particularly, one mother said that*, "Giving other mother's breast milk to infant was there if baby's mother died or seriously sick and this is only possible if they have blood relationship. For example, I can feed to my sister's baby otherwise it is not possible."*

Mother of20 years old stated that, "*I do not understand about Human Breast milk banking."*

On this discussion point, a 21 years old mother stated that,

"I have heard about donated human milk for infant feeding from other countrysuch kindsof practices is specially presents in orphanage but in our country there were no such kinds of practice."

Acceptability of Donating Human Breast Milk for Banking and Use of Donated Milk for Infants Feeding

On donating breast milk for banking and using a donated breast milk for infants feeding, the most common feared problems were safety issue specially transmissions of different diseases through donated milk. Some of the participants also stated that, religion was other issue which may prevent them from using donated human breast milk for infant feeding. Majority of the participants revealed that, they do not like the ideas.

Mothers of 23 years old stated that,

"I feared about transmissions of different diseases through donation and use of donated human breast milk for infant's feeding. Especially diseases such as HIV can be transmitted to baby through."

When they were asked about the use of donated human breast milk for infant feeding, most of the participants claimed that, on acceptability of using donated breast milk for infant feeding a 21 year old mother stated that,

"It is not acceptable to use others breast milk for infants feeding because it is not good and the milk may expire by itself." (21 and 20 years old mothers)

A 20 years old mother said that, *"I do not like to donate my breast milk for other infants, because I do not think that my breast milk is good for other baby."*

On this issue, a 21 year old mother had stated that,

"It is not good to feed others breast milk for my baby because there are some diseases such as "GOLFAA and FINNISA" Cancer and Acne which can be transmitted to baby through breast milk."

Another mother revealed that,

"I had information about wet nurse but this is only possible if we have blood relation with baby's family."

"I will not give other mothers' breast milk to my baby; rather I prefer other feeding such as cow milk or formula milk than donated milk." (20 and 22 years old Mothers) and others also claimed that, *"It is not right to feed others breast milk for infants even if baby cannot get his mother breast milk it is better to feed formula or cow milk by bottle."*

One of the reasons for not accepting to donate and use of donated breast milk for infant feeding was religion issue. This point most participants said that,

"In Muslims religion we do not support to feed others mother breast milk for our infants. Because it is prohibited."

Despite the above responses, some of participants stated that,

"It is good to donate breast milk for those babies who will not get their own mothers' breast milk."

On this issue a 27 years old Mother stated that,

"If breast milk is left from my baby or if I have excess breast milk, I will give it for other baby who cannot get his mother's breast milk. I do this because it good this to support others baby."

Other mother also suggested that, "*It is good idea to donate breast milk for other baby if we have enough milk. For example, a mother next my bed in this hospital (Hiwot Fana Specialized University Teaching) has breast milk to feed for her baby because she is sick for this kinds of baby happy to donate."*

On the same point 23 years old mother stated that,

"*Especially if the health of donor mother is checked donating breast milk will be solution for those mothers will not able to feed for their baby."*

4. Discussion

In Ethiopia, no study was conducted on acceptability of human breast milk donation for banking and its use for infants feeding. Moreover, services of human milk banking were not practiced in this country. Thus, the current study attempted to uncover about acceptability of human breast milk donation and its use for infants feeding.

In this study, only 11% of mothers were willing to accept donation of breast milk for banking and 15.2 % of them would accept to use donated breast milk for infants feeding. This finding indicated that level of acceptance of breast milk donation and use of donated breast milk for infants feeding were low. In line with current study, which was conducted in Nigeria showed low level of acceptance of breast milk donation and its use (Abhulimhen-Iyoha BI 2014).This low level of acceptance of breast milk donation and its use for infants feeding in developing countries might be related with lack of awareness about donated breast milk process and its safety. In current study, the major reasons mentioned for unwilling to donate breast milk for banking were, **f**ear of transmission of diseases,

This finding was lower than the study conducted in Nigeria which reported that level of breast milk donation as 39.9% (Abhulimhen-Iyoha BI 2014). This might be related with level of maternal awareness on human breast milk donation in previous study. In current study, among the mothers who were willing to donate breast milk, 14% of them stated that reasons of accepting donation of breast milk were to help other infants who are in need of. This finding was also lower than study which was conducted in France among eight human milk banks that indicated about 40% of reasons for milk donation was to help others (Emilie Azema, 2003). The discrepancy might be related to level of awareness or knowledge as there were many breast milk banking services were located in prior study area.

In this study, 165 (15.2%) of mothers reported that they have willingness to use donated breast milk for infant feeding. This finding was comparable with study which was conducted in Nigeria (Abhulimhen-Iyoha BI 2014). The study also revealed that, among mothers who accepted the use of donated breast milk, 134 (35%) of the participants reported the reason of acceptance breast milk is best diet for infants. This result was lower than finding reported from France, which reported, 76.9% of the participants accepted donated breast milk because breast milk is best diet for infants feeding. The variation of this reported reasons might be related to maternal awareness about human breast milk banking which is lower in the current study.

With regards to refusal to use donated breast milk for infant feeding, 746 (68.8%) of the participants reported that reasons of refusal were fear of transmission of disease to baby. This finding was lower than study reported from Nigeria which stated main reason of refusal was fear of transmission of diseases (84.6%) (Abhulimhen-Iyoha BI 2014).The discrepancy contributed to mother's knowledge about risk of body fluid like breast milk for transmission of infection. In addition, other reasons of refusal for use of donated breast milk for infant feeding were reported as fear of unhygienic handling of breast milk (43.9%) and fear of not having enough milk for their own baby, (51.2%) were higher than the previous study reported from Nigeria. These differences might also be related to poor maternal awareness or knowledge about milk production can increase with more expression of breast milk.

This study showed that mother who ever heard about human milk banking, accept donation of human breast milk six times more likely (AOR=6.8; 95% 2.8, 16.8) than who did not heard about it. This may be related to the fact that mothers who heard about human milk banking have better awareness about the advantage of donated human breast milk for infants feeding.

To explore more about participants feeling towards HMB or donated human breast milk, and its acceptability for infants feeding this study was supplemented with qualitative study.

In this study, human breast milk donation and its use for infants feeding is not generally accepted. Majority of participants stated that they would not donate breast milk for banking and most mothers would not accept donated breast milk for infants feeding. With regards to reasons of unwillingness to use donated breast milk for infants feeding, most of them stated that,

"We feared about transmissions of different diseases through donation and use of donated human breast milk for infant's feeding. Especially diseases such as HV can be transmitted to baby through."

This is the fact that many people have information or awareness about transmission of different diseases including HIV can occur through body fluid such as human breast milk. With regards to human milk donation services the standard of infection prevention must be the first issue to be answered or standard of safety for breast milk donation should be assured before starting of these services. On the other hand, fear of the people to share breast milk for other baby is related with their knowledge about safety assurance.

In this study, other reason of refusal which was motioned by mothers was related with religion issues. Some of mothers stated that,

"we had information about wet nurse but this is only possible if we have blood relation with baby's family. I will not give other mother's breast milk to my baby; rather I prefer other feeding such as cow milk or formula milk than donated milk." (20 and 22 years old Mothers) and others also claimed that,

"It is not right to feed others breast milk for infants even if baby cannot get his own mother breast milk it is better to feed formula or cow milk by bottle."

In this case the participants mention that to give others breast milk for the baby, there should be blood relationship and it was mentioned as other feeding was better than donated breast milk.

Even though majority of the participants had not supported the idea of breast milk donation for banking and its use for infants feeding, few mothers had supported the idea of breast donation for banking and its use for infants feeding. Some mother said that,

"It is good idea to donate breast milk for other baby if we have enough milk because there are some mothers who may not feed their own baby because of different reasons. For example, a mother next to my bed in this hospital (Hiwot Fana Specialized University Teaching) has problems to feed breast milk for her baby because she is sick. So for these kinds of baby it is good to donate."

This is the fact that study participants who had information or awareness about the process and safety of donated breast milk accept donation of human breast milk and it's for infants feeding.

5. Conclusion

In conclusion, this study showed that the acceptance of human breast milk donation for banking and use of donated breast milk for infants feeding in this study area was very low. Mainly, reported reasons of refusal were transmission of diseases from the donator and safety of breast donated milk. Even though nutritional value of human breast milk is very high for infants, most participants had refused idea of human breast milk banking for those infants who lack their mothers' breast milk. In all few participants have accepted the use of human breast milk donation.

6. Limitation of the study

This study was descriptive cross-sectional which may not cover all factors that affect acceptability of human milk banking in the study area.

7. Recommendation

As this study was the first study conducted in Ethiopia and there was no services of human milk donation, the following recommendation are suggested for policy makers and researchers.

Ministry of Health:

- ✓ Should arrange health education human milk donation.
- ✓ Should introduce the service of human breast milk banking in our country to support those babies who cannot get their own mothers' breast milk.
- ✓ Should develop protocol for human milk donation.
- ✓ Should develop safety protocol for human milk donation and banking
- ✓ Should plan for research at national level on safety and acceptability of human milk donation.

Researchers:

- ✓ Further study should be conducted on safety and acceptability of donated human milk banking.

Hiwot Fana Specialized Teaching Hospital, Jugola, Dilchora and Karamara Hospitals:

- ✓ Should arrange health education on milk donation and banking to create awareness about human milk banking among lactating mothers.
- ✓ Should develop standard protocol for human milk donation and banking to support those infants who cannot get their own mother's breast milk

Dissemination of the Result

- ✓ The finding of this study was summited to Haramaya University, Harari region, somale region and Dire Dawa administrative city Health bureaus.

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