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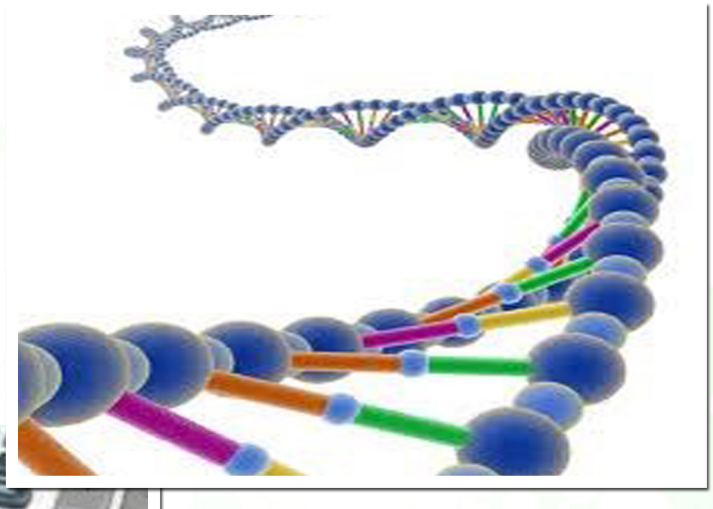

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1. Anemia and its Associated Factors among Haramaya, and Dire Dawa University Regular Students, Eastern Ethiopia

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Abstract: Anemia is a common blood disorder associated with abnormal decrease in number of red blood cell or less than the normal quantity of hemoglobin in the blood. According to World health Organization (WHO), an estimated 150 million individuals in the Eastern Mediterranean Region suffer from some type of anemia. University student are classified under the vulnerable group that suffer from anemia because of having long schedule of studying in college, and other curriculum activities. Their living in the university away from their families is reflected upon their diet habits. This study focused on estimating the prevalence of anemia among university students and classifies anemia severity according to hemoglobin concentration. The objective of this study was to assess the prevalence and determinants of anemia among Haramaya and Dire Dawa university regular students from May 20 - June 20/ 2015.A cross-sectional study design was conducted on 895 Haramaya University students from Main, Harar, and Chiro Campus and Dire Dawa University students. A multi-stage sampling technique was used. First students were stratified by their collage then by their department then by year of study and sex.Then study participants were selected by simple random sampling method by using proportion to population size. The collected data were coded, entered, and cleaned through Epi. Info version 3.5.4 and then exported for analysis to SPSS version 20.0.Chi-square test, and OR was used to compare the strength of association between variables. P-value less than 0.05 was considered statistically significant. Total of 895 students 525(59%) and 370(41%) from Haramaya and Dire Dawa University, respectively were enrolled in this study. Out of 895 students, 73% were males, whereas, 27% were female. The overall prevalence of anemia among Haramaya and Dire Dawa university students of both sexes 9.8%. That mean out of 895 study participants 88(9.8) of them were anemic. The overall average Hb was 15 gm/dl ± 1.95. Out of 88 anemic students 43 of them were male, and the remaining 45 were female. Among male study participants, 6.6% of them were anemic whereas among female study participants, 18.6% of them were anemic. So in our study anemia was more common in female than male university student.

1. Introduction

1.1. Background

Anemia is a common blood disorder associated with abnormal decrease in number of red blood cell or less than the normal quantity of Hg in the blood. Anemia remains a serious public health challenge worldwide. According to World health Organization (WHO), an estimated 150 million individuals in the Eastern Mediterranean Region suffer from some types of anemia. There are many causes for anemia; these causes may simply be attributed to acquired or congenitaldis-orders. Iron deficiency anemia is the most frequently acquired Nutritional Anemia And Over 2 Billion People-I.E., Nearly One Third- Throughout The World Have Iron Deficiency anemia (WHO, 2011).University students also come under the vulnerable group that suffer anemia because of having long schedule of studying in college, and other curriculum activities. Living in university away from parents and families was reflected upon their diet habits and had a significant reflection upon the prevalence of anemia among the studied group, and also appropriate nutrition requirements increase significantly during certain period of life.Thus, placing individuals during these periods at greater risk of deficiency(H.F. Abdul et.al,2011). Most of the anemia prevalence related studies have been performed on infants, children, adolescentsand pregnant women. Very few studies concentrated on University students.. Thus, the purpose of this study was to estimatethe prevalence of anemia among Haramaya University and Dire Dawa university students.

2. Methods and Materials

2.1. Study Design and Study Population

A cross-sectional quantitative study design was conducted on Haramaya University and Dire Dawa University regular students from May 20 - June20/ 2015.

2.2. SampleSize and Sampling Technique

The sample size was 895 students sampled by a multi-stage sampling technique including students from each college and departments in the two universities.

2.3. Data CcollectionMethods and Instruments`

Self administered and pretested questionnaire was used for data collection. This questionnaire was developed after a comprehensive review of different literatures. The wording and sequence of questions were designed in such a way that the sequence of ideas (from general to specific, from impersonal to personal, and from easy to difficult questions) was maintained. Blood Sample was collected appropriately and investigated using appropriate laboratory instruments (hemoglobin level using hemacue, blood film and stool examination was done using Microscope). Assessment was undertaken when participants were in stable conditions mainly when they were free of duties. For curtesy, all concerned bodies were informed in advance and all required procedures were communicated to the study participants prior to data collection.

2.4. OperationalDefinition

Anemia: According to the new WHO, anemiais definedascut-off levels for hemoglobin as<12.0 g/dl for15+ years Females and<13.0 g/dl for 15+ years males (WHO, 2011).

Dietary Habits: are the habitual decisions of individuals or group of people regarding what foods they eat.

Health seeking behaviors:
defined as astate in which a person in stable health is actively seeking ways to alter his or her personal habits or environment in order to movetoward a higher level of health.

Substance use: using one or many psychoactive substances without giving rise to health or behavioral problems that might harm users themselves or anyone else.

2.5. Data Analysis

The collected data were first coded, entered, and cleaned through Epi. Info version 3.5.4 and then exported for analysis to SPSS version 20.0. Analytic cross tabulation was performed to identify the relationship between some independent variables of our interest with the dependent outcome. The association between the determinant factors or independent variables with the outcome of interest was measured using bivariate analysis and those factors that show an association with the outcome of interest was further analyzed using multivariate logistic regression model. Chi-square test, and OR was used to compare the strength of association between variables. P-value less than 0.05 was considered statistically significant.

2.6. Data Quality Control

The questionnaire was pre-tested and feedback was used to make modifications to the questionnaire. Field assistants were selected according to their qualifications, work experience in the field of data collection and experience in carrying out surveys and supervision. In addition to this, they were given extensive training for two days before the data collection was started. During the training period, the objectives of the study, methods of data collection and field supervision was discussed. Furthermore, each question included in the questionnaire was discussed in detail. Field practice (pre-test) was undertaken to check the practicality and applicability of the questionnaire on 5% of the sample size. The data was checked for its completeness each day by supervisors and principal investigators after they were collected and double entry of data was performed. Regarding laboratory samples, all instruments were kept in appropriate temperature and condition. Hand washing facility was facilitated during laboratory sample collection to prevent cross contamination. Each sample and test tubes and cups was safely stored and transported at recommended temperature and lightings.

2.7. Ethical Consideration

Ethical clearance letter was obtained from the institutional health research ethics review committee (IHRERC) of Haramaya University, college of health and medical sciences.

Letter of permission was written to the Departments. Written signed informed consent was obtained from the participant to be involved in this study. The study subject was told that s/he has the right to participate or not to participate in this study. S/he was also informed that no harm was imposed up on him or her due to participation or non-participation in this study. The confidentiality of the study subject's information was strictly maintained. Anemic Students was treated and the cost was covered by the Principal investigator.

3. Result

3.1. Socio-demographic Conditions of Study Subjects

Total of 895 students, 525(59%) from Haramaya University and 370(41%) fromDire Dawa University, were enrolled in this study. Out of 895 students, 73% were maleswhereas 27% were female (refer Tabbe 5 $ 6). Of the total population, 47.4 % of study participants were Orthodox Christian, 25% were Muslim, and the remaining 24% were protestant by their religion. Regarding their ethnic composition, the majority of students involved in study were Oromo (47%), 25% were Amhara, and the remaining 28% were other ethnic group in Ethiopia.

The mean age of the students was 21.3 ± 1.6 years. The majority of the students (63.2%) belonged to the age group ranging from 21-25 years. However, a small percentage of students (2%) were above 25 years of age ((refer Tabbe 5 $ 6)). The percent of first, second and third year students were 25.3%, 29.8% and 31.6%, respectively. Only two students were six year of study. From the total number of participants, 53.4% of study participants were born in urban area. The mean individual participants' income was 326 br ranging from 0 to 1000 Ethiopian Birr per month(refer Tabbe 5 $ 6).

The overall prevalence of anemia among Haramaya and Dire Dawa university students of both sexes was 9.8%. This means, out of 895 study participants, 88(9.8) of them were anemic. The overall average Hb was 15 gm/dl ± 1.95. Out of 88 anemic students 43 of them were male, and the remaining 45 were female. Among male study participants, 6.6% of them were anemic whereas among female study participants, 18.6% of them were anemic. So in our study, anemia was more common in female than male university students ((refer Tabbe 5 $ 6)). The majority of anemic male and female study participants were found in age interval of 18-20 and 21-25 years, respectively.

Among Haramaya University study participants, 32(6.1%) of them were anemic, and 56(15.1%) of Dire Dawa study participants were anemic. The majority of anemic study participants from Dire Dawa University were females who accounted 66.7% of anemic participants. From each batch of study, 11.2%, 16%, 7.3%, 14.3% and 2% of first, second, third, fourth and fiveth year students, respectively were anemic Of this, 55.7% anemic students in the study came from urban area. The majority (54.5%) of anemic individuals got monthly income less than 250 Ethiopian birr, where majority of them were males. The majority of anemic females got monthly income from 250-500 Ethiopian per month.

3.2. Addictive and Drinking of Study Participants

Out of study participants, 21% of them drunk alcohol, of this 59%, 31.5% and 9.5% of them have drunk one, two, and more than 3 times per week, respectively. Out of 187 alcohol user, 19(10.2%) of them were anemic. As the data indicated, alcohol users were slightly more anemic than non user(refer Tabbe 5 $ 6). From the total study population, 56% of them drunk coffee and while 73% of them drunk tea at least once per day. From the study, it was indicated that 15% of study participants who drink coffe/or tea twice per day were anemic. Among 895 study participants, 364 (41%) of the participants were *khat* chewers. Out of 364 *khat* chewers, 36(10%) of them were anemic, and from 36 anemic *khat* chewers, 34(94.4%) of them chew chat more than twice per week. Only 7.6% of study participants were smokers, and out of 68 cigarate smoker, 15(22.1%) of them were anemic. Out of 15 anemic smokers, 11(73%) of them were male.

3.3 Result for Anemia

Regarding the disease exposure level, among 895 students who participated in the study, around 254(28.4%) were caught by malaria at least once in their life time (refer Table1). concerning malaria preventive experience of students, 17.3% of students reported using bed nets consistently and 75.3% of them by wearing shoes consistently. Data on medication use shows, 18.3% of the participants use de worming prior to the study and 12.1 took iron supplementations. The study also revealed family history of anemia. Accordingly, 17.4 % students had family history of anemia.

Table1. Previous disease history of Study participants of Haramaya and Dire Dawa University 2015/2016.

Variables	Yes No. (%)	No No. (%)	Total
Ever diagnosed for malaria	299(33.4%)	596 (66.6%)	895(100%)
Tested positive for malaria	188(62.8%)	111(37.2%)	299(100%)
Suffering from chronic diseases	189 (21.1%)	706(78.9%)	895(100%)
Ever diagnosed for hook worm	176(19.7%)	719(80.3%)	895(100%)
Ever tested positive for hook worm	97(55.1%)	79(44.9%)	176(100%)
Experienced bleeding in the last one month	203(22.7%)	692(77.3%)	895(100%)

Concerning previous experience of anemia, among 895 students participated in the study, 243(27.2%) were tested for anemia. Among those tasted for anemia, 55(6.1%), 77(8.6%), 10 (1.1%) suffered from mild, moderate and severe anemia, respectively. The rest 142 (40.1%) didn't know the anemia level they had suffered from.

The study also assessed the menstrual status of female students. Accordingly, from 242(27.1%) of female students participated in the study, 88(9.8%) of them experienced irregular menstrual cycle at least once in life time while 45(5%) experienced excessive

bleeding at least once in life time. When we look at age at menarche, the minimum age at menarche was 10 year and the mean age at menarche was 14.39. Regarding the length of menstrual cycle among female student in the last 12 months, regular menstration (21-34 day's) occurred on 141(15.8%) of the female students, more frequent menstration (in less than 21 days) occurred on 14(1.6%) female students, less frequent menstration (more than 45 days) occurs on 0.2% of the students, and unpredictable menstration appeared on 30 (3.4%) of the female students. The length of menstrual days ends within 7 days for 159 (67.08%) of female students and stay for more than 7 days for 78 (32.98%) of students. The following table shows menstrual characteristics of female students.

Table2. Menstrual characteristics of female students study participants of Haramaya and Dire Dawa University, 2015/6.

Variables	Frequency			
	Never occur	Occur only at some periods	Occur at every periods or at most periods	Total
Experiencing gushing/flooding of period	104(57.1%)	66(36.3%)	11(6%)	181
Experiencing bleeding through pad	61(34.1%)	67(37.4%)	51(28.5%)	179
Prevented from activities during period	110(60.4%)	62(34.1%)	10(5.5)	182
Double up protection	95(53.1%)	78(43.6%)	6 (3.3)	179
Changing night/sanitary pad	35(19.6%)	98(54.7%)	46(25.7%)	179

Prevalence of anemia is determined by considering hemoglobin level of less than 12.0 mg/dl for female and 13.0mg/dl for male as a cut point. Accordingly, the prevalence of anemia among students was 9.2%. See table below

Table3.Prevalence of anemia among Haramaya and Dire Dawa university students, 2015/2016.

Anemia	Sex		Total
	M	F	
YES	43 (6.6%)	45 (18.6%)	88 (9.8%)
NO	610 (93.5%)	197(83.8%)	807 (90.8%)
Total	653(100%)	242(100%)	895(100%)

The study also revealed the magnitude of intestinal parasitoids. Accordingly, about 7.5% of the participant students were identified with some types of parasitic infections (Refer Table4)

Table4. Types and magnitude of parasitic infestation among students of Haramaya and Dire Dawa universities.

Types of parasitic infestation	Magnitude	
	Frequency	%
NO ova of parasites	828	92.5
Hook worm	10	1.1
Ascariasis	13	1.5
Giardiasis	2	2.3
Amebiasis	14	1.6
Others	9	1.0
	895	100

3.5. Factors Associated with Anemia among Students of Dire Dawa and Haramaya Universities

The study assessed different factors that were associated with anemia, the following tables show different factors under study.

Table 5. Factors associated with anemia among male students of Dire Dawa and Haramaya universities, 2015/2016.

Variables	Anemia		P-value
	Yes	No	
Age in years			
< = 20	14 (2.14%)	176(27%)	
>20	29(4.44%)	434(66.4%)	0.6
Total	43(6.6%)	610(93.4%)	
Income			
<500 ETB	41(7.5%)	526(80.5%)	0.4
500-1000ETB	2(0.4%)	84(12.9%)	
>1000ETB	0	0	
Total	43(6.6%)	610(93.4	
University			
HU	17(2.6%)	380(58.2%)	0.002
DDU	26(4%)	230(36.2%)	
Total	43(6.6%)	610(93.4%)	
Food frequency habit			
Once /day	0	24(3.8%)	
Twice /day	4(0.5%)	61(8.6%)	0.4
3 or more times /day	39(6%)	525(81.6%)	
Total	42(6.6%)	610(93.4%)	
Fruit consumption habit			
Once/day	17(1.8%)	373(57.1%)	
Twice /week	26(4.8)	195(29.9%)	0.00
>3times /week	0	42(6.4%)	
Total	43(6.6%)	610(93.4%)	
Meat consumption habit			
Once/day	0	56(8.8%)	

Twice /week	2(0.3%)	63(9.9%)	0.42
>3times /week	40(6.3%)	478(74.8%)	
Total	42(6.6%)	597(93.4%)	
Egg consumption habit			
Once/day	11(1.7%)	131(20.6%)	
Twice /week	12(1.9%)	105(16.5%)	0.12
>3times /week	19(3.0%)	376(59.2%)	
Total	42(6.6%)	593(93.4%)	
Consume alcohol			
Yes	15 (2.3%)	149(22.7%)	
No	28(4.2%)	461(70.7%)	0.1
Total	42(6.6%)	610(97.4%)	
Blood loss in the last month			
Yes	10(1.6%)	101(16.4%)	
No	32(5.0%)	472(76.9%)	0.3
Total	41(6.6%)	573(93.3%)	
Previous taste for malaria			
Positive	13(0.8%)	116(60.7%)	
Negative	2(1.0%)	76(31.4%)	0.2
Total	15(7.9%)	176(92.1%)	

Table6. Factors associated with anemia among male students of Dire Dawa and Haramaya universities, 2015/2016.

Variables	Anemia		P-value
	Yes	No	
Age in years			
< = 20	29(12%)	90(39.4%)	
>20	16(6.6%)	107(43.6%)	0.12
Total	45(18.6%)	197(81.4%)	
Income			
<500 ETB	42(17.2%)	164(69.4%)	
500-1000ETB	3(1.4%)	33(13.0%)	0.2
>1000ETB	0	0	
Total	45(18.6%)	197(81.4%)	
University			
HU	15(6.0%)	113(46.7%)	
DDU	30(11.1%)	84(34.7%)	0.2
Total	45(18.6%)	194(81.4%)	
Food frequency habit			
Once /day	0	7(3.0%)	
Twice /day	6(1.7%)	20(8.3%)	0.5
3 or more times /day	39(15.0%)	177(70.1%)	
Total	45(18.6%)	197(81.4%)	
Consume alcohol			
Yes	4(1.7%)	19(7.8%)	
No	41(15.2%)	178(73.6%)	0.6
Total	45(18.6%)	197(81.4%)	
Menstrual irregularity			

Regular	14(10.2%)	127(53.8%)	0.6
Irregular	16(6.8%)	69(29.2%)	
Total	40(16.9%)	196(83.1%)	
Length of days of menstruation			
<7days	32(17.0)	127(67.6%)	0.5
>7days	8(4.3)	21(11.2%)	
Total	40(21.3)	48(78.7)	

4. Discussion

Anaemia is the most common and widespread health problem in both developed and developing countries. Anaemia, especially iron-deficiency anemia, is themost common nutritional deficiency worldwide.The detrimental effects of anaemia on work productivityof adults and physical development of children are of major concern. The current study revealed the prevalence of anemia among students in Haramaya and Dire Dawa Universities is 9.8%. The magnitude of anemia among female students is higher than their male counter part; 18.8% in female and 6.6% in male. The result of the current study showed that the magnitude of anemia is lower when compared with hospital-based study conducted in Nepal Gunj Medical College. Accordingly, a study conducted on a total of 2027 adolescents (10-19 years old) showed that an overall prevalence of anemia was 52% for both males and females. From the total subjects of the study, 29.7% of the females and 22.4% of the males were anemic(Priti Singh*et al*,.2013). The result on the current study also showed lower prevalence of anemia compared with the study conducted among adolescent boys in urban Meerut, India which reveals overall prevalence of anemia among boys, which was 43%(DebjitChattopadhyay and Shouvanik Adhya,2013**)**.. The lower prevalence in the current study could be due to the difference in the study setting and study population.

In the current study, aneamia is more prevalent in female students than male students in contrast to study conducted in the Palestinian adolescents in the West Bank in two schools in Hebron and Ramallah which detected more prevalence in Male than female(Mikki.N. *et al*.,2011).

Prevalence of aneamia in female in our study is 18.6% which is in line with the study conducted among women of reproductive ages in Ethiopia. According to this study, the prevalence rate of iron deficiency anemia was 18.0% (emalHaider, 2010).

In addition, the frequency of feeding habit could be the reason for low prevalence of anemia as the majority of the participants feed three or more times per day. On the current study, fruit feeding habit (p= 0.00) and place of study (p= 0.002) was associated with anemia. This finding goes in line with a study conducted among Adolescents in Denizli, Turkey. But the current contradict with most of the studies as age, income, cigarette smoking, and parasitic infection was not associated with anemia (YaseminIsikBalci*et al*., 2012).

The present study assesses previous malaria and hookworm infections as factors to associate with anemia. Accordingly, 32.2% and 19.0% of students were previously tested

positive for malaria and hookworm, respectively. Nevertheless, previous infections by malaria and hookworm were not associated with anemia in the current study. This result contradicts with study conducted in urban slum, Multan nagar which were found previous infection of malaria and hookworm to be statistically significant in both sex (Gupta, D. *et al*., 2013).

Giardiasis (2.3%), Amebiasis (1.6), Ascariasis (1.5%), Hookworm (1.1%), were some of parasitic infections identified and accounted around 7.5% in the current study. This is relatively lower than the study conducted at University of Gonder which reports the prevalence rate as 43 (32.1%) for male and 61 (35.9%) for female. The predominant intestinal parasite was Hymenolepis nana, followed by Entamoeba histolytica and Ascaris lumbricoides with 42 (13.8%), 28 (9.2%), 18 (5.9%), respectively. But the prevalence is very higher in the current study when we compare it with a study conducted at the benin city of Nigeria which reveals the overall prevalence of intestinal parasitic infections as 3.9%. *Ascaris lumbricoides* was the most prevalent (51.4%) while *Entamoeba histolytica* had the least prevalence (5.4%). This was may be due to the characteristic difference in the study population and study setting (Yaregal *et al*., 2014)

5. Conclusion and Recommendation

5.1. Conclusions

The current study revealed that the prevalence of anemia among students in Haramaya and Dire Dawa Universities is 9.8%. The magnitude of anemia among female students is higher than male their male counterpart; 18.6% in female and 6.6% in male. Fruit feeding habit (p= 0.00) and place of study (p= 0.002) was associated with anemia on the current study. About 7.5% of the participant students were infected with some form of parasitic infections on the present study

5.2. Recommendations

Based on the findings of the current study, the following recommendations were forwarded for future consideration by the concerned bodies.

1. Respective university cafeterias should diversify the food prepared for students and consider adding fruits in students' menue;
2. Health service providing units in the respective universities should consider iron supplementation for students in need mainly for females;
3. Deworming program should be planned on periodic basis; and
4. Further advanced analytic studies on specific cause of anemia should also be conducted.

6. Acknowledgments

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participants, and Haramaya University College of Health and Medical Sciences ethical review committee for their support to facilitate conditions for this research.

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2. Awareness and Practices of Hygiene among 5 – 10th Grade Students in Dire Dawa Administration, Ethiopia.

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Abstract: Proper personal hygiene can be culture specific and may change over time. It is influenced by social, familial and individual factors as well as the children's knowledge of personal hygiene, comfort, and basic needs. Poor knowledge, attitude and practice of personal hygiene, such as hand washing, tooth brushing, poor menstrual hygiene has negative consequences for an individual long term overall development. Good personal hygiene practice such as good hand washing practice brushing teeth at least twice, proper menstrual hygiene practices are therefore a prerequisite to a student survival. Objective: The objective of the study was to assess awareness level and practices of the 5th-10th grade students on personal hygiene and its determinant factors.

Cross-sectional study design was used to meet the desired objectives. The study used quantitative supplemented with qualitative data collection method. The data were generated through interview and focus group discussion (FGD). A total of 818 students were interviewed and eight students were undergone through FGD. Stratified multistage sampling technique was used to select participants. In First stage, schools were clustered by level (second cycle primary and high school) and then by type as (Public/Private). Then, six government and four private schools were randomly selected. Next, a stratified sampling technique (proportionate allocation sampling) was used to select students from each grade level and section. Finally, simple random sampling technique was used to select the student from each section. Data was double entered and cleaned using Epi-Data version 3.3, and was analyzed by using SPSS version 21.From the total participants of the study, nearly one fifth (21.1%) of the students' father and one fourth (26.5%) of the students' mothers were uneducated, and almost 2 out of 3 (68.5%) of the students' families were categorized as middle income families. Almost all (90 %) of the students drink pipe water, 84.2 % of the respondents are urban residents, and from these 78.2% were attending their school in public schools while the rest were private school students. Nearly 2 out of 3 (58.9%) students had good knowledge on personal hygiene. Increasing age (AOR 1.457, CI 1.007 – 2.106), sex being female (AOR 1.783, CI 1.332 – 2.387), increasing grade level (AOR 1.149, CI 1.024 – 1.289),

higher family income (AOR 1.665, CI 1.061 – 2.613), Private school (AOR 2.211, CI 1.455 – 3.360) are significantly associated to having Good level of knowledge of students. Nearly half (55.1%) of the students have good attitude to personal hygiene. Increasing in age (AOR 1.563 CI 1.067 – 2.245) is positively associated with developing positive attitude whereas father's level of education (AOR 0.879, CI 0.772 – 0.999) is negatively associated with developing positive attitude to personal hygiene. Almost 2 out of 3 (60%) of the students had good practice on personal hygiene. Father's level of education (AOR 1.187 CI 1.038 – 1.358), living at urban (AOR 2.542, CI 1.483 – 4.356), and learning at private school (AOR1.533, CI 1.009 – 2.330) were significantly associated with practice. Knowledge has positive effect on attitude and practice (56% of students who had good knowledge had positive attitude, 66.4 % of the students who had good knowledge on personal hygiene had good practice).In general, knowledge, attitude and practice of students were good compared to similar studies. Age, Sex, Grade, family income, and learning at private schools were significantly associated with level of knowledge of students' hygienic practice. Age, paternal level of education are also associated with attitude of students whereas; paternal educational status and school location are statistically associated with personal hygiene practice. Therefore, there is a need for parents and teachers as agents of health promotion to preserve the values of personal hygiene in school children.

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1. Introduction

Good practices of hygiene comprises of three categories. These are personal hygiene, house hold hygiene, school hygiene, and community hygiene (Save the children 2010). Therefore, good hygiene and sanitation in schools contribute to make education entertaining and retain students in the education system so as to meet the goal of Universal Primary Education (WSP 2007).

Personal hygiene comprises of hand washing with soap at crucial times such as before eating & preparing food, after defecating & cleaning a baby's bottom, or assisting an older or sick person to defecate (Bakdash 2011). Moreover personal hygiene involves keeping the body clean (nails, fingers, toes, teeth, ears, face, hair, body), wearing clean shoes, wearing clean clothes, using a latrine for urination and defecation, and cleaning the body well after defecation. It also includes menstrual hygiene and managing menstruation hygienically (Save the children 2010). Likewise, these habits help us protect our mental health and activity and will help us keep feeling good about ourselves (Hassan, 2013). It is influenced by social, familial and individual factors (Bakdash 2011). Besides, the children's knowledge on personal hygiene, comfort and basic needs, characteristic associated with child such as their natural and lack of knowledge are aggregating factors (FDRE Ministry of Health 2004, MR G.H.V. CHAKRAVARTHI 2008). Hygiene is essential to the public health mission of reducing the transmission and

consequences of disease. Diarrheal and respiratory infections, hepatitis A, urinary tract infections, constipation and intestinal worms have detrimental effects on children's cognitive and educational achievement (WSP 2007). Background skin diseases in children contribute to significant morbidity and psychological distress. Infective dermatoses are one of the major dermatoses in children. Low socioeconomic status, overcrowding and poor personal hygiene has been linked to skin diseases. (Gauchan, Kumar *et al.,* 2015).

Good oral hygiene is the foundation for a healthy mouth and prevents 80% of all dental problems. (Rubina. M, Attaullah B. *et al.,* 2009). Oral disease is one of the most costly diet-and life style-related diseases. Oral disease can lead to pain and tooth loss, a condition that affects the appearance, quality of life, nutrition alin- take and consequently, the growth and development of children (Archana J. Srinath Shetty et al. 2011). Frequency of tooth cleaning was significantly lower among children of parents with low level of education and less annual income as compared with those of high education and more annual income (Kumar, Panwar *et al*., 2011).

Acute diarrheal diseases and respiratory infections are the leading causes of death among children (WHO 2013). The main cause of diarrheal pathogens is the human feces and for this route of transmission contaminated hand plays a great role (WHO 2013, Issa, McHenry *et al.,* 2015). The high incidence of diarrheal diseases and other communicable diseases among school children may be due to poor knowledge and practice of personal and environmental hygiene (Hassan, 2013). Though air borne route is the main mode of transmission for respiratory pathogens, previous studies proved that contaminated handsplayrole, and hand washing with soap reduces the problem (Coyer, O'Sullivan *et al.,* 2011, WHO 2013). In addition to this, poor hygiene conditions might be increasing the susceptibility of exposure to infectious agents that might, at least in part, trigger the inflammatory responses (Pehlivan, Kurtuncu *et al*., 2011). Lack of resources, namely soap and water, as well as inadequate sanitation facilities may be two of the main reasons why children do not wash their hands(WHO 2013). Hygiene practices are also heavily influenced by students' knowledge and attitudes towards hygiene. Laziness, the rush to go to breaks, the time it takes away from playing, and the dirt and smell of the toilets. (WSP 2007). Rural Ethiopia had poor status regarding knowledge, attitudes, and practices (KAP) of hygiene. As 60 % of school children did not know about the possible transmission of diseases through human feces(Ministry of Education 2012).

Isolation and restrictions (socially and spiritually) of the menstruating girls have reinforced a negative att itude towards this phenomenon (WSP, 2007). What made it serious is a comprehensive approach to menstrual hygiene promotion is still a neglected area. They use rags that are washed quickly (without clean water and soap) and dried in dark places which are unhealthy practice and often leads to infections and illness. Often, these infections are left untreated due to shame and ignorance (Plan. Nederland, Sharon. Roose *et al.* 2010, Rah, Cronin *et al*., 2015).

It was found that the female students and students whose mothers are literate were more knowledgeable than the male and those students whose mothers were uneducated

(Miko, Cohen *et al.*, 2013). More women than men reported consistent hand washing before preparing food and after using the toilet (Sarkar, 2013). Personal hygiene health education is, therefore, recommended to be taught in secondary schools (Abiola, Nwogu *et al.,*2012).In Ethiopia, especially in rural areas, scabies, typhoid, fungus, skin infections, ulcer, trachoma, relapsing fever, intestinal parasites, diarrhea and other communicable diseases are predominantly seen due to poor personal hygiene (FDRE Ministry of Health 2004). Thus, the objectives of this study is to assess the level of awareness and practice on personal hygiene and determining factors among 5-10th grade students of Dire Dawa Administration.

2. Materials and method

2.1. Study Design and Area

Cross-sectional study design was conducted from June - July 2015 in Dire Dawa administration. Dire-Dawa administrative council has 19 secondary schools (9–12th grades) of which 10 is governmental chools and 9 of them are private high schools. And the schools had 107 primary schools during data collection time, from which 67 of them were governmental and 40 of them were private primary schools. Generally, DD administration had 76,154 students, of which 64,423 were attending primary school and1, 1731 of them were high school students. Among the total students, 42,406 were attending 5th – 10th grades (H. Riad, 2012).

2.2. Sample Size Determination

Thesamplesizeisdeterminedusingsinglepopulationproportionformulaforcross- sectional study.

Sampling procedure

Stratified multistage sampling technique was used to select participants for quantitative study. In first stage schools were stratified by school level (2nd cycle primary and high school) and then by ownership as (Public/Private).Then, six government and four private schools were randomly selected. At the third stage, a stratified sampling technique was used to select students from each grade and section level. Finally, simple random sampling technique was used to select the student from their sections.

2.3. Data Collection Method

Quantitative data collection method was used to interview a total of 818 students. This was supplemented with qualitative data collection method (Focused group discussion and school compound survey checklist). For this, different FGD on personal hygiene was conducted for participants comprising of both male and female students and 4 FGD on menstrual hygiene on which only female students were participated.

2.4. Data Analysis

Data was double entered and cleaned using Epi-Data version 3.3, and was analysed by using SPSS version 21.

2.5. OperationalDefinitions

Knowledge: It refers to the level of understanding regarding personal hygiene among grade 5 – 10th students.

Attitude: It refers to a complex mental state involving beliefs and feelings and values and dispositions to act in certain ways regarding personal hygiene among grade 5-10th students.

Practice: It refers to the act of rehearsing a personal hygiene behavior over and over, or engaging in an activity again and again, for the purpose of improving or mastering it, as in the phrase "practice makes perfect" among grade 5-10th students.

Knowledgeable (Good knowledge): Studysubjectswho willrespond more than mean score value forknowledge questions (Oyibo PG 2012).

Positiveattitudetowards personalhygiene: study subjects who will respond more than mean score value for attitude equestions.

Good practice: studysubjects whowill respond more than mean score value for Practice question (Oyibo PG 2012).

3. Result

3.1. Socio- demographic and Economic Characteristics of the Study Respondents

A total of 818 (21.1%) of the participant students' fathers and one fourth (26.5%) of the students' mothers were uneducated, and almost 2 out of 3 (68.5%) of the students' families were categorized as middle income families. Almost all (90 %) of the students household used pipe water as sources of drinking water, 84.2 % of the respondents were urban residents and from these 78.2% were attending their school in public schools and the rest were private school students. The lowest age for the respondents was 10 and the highest age was 25. The mean, median and mode of the age of the students was

Table 1. Socio- demographic and Economic Characteristics.

Variables		Frequency	Percent
Sex	Male	367	44.9
	Female	451	55.1
	Total	818	100.0
Grade	Fifth	182	22.2
	Sixth	138	16.9
	Seventh	155	18.9
	Fifth	150	18.3
	Ninth	110	13.4
	Tenth	83	10.1
	Total	818	100.0
Ethnicity	Oromo	269	32.9
	Somali	114	13.9
	Amhara	274	33.5
	Tigrai	43	5.3
	Others	117	14.3
	Total	817	99.9
Religion	Orthodox	428	52.3
	Muslim	299	36.6
	Protestant	60	7.3
	Catholic	15	1.8
	Others	15	1.8
	Total	817	99.9
Marital Status	Under Age	678	82.9
	Single	91	11.1
	Married	41	5.0
	Divorced	5	.6
	Widowed	3	.4
	Total	818	100.0
Father's level of Education	Un educated	173	21.1
	Formal education	99	12.1
	Primary	207	25.3
	Secondary	154	18.8
	Graduated	185	22.6
	Total	818	100.0
Mother's level of education	Un educated	217	26.5
	Formal education	110	13.4
	Primary	216	26.4
	Secondary	158	19.3
	Graduated	117	14.3
	Total	818	100.0
Family monthly income	Lower	160	19.6
	Medium	561	68.6
	Higher	97	11.9
	Total	818	100.0
Sources of drinking water	Piped-water	737	90.1
	Well	30	3.7
	Spring	28	3.4

	Rain-Water	5	.6
	Others	18	2.2
	Total	818	100.0
Place of residence/ school location	Urban	689	84.2
	Rural	129	15.8
	Total	818	100.0
School Type	Government	640	78.2
	Private	178	21.8
	Total	818	100.0

3.2. Knowledge of the Students

Among FGD participants, 80% of them were not washing hands before meal. This can cause typhoid fever, and diarrhea. Besides, 30% of the participants reported not washing legs and not taking shower on regular bases. This can cause fungal infections and bad odor. Participant6 expressed as "I will be infected with fungal disease, if I do not wash my legs and I will be infected by Skin disease if I do not wash my uniforms regularly", Respondent 1 also replied as "If I do not wash my sock and legs, I'll get skin disease like fungus". Respondent 2 stated as "if an individual do not keep his/ her hygiene for short period of time, we will isolate him/her."

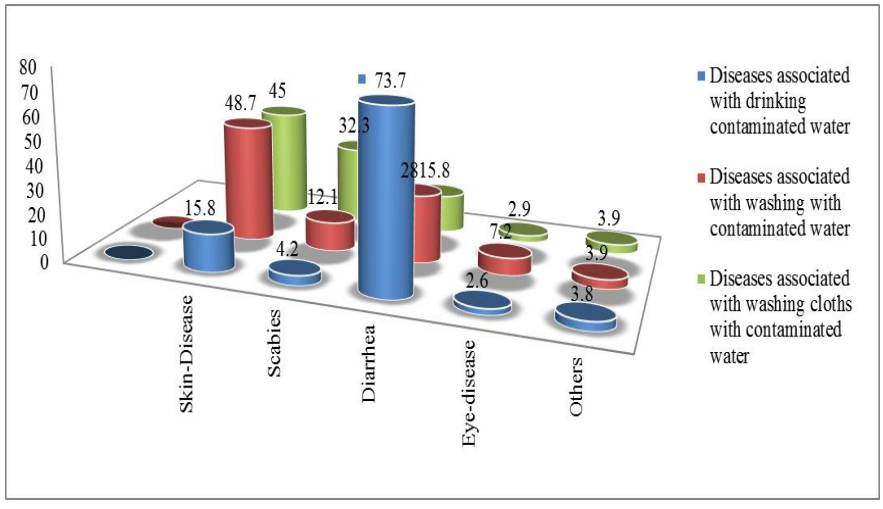

Figure 1. Knowledge of the students on some water associated diseases among grade 5-10thstudentsofDireDawaAdministration from January 07- February 30, 2015.

Among the total female students, 68.6% of them knew about menstruation before menarche. Similarly, 55.5% of the responded that causes of menstruation is natural or physiological. The other 26.5% replied that it is curse of God, and 44.7% of the total female students believed that sources of blood for menstruation is uterus and almost one third (32%) do not know sources of menstruation. From the total female student participated in the study, half (51.9%) of menstruating students' missed schooling, of which 13.4% of them missed class for at least 1st day, 10.9% for 2-3 days, 10.5% of them

missed less than 6 hours, 8.2% of them missed classes for more than 4 days, and 8.9% of them missed less than 2 hours) and the left 48.1% never missed their class at all due to menstruation. The causes of missing class reported by these student is dysmenorrhea (26.5%), followed by lack of privacy for cleaning and lack of disposal facility for used pads (21.9%) respectively, shortage of water supply for cleaning (11.7%), fear of accidental menstrual leakage (9.5%) and Shame (8.5%).

Majority of them get information about menstrual hygiene from their mothers (43.6%) followed by their school teachers (34.9%), and the rest of the female students get from friends (peers) (15.1%), 4.7% from others like neighbours, father, aunt and only 1.8% get the information from their sisters.

Nearly 2 out of 3 (58.9%) students had good knowledge on personal hygiene. Increasing age (AOR 1.457, CI 1.007 – 2.106), sex being female (AOR 1.783, CI 1.332 – 2.387), increasing grade level (AOR 1.149, CI 1.024 – 1.289), family income status being higher (AOR 1.665, CI 1.061 – 2.613), school ownership being private (AOR 2.211, CI 1.455 – 3.360) were significantly associated to having good level of knowledge of students. Nearly half (55.1%) of the students had good attitude on personal hygiene.

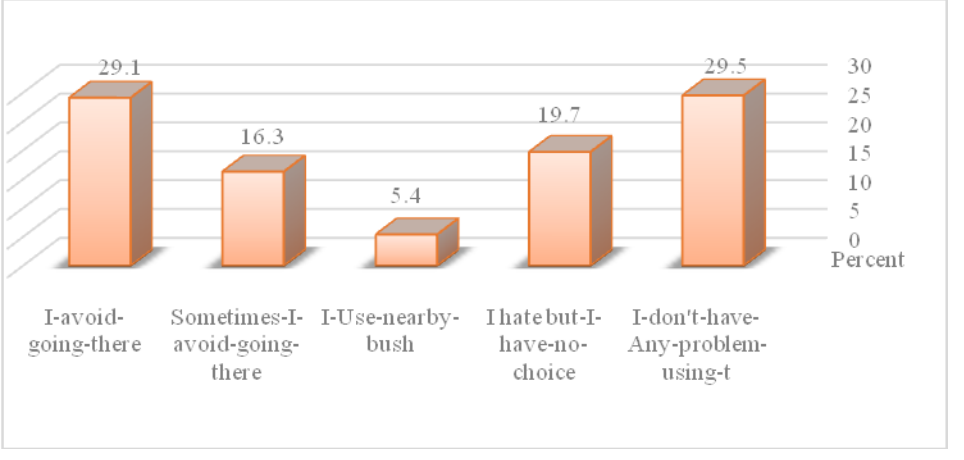

Figure 2. Attitude of students towards using their school latrine in Dire Dawa administration from June 07 – 30, 2014.

Out of the total participants, 48 % of the students rate the hygienic status of their school compounds as unclean and 23 % of them reported that student defecate anywhere. Whereas the observational checklist showed 3 out of 10 schools had hygienic compounds, 2 of them were high schools and only 1 was primary school. And most of the FGD participants reported that their school compound was unclean. One of the participant reported "The class is dusty all the time due to shortage of water for cleaning. The latrine is also very dirty, we hate using this school's latrine but the the schoo guards do not allow us to go out from the school compounds, sometimes we can't get access to water for drinking or for washing hands; we buy water from this school's cafeteria by 1 birr, the cleanness of the plastic bottle used as container is still in question".

3.3. Factors Associated with Attitude of the Students

Increasing in age, (AOR 1.563 CI 1.067 – 2.245) is positively associated to develop positive attitude whereas father's level of education being graduated (AOR 0.879, CI 0.772 – 0.999) was negatively associated with developing positive personal hygiene attitude. Almost 2 out of 3 (60%) of the students had good practice on personal hygiene.

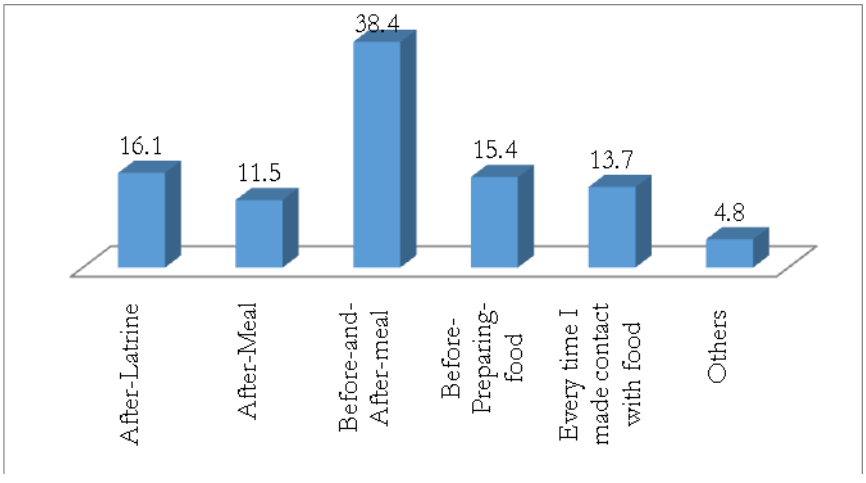

Figure 3. Attitude of students towards using their school latrine in Dire Dawa administration from June 07 – 30, 2014.

Of the total female students, 39% of them got shocked during the onset of their first menstruation, 29 % of them were confused about the occasion and only 24.9 and 10.6 % feel nothing and happy, respectively.

FGD with urban female students depicted that their latrine was unhygienic, though there was no water at or nearby their latrine for washing their hand or for menstrual hygiene and the water they have in common inside of their school compound is not considering their number.They reported only one communal tap water source for urban students.For rural students, there were no water source nearby or inside the latrine which is used hand washing after using toilet. Students did not also have dust bin at their toilet. As a result, they threw waste materials directly into their latrine which in turn may cause inappropriate filling of the latrine with solid wastes as a menstruating women may use 2 or more sanitary napkin during her school time. They also be disturbed by male counter parts as their toilet doors are not closed from inside. One of the respondent reported as *"Male student may inter into the latrine you are using suddenly because the door is not locked from inside, even some doors are totally open, you will not be comfortable at this time."*

Similarly, rural school students reported they had no water in or after toilet, even no water for teachers, and both student and teachers share common latrine

They reported it as "…. *we are using the toilet in common with our teachers. There were no separate latrine for the teacher and the students. Moreover 'the toilet is totally not clean, you may see poops everywhere inside or outside the toilet. And the latrine has no door totally' the water we have in common is located very far about 200 meter from the latrine*".

3.4. Factors Associated with Awareness and Practices of Hygiene

Father's level of education being higher (AOR 1.187 CI 1.038 – 1.358), place of residence being urban (AOR 2.542, CI 1.483 – 4.356), and school owner being private (AOR 1.533, CI 1.009 – 2.330) were positively associated with practice. Knowledge has positive effect on attitude and practice (56% of students who have good knowledge have positive attitude, 66.4% of the students who had good knowledge on personal hygiene has good practice).

4. Discussion

Globally, the high mortality and morbidity due to communicable diseases among school-age children had been attributed to their neglect of personal hygiene (Oyibo PG 2012). In Ethiopia, especially in the rural areas, scabies, typhoid, fungus, skin infections, ulcer, trachoma, relapsing fever, intestinal parasites, diarrhea and other communicable diseases are predominantly seen due to poor personal hygiene. Most students reported hand washing before meals (99.0%), but only 36.2% reported using soap. Similar study reported that 76.7% of students reported that washing hands after defecation was important, only 14.8% reported actually following this practice (FDRE Ministry of Health 2004). This research revealed that the average level of good knowledge of students was relatively low (58.9%) compared to study conducted in Nigeria (Oyibo PG 2012). And a little bit higher compared to survey conducted in Northern Showa, Ethiopia by Bizu Gelaye, (Gelaye Bizu, Alyssa Vivas et al. 2011) and study by Williams M.A. (Vivas A.P., Aboset N. et al., 2010) 52%, respectively. This difference is because of socio-cultural and economic factors, and climatic difference between the study areas, and smaller sample size.

Having good knowledge on personal hygiene has positive impact on developing positive attitude and having good practice on personal hygiene in the school environment or at home. In our study, 56 % of the students having good personal hygiene had positive attitude towards proper personal hygiene and 66.4% of students who had good knowledge and good personal hygiene practice. These findings are supported by Biswas *et al.* (1990) (Asha Rai M.G. 2013). Dorge *et.al.* determined that after giving an school health intervention program, there was significant improvement in the personal hygiene of the students (Dongre, Deshmukh et al. 2007).

Many studies recommended to wash hands before handling or preparing food, lunch and meal breaks, providing first aid or medication, and after providing first aid or medication, touching blood or body fluids, using toilet, coughing, sneezing or wiping ones nose, touching animals, removing protective gloves (Djibouti school health and sanitary survey 2009, Gelaye Bizu, Alyssa Vivas et al. 2011). Varied behavior related to hand washing was reported in this study. From the total respondents, 13.7% of the students wash their hands every time they made contact with food, 38.4 % before and after meal, 16.1% wash their hands after using toilet, 11.5% after meal. This finding showed poor self-reported habit of hand washing compared to similar studies. For instance, a research done by Dr. Nazar Ali Sheren in Erbil city on students' hand washing behavior revealed behavior of hand washing. Before eating 20%, after eating

55%, after visiting toilet 60%, during coughing and sneezing 2% (Dr.Nazar Ali.Sheren, Dr.Kareem F.Aziz et al. 2012). And Gelaye B. in Northern Showa, Ethiopia (Gelaye Bizu, Alyssa Vivas et al. 2011) who reported the percentages of children who reported the importance of and the preference for hand washing before eating were 99.7% and 98.8%, respectively. Particularly, the hand washing practices or habits among children in our study was significantly lower than frequencies reported from other similar studies narrated above. This is because 1) most of the students' parents were uneducated. 2) No practical personal hygiene curriculum in the educational system of Ethiopia especially for teenage students (it is only theory based). 3) lack of social norms for hand washing before feeding or preparing food (Alive and Thrive 2012). 4) Ignorance of the family about their children because caring a large number of children is difficult. 5) Caring for child is culturally left to women in our country.

With proper use, all types of soaps are equally effective at rinsing away the germs that cause disease (UN 2008). However, majority (89%) of the students in our study used soap and water to wash their hands, 8% used water only and 1% used ash and water. This finding is higher compared to similar studies done in different regions and countries. Only 36.2% of students who washed their hands reported using soap(Gelaye Bizu, Alyssa Vivas et al. 2011). And forty percent of school children practiced regular hand washing with soap and water and 41.2% never used soap with hand washing (Anant Arunrao Takalkar, Abhay Subhashrao Nirgude et al. 2013).

From female student who started menstruating, majority (51.9%) of them were absent from their class at least once per period because of either of the following causes; abdominal pain, being ashamed, and fear of stigma and discrimination. Besides, almost all (8/10) FGD participants reported as every individuals know they are menstruating during their menstrual cycle. Similar study by Ezra Guya reported that 24.8% of the menstruating female students were absent from school or classrooms at least once because of lack of any of the cleaning facilities at their schools (Ezra Guya, Aloyce W. Mayo et al. 2014). The greater variation is due to lack of open discussion between the female students and their family members on reproductive health issues, socio cultural issues (menstruating women is seen as devil in some societies and religions), low literacy status of mothers in the study area and the study participants are teen age.

UNICEF estimated that about 10% of school-age African girls do not attend school during menstruation, or drop out at puberty because of the lack of clean and private sanitation facilities in schools (UNICEF 2005). A study undertaken by Water Aid in 2011 in urban secondary school in Malawi revealed that all girls experienced difficulties in dealing with menstruation at schools because of poor toilet conditions (WaterAid 2011). The same study in Nepal by year (2009) reported that many girls (53%) were absent from school due to menstruation as they worry that boys would realize their condition. Similar findings were reported by a survey carried out by Water Aid in India, in which 28% of girls did not attend school during menstruation due to lack of facilities (WaterAid 2009). In the same manner, half (51.9%) of the female students in Dire Dawa administration do not attend school at least once (one day) during menstruation. Cause of discrepancy is sociocultural issue and low number of

educated mother in for those studies having large number of school missing. The absence from school was greater (53%) among students learning in governmental schools compared to those attending their private schools (20.4%) in Dire Dawa administration (Ezra Guya, Aloyce W. Mayo et al. 2014) and (15.8%) (Ezra Guya, Aloyce W. Mayo *et al.*, 2014). They reported the cause of missing class is abdominal pain (26.5%), lack of privacy for cleaning and lack of disposal facility for used pads (21.9%), respectively, shortage of water supply for cleaning (11.7%), fear of accidental menstrual leakage (9.5%) and Shame (8.5%). The finding is similar with studies done in Djibouti by Water Aid which reported abdominal pain as the most common medical problem experienced by the survey respondents (85%). (waterAid, 2009). This difference is because of better Hygienic facility facilities in private (half of the inspected private schools fulfil UNICEF's minimum requirement for Hygiene facility compartments) schools than in government schools (not fulfilled the minimum requirements), large number of students attending government schools than private one because of economic reasons and practically private schools are more strictly in school attendance than government schools.

Among reasons highlighted by survey respondents in FGD for being absent in school during menstruation were lack of privacy, absence of soap in toilets, unavailability of water, absence of doors on toilet rooms and absence of bins for disposal of used absorbent pads. Some girls even wondered why government is not addressing this problem, which is primarily a very fundamental one. And this finding has similar idea with research done by (Ezra Guya, Aloyce W. Mayo et al. 2014).

Majority of the female students learning from 5– 10th grade in Dire Dawa administration got information about sexual and reproductive health or menstrual hygiene from their mothers (43.6%) followed by their school teachers (34.9), and the rest of the female students got from friends (peers) (15.1%), 4.7% from others like neighbors, father, aunt and only 1.8% got the information from their sisters. This finding is nearly similar with study conducted by Water Aid 2009 who described sources of information about menstrual hygiene as from their mothers (51%) or sisters (41%) (waterAid 2009).

Out of the total of female students, 68.7% used sanitary pad as absorbent materials during their menstrual period, 13.6% used new cloths and 11.1% used old cloths. More than half (59.3%) of the female students do not reuse sanitary pads, from those who reused sanitary materials for cleaning during menstruation 26% dry washed absorbent in the bath room, only 5.2% of them dry these materials within other cloths on sun. The finding shows higher practice compared with similar study done in India that was observed only one-fourth the respondents were used properly the Napkins during their menstrual periods but remaining women have practiced to use both locally prepared Napkins and cloth. The study also shows that the menstrual hygiene practices among women during the menstruation that of the total 36786 women, 83 percent of the women used cloths to prevent the bloods strains followed by locally

prepared napkins and the sanitary napkins with the percentages of 7.6 and 23.5. The differences are due to small sample size.

5. Conclusion and Recommendation

Knowledge, attitude and practice of Dire-Dawa administration students were good compared to similar studies. Age, Sex, Grade, family Income, School ownership are statistically significantly associated to level of knowledge of students. Age, father's level of education are associated to attitude of students whereas father's educational status and school location are statistically associated with personal hygiene practice.

- Safe and hygienic schools and effective education require the participation of community members, parents, teachers and above all, children.
- It is also important to focus on children because they are the parents of the future
- Moreover; at all ages, children and adolescents can be engaged actively in learning experiences that enable them to practise basic hygiene and sanitation and advocate it at home and in their community.
- To create & strengthen life skills based hygiene, education can help to create effective education and hygienic schools by giving children not only knowledge but also attitudes and skills for coping with life. There is, therefore, a need for parents and teachers as agents of health promotion to preserve the values of personal hygiene in school children.
- So based on the above conclusion we recommend school curriculum developers to include personal and menstrual hygiene topics in the students' teaching course materials, school administrators to establish personal hygiene club and strengthen and enrich the girls' club; the health bureau to create awareness for the student's family especially those for mothers as the sources of information for menstrual hygiene for majority of school girls are their mothers.
- Though the government and NGOs were involved to create awareness among women about the hygiene practice and health related issues still they are lacking behind in the practices of hygiene.
- Studies are required to evaluate the effects of menstruation-related morbidity to evaluate the efficacy of any therapeutic alternatives.

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3. Cockroaches Infestation and Awareness of Households on their Public Health Importance and Associated Factors in Harar Town, Eastern Ethiopia

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Abstract: Indoor pest infestations are not only nuisances, but can also transmit infections and be sources of allergens. Cockroaches are among the notorious pests that are found all over the world in households and other places; and are considered public health problems. Health burdens associated with poor housing and indoor pest infestations are likely to affect young children and the elderly in particular, who spend most of their time indoors at home. However, information is lacking in Ethiopia as to the community awareness on public health importance of cockroaches and the factors accounting to their infestation of dwelling houses.The objective of this study was to estimate the prevalence of residential households infested with domiciliary cockroaches, and to assess the factors associated and the residents' awareness on public health importance of cockroaches in Harar town from Jan. 16 - 31, 2015.

Cross-sectional study design using quantitative methods was implemented to conduct the study. All residential households in Harar town were the source population; and the study population was those in the six kebeles of the town's Demographic and Health Surveillance Site. The sample size was 660 households selected by Systematic Random Sampling method from the Database of Harar Demographic Surveillance Site. Pre-tested structured questionnaire was used for the data collection. In analyzing the data, Stata version 12 software was used and descriptive, bi-variate and multivariate statistical techniques were employed. Significant results were assumed at $p< 0.05$. More than four fifth, (81.5%), of the sample residential households reported that their homes were infested by cockroaches. A higher proportion of respondents, 351(65.4%), complained cockroaches are problems in their houses. Nearly half of the respondents, 168(47.9%), felt irritated for simple presence of cockroaches in their houses. However, 229(34.9%) of respondents did not know the harmful health effects cockroaches can pose. Almost all of the respondents, 648(98.2%), reported that they have never been informed about problems of cockroaches or their

management by health professionals. Furthermore, after adjusting the effects of possible confounders, lack of windows in the main household (AOR=3.72, P<0.05), presence of other insect pests (AOR=0.003, P<0.05), and increased number of rooms in the household (AOR=3.8, P<0.05 for3-4 rooms; AOR=8.8, P<0.05 for 5 or more rooms) were significantly associated with the self reported cockroach infestation.The proportion of residential households infested with cockroaches in Harar town is very high, but the community awareness about their health effects is quite low. This calls for due attention on public health control measures of cockroaches by the health authorities in the Region.

1. Introduction

Indoor pest infestations are not only nuisances, but are also allergen sources (Cohn, R. D., *et al*., 2004, Cohn, R. D., *et al*., 2006). Cockroaches are insects found all over the world with over 4,500 species associated to human habitats of which about 30 species are well known as pests. Cockroaches are one of the important groups of insect pests in urban environments (Cochran D. G, 1982). They are among the notorious pests often found in dark, warm and moist areas inside houses, hotels, restaurants, supermarkets, public places, and refuse dumps; and they are most active at night, during which time they forage for food and mate (Pai, W H. H., *et al*., 2004) Lower income homes are associated with higher cockroach allergen levels (Cohn, R. D., *et al*. 2006,Leaderer, B. P., *et al*., 2002, Kitch, B., *et al*., 2000). In addition to their repulsive and annoying characteristics, cockroaches eat and contaminate food and leave a persistent offensive odor in infested places and cause allergic reactions and psychological distress (Rust M. K, 1995, Wikipedia free encyclopedia.2013). As a potential mechanical vector of human diseases, many pathogenic organisms have been associated with cockroaches. These include poliomyelitis viruses, bacteria, fungi, protozoa, and helminthes (Addisu Kinfu, and Berhanu Erko, 2008, Baumholtz M. A., *et al*, 1997, Fathpour H., *et al*, 2003, Saichua P., *et al*., 2008, Tatfeng Y. M.,*et al*., 2005). Health burdens associated with poor housing and indoor pest infestations are likely to affect young children and the elderly in particular, who spend most of their time indoors at home. Cockroaches are something that many people are worried about when they see them in their homes. This is because the presence of cockroaches indicates unsanitary conditions (Etim, S. E., *et al*., 2013, Asa Bradman, *et al*., 2005).

Even though several studies conducted worldwide indicate the public health significance of cockroaches, very little research has been done in Ethiopia in general and there is no documented evidence of the level/magnitude of cockroach infestation and problem in Residential Households in Harar town in particular. Therefore, this study was found essential to evaluate the burden of the problem in the town and to understand the public awareness towards these notorious insects and document a baseline evidence for interested individuals who wish to conduct further in-depth study on this problem. The objectives of this study were to assess the proportion of Residential Households infested

with domiciliary cockroaches, the factors associated; and the residents' awareness on public health importance of cockroaches in Harar town;

2. Method and Materials

2.1. Study Area

The study wasconducted in Harar town the capital of Harari National Regional State in Eastern Ethiopia from January 16-31, 2015. According to the Ethiopian 2007 national population census, Harar town has a total population of 99,321. The town is administratively divided into six districts (Woredas) and 19 kebeles (the smallest administrative units) with a total of 39, 360 households (HBFED, 2011). The study wasconducted in the six kebeles of Harar Demographic Surveillance Site (DSS) randomly selected previously by Haramaya University as urban DSS and assumed to represent Harar town. The DSS site has a population of about 36,120 and estimated total households of 10,500 (KDS-HRC, 2011). The study was conducted from Jan.16-Jan.31, 2015.

2.2. Study Design

A cross-sectional study design on Residential Households was conducted using quantitative method. The population of the study was all residential households in Harar town and the participants of the study were residential households in the six DSS kebeles of the town. Residents who lived for more than six months in the household were included in the study.

2.3. Sample Size Determination

Sample size was determined using a single population formula; with the assumption of a 50% (i.e. p=0.5) prevalence as no previous similar study was observed and with the assumption that this will give the study a maximum sample size. The estimate of the sample in this study was precise at confidence level of 95 percent and margin of error of four percent (d). Then, using the formula of Cochran (Cochran, G.M., 1977), i.e., $n=Z^2PQ/d^2$, the sample size was calculated to be: $(1.96)^2(0.5)\ (0.5)/\ (0.04)^2 = 600$ and with a consideration of a 10% non-response rate, the final total sample size was 660 households.

2.4 Sampling Procedure

To sample eligible residential households for this study, the database of Kersa Demographic Surveillance and Health Research Center (KDS-HRC) was used. List of residential households from the database were used as frame for selecting the required number of samples. The total sample size determined was then distributed among the six kebeles of the study area proportional to the size of the residential households existing in each kebele.Study households were selected from each kebele using systematic random sampling technique from a random start point from the list of households in the KDS-HRC data base as a sampling frame. The initial household was

randomly selected by lottery system from the residential household frames, using number between one and the sampling interval.

2.5. Data Collection Method

A structured questionnaire was delivered in a face-to-face interview to solicit the required data. Respondents were adults of age greater than 18 years old in normal physical state and able to answer the interview. Respondents were either of the spouses in the household, or in their absence any adult who was a usual resident. The questionnaire was originally prepared in English language and later translated into the local languages, Amharic and Oromiffa, for easy understanding and communication between the data collectors and the respondents.

2.6. Data Quality Control

Data collectors and supervisors were given a one day intensive training to enable them effectively administer the data collection process. The questionnaire was pre-tested in residential households of one of the non selected kebeles in the town (kebele 14) to ensure that the questions that are going to be asked and the method of delivery was appropriate. Based on the result of the pre-test survey, discussions were also undertaken with the data collectors and supervisors and observed errors and discrepancies were edited and corrected.

2.7. Variables of the Study

The dependent variables of the study were proportion of households infested by cockroaches (Infested or Non-infested) and level of awareness of respondents on the public health effects of cockroaches. The independent variables used in this study include socio-demographic variables, and housing characteristics.

2.8. Data Analysis Method

Data analysis was made using Stata Version 12 software and descriptive, bi-variate and multivariate statistical techniques were employed. Results were displayed using tables, graph (Annex 1) and word descriptions.

2.9. Ethical Assurance

Ethical approval was obtained from the Institutional Health Research Ethics Review Committee of the College of Health and Medical Sciences of Haramaya University prior to launching of the study. In addition, written and signed consent of participants was sought in advance to the administration of the interview.

3. Results

3.1. Socio-demographic Characteristics

Six hundred sixty residential households were included in the study. The overall response rate for the study was 100%. The respondents for the questionnaire were household heads (spouses) or in their absence, any adult who was a usual resident and permanent member of the household. The majority of the respondents, 538(81.5%),

were female and Orthodox by religion 400(60.6%). The mean age of respondents was 37 years, and all were adults whose ages were 18 years and above. The literacy status of the heads of the households indicated a considerably high proportion being illiterates, 544(82.4%). With regard to household income, 242(36.7%) were in the lower quartile with monthly average income of less than one thousand Birr. A higher proportion, 309(46.8%) of households had 1 to 3 usual resident members (Table1).

Table 1. Major Socio- demographic Characteristics of the Study Respondents and Household Heads in Harar Town, 2015 (n=660).

Variables	Number	Percentage
Sex of Respondents		
Male	122	18.5
Female	538	81.5
Religious affiliation		
Orthodox	400	60.6
Muslim	215	32.6
Protestant	44	6.7
Catholic	1	0.1
Literacy		
Illiterate	544	82.4
Literate	116	17.6
Household Monthly Income(in Birr)		
1st Quartile(<1000)	242	36.7
2nd Quartile(1001-1500)	113	17.1
3rd Quartile(1501-2500)	158	23.9
4th Quartile(>2501)	142	21.5
No response	5	0.8
Household Size(No of persons per		
1-3 people	309	46.8
4-6 people	296	44.8
>7 people	55	8.4

3.2 Housing Characteristics

The mean age of the study houses was 36.1 years, where 269(40.8%) of the houses were older than the mean age. The tenure (ownership) status of the study houses indicated that, 368(55.8%), were rented either from government or from private. About 353(53.5%) of the housing units were attached to other houses or were apartments. Of the study residential houses, 542(82.3%) had open-able and closable windows for the main house. With regard to the type of material the walls were made, the majority were made of wood and mud 378(57.3%). In 487(73.8%) of the houses their walls were reported to be smooth (Table2).

Table 2. Housing Characteristics of Residential Household in Harar town (n=660).

Variables	Number	Percentage
Tenure Status		
Owned	292	44.2
Rented	368	55.8
Type of Housing Structure		
Detached	307	46.5
Attached	353	53.5
Availability of Openable and Closable Window of the Main House		
Yes	542	82.3
No	118	17.7
Wall Material		
Wood and Mud	378	57.3
Stone	137	20.8
Hollow Blocks	130	19.7
Other	15	2.2
Condition of the Wall		
Dilapidated	164	24.8
Smooth and Even	487	73.8
No response for the Question	9	1.4
Number of Rooms		
1-2 rooms	248	37.6
3-4 rooms	255	38.6
5+ rooms	157	23.8
Toilet Availability &Attachment to Main House		
Attached	90	13.6
Detached	503	76.2
No Toilet	67	10.2
Kitchen Availability &Attachment to Main House		
Attached	107	16.2
Detached	413	62.6
No Kitchen	140	21.2
Availability of Solid Waste Container with Cover		
Yes	208	31.5
No	452	68.5
Availability of Modified Liquid Waste Disposal System		
Yes	209	31.7
No	451	68.3
Observed General Sanitation of HH Compound		
Good	239	36.2
Average	371	56.2
Poor	50	7.6

3.3. Status of Cockroach Infestation and Respondents' Awareness towards the Public Health Importance of Cockroaches

Among the 660 residential houses studied, 538 (81.5%) of the respondents declared that their houses were infested with cockroaches as observed since the last twelve months from the time of interview. Infestation in this study is operationally defined as the observation of the presence of live cockroach(s) (one or more in number) during the specified period in the household as reported by the respondents. Of those who reported their houses being infested, 377(70.1%) declared cockroaches a day-to-day observation in their houses. In addition, respondents were also asked to mention sources of cockroach infestation in their households. The possible options for sources of infestation were from toilet, kitchen, rubbish container, neighbor households, and sources not known by the respondent. Accordingly, the major sources mentioned were from kitchen (282, 64.2%), followed by from rubbish container (146, 33.3%) (Figure1).

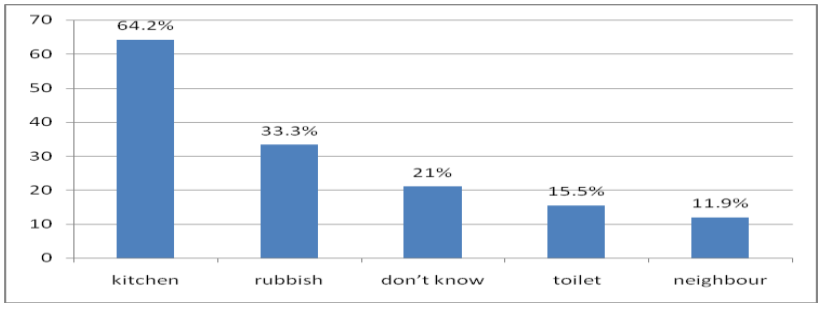

Figure 1. Reported Main Sources of Cockroach Infestation of Residential Houses in Harar Town, 2015

Different questions were also asked to measure level of awareness of respondents about the public health importance of cockroaches. Accordingly, a higher proportion of respondents, 351(65.4%), complained cockroach infestation is a problem in their houses. The majority, 332(86.5%), of the respondents worried about cockroaches; with major complaint that cockroaches contaminate/spoil food stuffs and household articles, 200(60.2%), followed by nuisance due to their presence in the houses, 180(54.2%). Nearly half of the respondents, 168(47.9%), felt irritated or did not have tolerance at all for roaches presence in their households. With regard to the awareness of harmful health effects of cockroaches, over one third of respondents, 229(34.9%), did not know the harmful effects of cockroaches on human health. Of those who believed that cockroaches pose harmful health effects, a high proportion, 147(65.9%), mentioned that diarrheal diseases were the health treats due to infestation by cockroaches. Almost all of the respondents, 648(98.2%), said they have never been informed by health workers about public health problems of cockroaches or their management (Table3).

Table 3. Awareness of Respondents towards Public Health Significance of Cockroaches in Harar Town.

Variable	Number	Percent
If roach infestation is considered problematic(n=537)		
Yes	351	65.4
No	186	34.6
Ever been worried of roach infestation(n=384)		
Yes	332	86.5
No	52	13.5
Types of worries for roach infestation(n for each response=332)		
Complained nuisance	180	54.2
Expressed carry infection	30	9
Contaminate or spoil food stuffs and/HH articles	200	60.2
Produce bad odor	11	3.3
Spoil HH cleanliness	85	25.6
Level of tolerance towards roach infestations(n=351)		
High	109	31.1
Low	47	13.4
No tolerance/irritating	168	47.9
Indifferent	27	7.7
5. Believe that roach infestation causes harmful health effects(n=		
Yes	223	34.1
No	203	31.0
Don't know	229	34.9
6. Believe the diseases inflicted/transmitted by roaches(n for		
Asthma/respiratory disorder	15	6.7
Skin Allergy	32	14.3
Diarrheal Diseases	147	65.9
Other Parasitic Intestinal Diseases	78	35
7. Information/Education about roach management from healtl		
Yes	12	1.8
No	648	98.2

3.4. Association of Cockroach Infestation of Residential Households with Socio-demographic, and Housing Characteristics

Cockroach infestation of the study households were analyzed in a separately regressed bi-variate analysis of the respondents' socio-demographic as well as household and housing characteristics in order to determine if there is a statistically significant association (at $p \leq 0.05$) between the variables of interest as indicated in table 4 and table 5 respectively. From the variables considered on the socio-demographic characteristics, only household size revealed to be significantly associated at $p=0.033$. It showed a higher proportion of the infested residential houses (55.7%) had four and above usual resident members compared to households having less than three usual resident members. In the bi-variate analysis, although not found significant, average monthly income of households showed that those at the lower quantile predominantly reported

the infestation of their homes with cockroaches. Similarly, more households that responded did not receive informationabout health effects of roaches or their proper management from health workers were found to be infested by cockroaches compared to those who said received information from health workers (Table 4).

Table 4. Results of Separately Regressed Bi-variate Analysis on the Association of Cockroach Infestation with Socio-demographic Characteristics in Harar Town.

Variables	Outcome			95%CI	P-
1. Household Size(No of people)	Infested	Non-			
1-3	237(44.3%)	70(57.9%)	1		0.033*
4-6	253(47.3%)	41(33.9%)	1.82	(1.19,2.79)	
7+	45(8.4%)	10(8.3%)	1.33	(0.64,2.77)	
2. Literacy status of HH					
Literate	90(16.8%)	25(21.0%)	1		0.275
Illiterate	446(83.2%)	94(79.0%)	1.32	(0.80, 2.16)	
3. Average Monthly					
1st Quartile(<=1000)	202(37.7%)	39(33.3%)	1		
2nd Quartile(1001,	93(17.4%)	19(16.2%)	0.95	(0.52,1.72)	0.120
3rd Quartile(1501,	133(24.8%)	25(21.4%)	1.03	(0.59, 1.78)	
4th Quartile(>=2501)	108(20.1%)	34(29.1%)	0.61	(0.37, 1.03)	
4. Occupation of HH					
Government	136(25.3%)	39(32.5%)	1		0.063
Self-business	193(35.9%)	42(35.0%)	1.32	(0.81,2.5)	
Farmer	9(1.7%)	1(0.8%)	2.58	(0.32,21.0)	
Daily laborer	73(13.6%)	17(14.2%)	1.23	(0.65,2.33)	
Pension	78(14.5%)	18(15.0%)	1.24	(0.67,2.32)	
House wife	24(4.5%)	0(0.0%)	-	-	
Other	24(4.5%)	3(2.5%)	2.29	(0.66,8.02)	
5. Information about Roach Management from Health Workers					
Yes	9(1.7%)	3(2.5%)	1		0.553
No	528(98.3%)	118(97.5%)	1.49	(0.40,5.60)	
6. Awareness about Harmful Health Effects of Roaches					
Yes	184(34.6%)	37(30.6%)	1		0.401
No	348(65.4%)	84(69.4%)	0.83	(0.54, 1.28)	

On the other hand bi-variate regression analysis of housing characteristics as shown in Table 5, illustrated only two variables were statistically associated with the infestation of households by cockroaches: presence of insect pests in the household other than

cockroaches (p=0.00) and number of rooms in the household (p=0.034). Among all the cockroach-infested households, 95.5% had reported the presence of other pests than cockroaches and 64.2% had more than two rooms. These other common household pests (not accounting cockroaches) reported to be present in the households (n=626) include flies (66.3%, mosquitoes (57.9%), fleas (11.7%), ants (1.8%), bedbugs (1.4%), and termites (0.6%).

In additional to the above-mentioned analysis, the association of the health effects of cockroach infestation on residents with the status of the household infestations with cockroaches was also investigated using bi-variate analysis (Table 6). Even though the relationship was not found to be statistically significant, a higher proportion of respondents from infested households have indicated the presence of family members suffering from asthma/respiratory disorders (85.9%) and skin allergy (90.3%).

Table 5. Results of Bi-variate Analysis on the Relationship of Cockroach Infestation with Housing Characteristics in Harar Town.

Variable	Outcome		COR 95%CI	P-value
1.Wall condition of the Main House	Infested	Non-infested		
Smooth/even	397(74.8%)	89(75.4%)	1	0.881
Dilapidated	134(25.2%)	29(24.6%)	1.04	
2. Kitchen Availability & Attachment to Main House				
Yes detached	347(64.8%)	64(52.9.0%)	1	0.062
Yes attached	78(14.6%)	28(23.1%)	0.51 (0.31,	
No kitchen at all	110(20.6%)	29(24.0%)	0.70 (0.43, 1.14)	
3.Availability of Window of Main House				
Yes	436(81.3%)	105(86.8%)	1	0.159
No	100(18.7%)	16(13.2%)	1.51 (0.85, 2.66)	
4.Availability of Waste Container with Cover				
Yes	161(30.0%)	46(38.0%)	1	0.089
No	375(70.0%)	75(62.0%)	1.43 (0.95, 2.16)	
5. House Structure				
Detached from other	249(47.3%)	50(42.7%)	1	0.367
Attached to other	277(52.7%)	67(57.3%)	0.83 (0.55, 1.24)	
6. Presence of Modified Liquid Waste Disposal				
Yes	175(32.7%)	34(28.1%)	1	0.332
No	361(67.3%)	87(71.9%)	0.81 (0.52, 1.23)	
7.Presence of insect pests in the HH other than roaches				
Yes	510(95.3%)	10(10.9%)	1	0.000*

No	25(4.7%)	81(89.1%)	0.006 (0.003,	
8. Number of Rooms				
1-2 rooms	192(35.8%)	55(45.5%)	1	0.034*
3-4 rooms	211(39.3%)	44(36.3%)	1.37 (0.88, 2.14)	
5+ rooms	134(24.9%)	22(18.2%)	1.74 (1.02, 3.00)	
9.Toilet Availability & Attachment to Main House				
Yes&detached	417(77.7%)	86(71.1%)	1	0.326
Yes& Attached	66(12.3%)	23(19.0%)	0.59 (0.35, 1.00)	
No Toilet at all	54(10.0%)	12(9.9%)	0.93 (0.48, 1.81)	

*$p < 0.05$.

In general, as can be observed from the above results of bi-variate analysis in general, cockroach infestation of the residential households was found to be significantly associated with household size (number of usual /residents/members of the household), presence of insect pests other than cockroaches and number of rooms of the household. Moreover, the investigators assumed for consideration of further multivariate analysis of those variables showing a statistical association at p-value <0.25. Therefore, seven variables with p<0.25 from the bi-variate results shown in Table 4 and Table 5 are considered for the multivariate analysis as described in Section 3.5 below.

Table 6. Results of Bi-variate Analysis on the Relationship of Cockroach Infestation with Their Health Effects on Residents in Harar Town, 2015.

Variables	Outcome			95%CI	P-
1. Asthma/respiratory disorder	Infested	Non-			
Yes	85(85.9%)	14(14.1%)	1	(0.39,	0.278
No	452(81.3%)	104(18.7%)	0.72		
2. Skin allergy					
Yes	56(90.3%)	6(9.7%)	1		0.079
No	481(81.1%)	112(18.9%)	0.46	(0.19,	

3.5. Factors Affecting Infestation of Residential Households by Cockroaches

Following the results of bi-variate analysis, the effects of important explanatory variables on the infestation status of residential households by cockroaches were assessed using a multivariate analysis. Binary logistic regression was employed to determine the relative importance of these factors by controlling for possible confounding variables. Consequently, out of a total of seven variables with p<0.25 at the bi-variate results, only three were found to be significantly associated with cockroach infestation in the multivariate analysis. Thus, availability of window of main house, presence of insect pests other than cockroaches, and number of rooms of the household were found to be highly significant (p<0.05) in determining cockroach infestation of residential (Table 7).

Table 7. Results of Multivariate Analysis That Revealed Significant Association With Infestation of cockroaches in Residential Households in Harar Town, 2015.

Variable	Parameter		
	AOR	95% CI	P-value
1.Availability of Window in Main House			
Yes(RC)	1		
No	3.72	(1.12-12.38)	0.032
2.Presence of insect pests other than roach in the HH			
Yes(RC)	1		
No	0.003	(0.001-0.010)	0.000
3. Number of Rooms			
1-2 rooms(RC)	1		
3-4 rooms	3.8	(1.19-12.10)	0.024
5+ rooms	8.8	(2.22-34.46)	0.002

The analysis indicated that the odds of cockroach infestation among residential households having no windows in the main house was 3.72 times higher than to those having windows in the main house (AOR= 3.72, 95%CI:1.12-12.38). The chance of households being infested by cockroaches were 3.8 and 8.8 times higher to households with 3-4 rooms (AOR=3.8, 95%CI: 1.19-12.10) and 5 or more rooms (AOR=8.8, 95%CI: 2.2-34.46), respectively when compared to households with 2 or less number of rooms. It was also found that the likelihood of cockroach infestation was less by 99.6% (AOR=0.004, 95%CI: 0.0012-0.0096) among households that indicated the absence of insect pests other than cockroaches than those indicated their presence (AOR=0.004, $p<0.05$).

4. Discussion

This study showed that the proportion of residential households infested by cockroaches were very high. More than four-fifth (81.5%) of the respondents had complained that their houses were infested by cockroaches. This finding is in agreement with a study done on level of cockroach infestation in urban communities of Iran (in the city of Yasui) on private houses in which 80% of the residents complained of cockroaches infestation. Moreover, survey on 348 study units of private houses, dormitories, and housing complex in the same area via questionnaires showed that residents for 72% of surveyed residential units admitted to cockroach infestation in their houses (Gholame Hosssein S. et.al, 2013). A study in the Agricultural Community of the Salinas Valley, Monterey County in California, USA, to see association of housing disrepair indicators with cockroach and rodent infestation also indicated 60% homes had cockroach infestation (Asa Bradman et. al, 2005). Surveys using sticky traps in public housing in Gary, Indiana (USA) during 2002–2004 indicated about 50% of the residences had cockroach infestations (Changlu Wang *et al.*, 2008). A cross-sectional descriptive study carried out in 2010 in Shahin Shahr, Isfahan, Iran on analysis of cockroach fauna and frequency in human residential habitats using interviewer

administered questionnaire comparably indicated 67.5% of houses were infested by all life stages of cockroaches (Dehghani R, 2014).

The household species of cockroaches spend large part of the time aggregated, hidden in dark and damp places (E. Sarinh *et. al.*, 2004, Pai, W H. H., *et al.*, 2004). Findings of this study showed odds of cockroach infestation significantly increases with absence of windows (OR=3.72) and with increase of number of rooms (OR=3.8 for 3-4 rooms and OR=8.8 for 5 or more rooms). In other words, the housing condition being poor in terms of absence of windows (darker rooms) and too many rooms with poor natural light in the study households could favor for high cockroach infestation. This is in agreement with a California study which indicated multiunit buildings, (AOR=3.0, $p<0.05$), were highly infested by roaches compared to separate houses (Asa Bradman *et. al.*, 2005).

In this study level of cockroach infestation was shown to be highly associated with the presence of other insect pests. The study results indicated that questionnaire respondents (households) who denied the presence of insect pests (un-accounting cockroaches) in a multivariate analysis were 99.6% less infested by cockroaches compared to those households which claimed the presence of other insect pests in the household (AOR=0.004, (95% CI 0.001- 0.010) at statistical significance level of $p < 0.05$. From the 626 houses studied, it was only 106(16.9%) households denied the presence of insect pests un-accounting cockroaches. Moreover, out of the 520 households who claimed the presence of other insect pests in the household, 510(95.3%) indicated that they have also cockroach infestation. This might indicate that the presence of other insect pests in residential households suggests poor housing and sanitation and that definitely is conducive for cockroach proliferation. This is supported by a statistical analysis carried in three communities of Ifelodun Local Government Area of Kwara State in Nigeria that indicated unfavorable housing conditions are strongly associated with pest infestation. This Nigerian study states that inadequate maintenance of existing residences and environs leads to disproportionately high incidence of pest infestation, arising from poor hygiene, and improper storage and disposal of wastes (Braimah O.J. et.al, 2015). This is also evidenced by another study done in Gary, Indiana (USA); that showed from 358 randomly selected apartments; 81% of them were found to be infested by cockroaches, mice, ants, spiders or flies, as indicated by the interviews and inspections. The Gary study reported that high pest infestation rates in the surveyed apartments were due to a combination of several factors like lack of proper maintenance of the residences, poor pest control operations, and poor house-keeping by residents (Changlu Wang *et al.*, 2008). Our study showed flies, mosquitoes and fleas as common household pests other than the cockroaches. This indicates poor housing sanitation that may also foster for the proliferation of cockroaches.

Awareness on public health importance of cockroach and information/education about roach management from health worker to residents are considered to be important contributors for initiation and utilization of appropriate roach infestation management. By increasing the awareness of citizens to observe sanitary principles and identify the center of proliferation of cockroaches can reduce cockroach infestation

(Cohn, R. D., et al., 2006). In this study, 65.9% of the respondents claimed to be not aware (either do not know, or do not believe) about the harmful health effects of cockroach infestation. More over 98.2% of the respondents indicated that they were not informed about cockroach management from health workers. This might indicate that the observed high prevalence of cockroach infestation of the residential households may be attributed to the low awareness of the community of the harmful effects of cockroaches although not found to be statistically significant at bi-variate and multi-variate analysis. But, among the households with cockroach infestation, 61.3% of the respondents had low or had no tolerance at all to the scene of cockroaches in their homes. This is related to the fact that cockroaches are something that many people are worried about when they see them in their homes and because the presence of cockroaches indicates unsanitary conditions (Etim, S. E., *et al.*, 2013).

The study also investigated if there are residents in the study households who complain of suffering respiratory disorders (like asthma) and skin allergies. Though not found significant, most cases were reported from cockroach infested households compared to those not infested (85.9% and 90.3% respectively). This is in line with several studies done worldwide that show cockroach related allergies (Sarinho E. *et al.*, 2004, Changlu Wang, *et al.*, 2006, Cohn, R. D., *et al.,* 2006).

5. Conclusion

This study revealed that infestation of residential households in the study area (Harar town) is very high. Despite for desirability bias of the respondents, the infestation/ prevalence of cockroaches can be said universal in the town. Although housing structure (attachment of the house to other households) was not found to be significantly associated to the presence of cockroaches. It can be; however, explained that since the study was conducted in urban setting, and the Ethiopian towns are at most, with a sub-standard housing conditions and almost in a highly crowded and congested mood, it is easy for the cockroaches to move to different households, hence leading to a universal infestation. It is also known that Harar, its walled city (where some of its kebeles are included in this study) is a "World Heritage" with its spectacular housing units that are attached and interconnected and with narrow alley would favor cockroaches to communicate easily from one house unit to the other. Moreover, the poor environmental hygiene in the crowded housing conditions would also favor the proliferation of cockroaches. In the same talk, it is observed that the level of awareness of the respondents to the public health effects of cockroaches is also low. But literature is abundant about the effects of cockroaches in disease transmission and in the infliction of allergic reactions on residents. Therefore, it is high time to the responsible public health and housing authorities in the study area to pay attention to the uncovered health burden that this study has revealed.

As this study is based on the respondents self report on the cockroach infestation status of their dwellings in the last 12 months prior to data collection, its findings might be influenced by social desirability bias.

6. Recommendations

The following are recommendations based on the findings of this study.

1. The health authorities in the town should pay special attention to the existence of high level cockroach prevalence in the residential households of the town.
2. The concerned health authorities and health institutions in the town should deliver to the residents of Harar town focused health information related to the public health effects of cockroach pest in-order to increase health awareness of the community.
3. Interested researchers soud conduct in-depth researches on the types of cockroaches and the types of infectious agents they may carry and the level of cockroach allergens and the like in the study area and anywhere else.

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4. Dietary Diversity and Associated Factors among HIV Positive Adults Attending ART Clinic at Hiwot Fana and Dilchora Hospitals, Eastern Ethiopia

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Abstract: Nutritional care considered as crucial component of comprehensive care for the People living with HIV/AIDS (PLWHA), particularly in resource-limited settings where malnutrition and food insecurity are endemic problems and low quality monotonous diets are the norm. Even though there is a complex interaction between human immunodeficiency Virus (HIV), immune function, dietary intake/diversity and nutritional status, significant numbers of PLWHA took less than the recommended eating occasions (frequency), energy intake and food diversity. Therefore, the aim of this study was to assess dietary diversity and associated factor among HIV positive adults (18-65years) attending ART clinic at Hiwot Fana and Dilchora hospitals, Eastern Ethiopia.Institution-based cross sectional study was utilized from November 2014 to February 2015 at ART clinics of Hiwot Fana and Dilchora hospitals. A total of 303 clients were selected by systematic random sampling technique from all adults attending in ART clinics of the two hospitals. The data were collected using an interviewer-administered questionnaire including questions about their socio-demographic factor, health related factor, behavioral factors, socio economic factors, 24 hour dietary recall and an individual dietary diversity score tool. Logistic regression and odds ratio at 95% CI were used to show association between dietary diversity and Independent factors. The findings of this study provided baseline information on dietary diversity and related factors for health care providers so as to improve nutritional care and support activity.A total of 303 adult HIV positive individuals on ART were participated in the study, of which62.4% were females. The largest number of participants, 49.5% were in the age group of 30-40 years. Eighty seven (28.7%) participants had low dietary diversity (<4 food groups). Duration of anti-retroviral treatment was the factor significantly associated with dietary diversity: respondents with duration of anti-retroviral treatment less than a year were less likely to have high dietary diversity comparing with those

greater than two years [AOR = 0.490; 95% CI: 0.091, 0.978].Low dietary diversity was nutritional problem among HIV positive adults. Duration of anti-retroviral treatment was the predictor of low dietary diversity. Therefore, appropriate dietary management of side effects of ART is important. Appropriate counseling and support during initiation of ART also recommended.

1. Introduction

Nutrition is an important component of comprehensive care for the People living with HIV/AIDS (PLWHA) and is particularly so in resource-limited settings where malnutrition and food insecurity are endemic. There is similarity in the cellular effects of malnutrition and HIV on the immune system compromising it by decreasing CD4 T-cells, suppression of delayed hypersensitivity, and abnormal B-cell responses (Scrimshaw *et al.*, 1997). Providing sufficient food and nutrition to meet people's basic needs for health, growth and development has been a long-standing challenge for African countries. This challenge is farther exacerbated by the emergence of HIV/AIDS. The effect of poor nutrition in the case of PLWHA is more horrendous as they have to grapple with opportunistic infections. Dietary management of PLWHA is key to sustaining the ability to continue participating in the workforce and contribute to socioeconomic development (Soyiri and Laar, 2004). Food insecurity and poor nutritional status may hasten progression to Acquired Immuno Deficiency Syndrome (AIDS)-related illnesses, undermine adherence and response to antiretroviral therapy, and exacerbate socioeconomic impacts of the virus. HIV infection itself weakens food security and compromises nutritional status by reducing work capacity and productivity, and jeopardizing household livelihoods (Castleman *et al.,* 2004).

Dietary diversification is a recommended approach to alleviate nutritional problems resulting from food insecurity and inadequate intake of micronutrients. Dietary diversity score at the individual level is Proxy indicators of adequate intake of energy and micronutrients (GinaKennedy *et al.*, 2007). Eating a diversity of foods is an internationally accepted recommendation for a healthy diet, and is associated with positive health outcomes such as reduced incidence of mortality (Michels *et al.,* 2002). Dietary diversity is therefore a key concept that should be promoted in managing the nutrition situation of PLWHA. The relationship between nutrition and HIV infection is very complex and is modified by factors such as nutritional status, including wasting or weight loss and micronutrient deficiencies, HIV disease stage, other physiological factors and diet. Comprehensives care of HIV disease includes combination of medical treatment and adjustment, nutrition assessment, management, and counseling and ongoing monitoring of outcome (USAID,2012).HIV-positive individuals require 20%-30% more energy than HIV-negative individuals of the same age, sex, and physical activity level (Shawel, 2013).

Dietary diversity is a qualitative measure of food consumption that reflects household access to a wide variety of foods, and is also a proxy of the nutrient adequacy of an individual's diet. Individual dietary diversity score (IDDS) aims to capture nutrient

adequacy and many studies amongst people of different age groups have shown that its increase is related to increased nutrient adequacy of the diet. Dietary diversity scores have been positively correlated with increased mean micronutrient density adequacy of complementary foods (FANTA, 2006) and micronutrient adequacy of the diet in adults (Ogle *et al.,* 2001; Foote *et al.,* 2004). Even though there is the complex interaction between dietary diversity/intake, immune function and HIV/AIDS and malnutrition, little study conducted regarding this public health significant problem throughout the country and no study is conducted in eastern Ethiopia. Therefore, the aim of this study was to assess dietary diversity and associated factors among HIV positive adults (18-65 years) attending ART clinic at Hiwot Fana and Dilchora hospitals.

2. Methods and Materials

2.1. Study Design, Area and Period

Institution based cross-sectional study design was used. The study was conducted from November 2014 to February 2015 at ART clinic of Hiwot Fana and Dilchora Hospitals which are among the Eastern Ethiopia hospitals found in Harar town and Dire Dawa city respectively. Harar 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. The town has a projected total population of 203,438 (M: F=102,369:101,069) in 2010. Harar town is divided in to 19 kebeles and can be divided into two ethnic zones; Harari dominated and mixed zone.The health service coverage is estimated to be above 100%. There are four governmental hospitals, two private hospitals and four health centers in the town (Harari Region, 2010).

Dire Dawa was founded in 1902 when the railroad from Djibouti reached the area. Dire Dawa is the second large city in Ethiopia. It is a commercial and industrial center located 515 kilo meter from Addis Ababa on the Addis Ababa–Djibouti railroad in the eastern part of Ethiopia. Based on the 2007 population and housing Census, Dire Dawa has a population of 341,834, of which 171,461 are men and 170,461 women; 233,224 or 68.23% of the population are urban inhabitants. Dilchora Referral Hospital (DCRH), the only governmental hospital in the Dire Dawa City Administration, was established in 1952 and since then has been serving the ever increasing population of the Dire Dawa City and its adjacent regions, Oromiya and Somali.

2.2. Sample SizeDetermination and Sampling Procedure

Sample size was determined by using a single population proportion formula by taking a value of 10.3% representing the prevalence estimates of adult malnutrition, as a proxy for dietary quality in sub-Saharan African countries was used (Olalekan A Uthman, 2008). Then the final sample size, including 10% of non-responding rate were 303 and enrolled by systematic random sampling method by using registration book of the patients as sample frame. The first study subject was selected using lottery method. One study subject was recruited only once. The study participants for each hospital were allocated proportional based on the number of ART patients in each hospital.

2.3. Data Collection Methods and Procedures

The standardized individual dietary diversity score tool with 24 hour food recall method (food and nutrition and technical assistance FANTA, 2007) was used to assess dietary diversity of adult clients living with HIV/AIDS.

2.3.1. Measurement of dietary diversity score

Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods, and it is also a proxy indicator for nutrient adequacy of the diet of individuals. Determination of dietary diversity score of the respondents were started primarily by listing all foods consumed by respondents (both inside and outside home(those who were not eaten at feasts or special occasions/ceremonies) in the previous 24 hour starting from breakfast which is considered to be eaten between 6:00am and 10:00 am then lunch (12:00am-4:00 pm) and Dinner (8:00pm-12:00 am) while snacks considered to be eaten before or after the major meal. Food eaten by the respondent were classified into the 12 food groups as Cereals, Oils/Fats, Sweets/Sugar, Legumes, white Root and Tubers, Fruits, Vegetables, Meat and meat products, Milk and Milk products, Eggs, Fish and Sea foods, spices, condiments and beverages (based on FAO /FANTA 2007 recommendation) which are commonly consumed in the study area. Participants received 1 point if they consumed at least once during the last 24 hours of the foods within each subgroup and 0 point if they never consumed the food. Individual Dietary Diversity Score (IDDS) was calculated as the sum of food groups consumed over 24 hours. Each food group eaten by a respondent was given a score of 1 and the total individual scores were computed**.** The total individual food scores were first categorized into terciles, namely Low IDDS terciles is equivalent to low dietary diversity (1 to 3 food groups); Medium IDDS terciles equivalent 4 to 5food groups and High IDDS terciles means 6 or more food groups. For further analysis, these groups were then dichotomized into two categories: where 0 to 4 were considered as low dietary diversity score and 5 or more food groups were considered as high dietary diversity score (FAO, 2007).

2.3.2. Anthropometry (Measurement of Weight and Height)

Weight was measured using a standard 140 kg Seca weighing scale which is used for weight measurement in ART clinic. The scale pointer was calibrated at zero before taking measurement. The person was required to dress in light clothes and take off shoes. Women were asked to remove scarf. He/she stand straight and unassisted on the center of the weighing scale platform. Measurement of weight was recorded to the nearest 0.1kg and was cheeked at least two times.Height was measured using the standard scale. The subjects were required to remove their shoes, stand erect, looking straight in a horizontal plane with feet together and knees straight. The heels, buttocks, shoulder blades and the back of the head should touch against the wall. Height measurement should be at least two times and recorded to the nearest 0.1cm.

2.4. Data Analysis

Data was coded, entered, cleaned and analyzed into SPSS version 16.0 statistical software. To keep the quality of data, questionnaire, standardized individual dietary diversity score, and 24 hour dietary recall tool were used. The English version questionnaire was translated in to local languages (Amharic, Afan-oromo and Somaligna) and then back to English to maintain its consistency for actual data collection purpose. The questionnaire was also pre-tested at other health centers or hospitals. Full training was given for 4 clinical nurses' data collectors and two supervisors. Furthermore, the investigators were give feedback and correction regarding the collected data on daily basis to the data collectors. Completion, accuracy, and clarity of the collected data were checked carefully.

Percentages of respondents with respect to food groups and number of meals eaten by each respondent in a 24 hour recall period were computed. Cross tabulations were carried out to test for association between respondent characteristics and dietary diversity score which is represented by the total number of food groups eaten by each respondent in the respective categories of 0-4 and 5+. The strengths of associations between respondent characteristics and individual dietary diversity scores (IDDS) were determined using odds ratios and 95% confidence intervals. Bi-variate analysis was used for each variable to check the association between independent variables and dietary diversity and those variables which was be found to have significant association ($p<0.05$) in the bi-variate analysis was entered into multivariable logistic regression model so as to control for possible effect of confounders and variables which have significant association was identified on the basis of OR at 95% CI.

2.5. Ethical Considerations

Ethical clearance was obtained from institutional Review committee from Colleges of Health and Medical Science, Haramaya University. Permission to conduct the study was obtained from Hiwot Fana and Dire Dawa hospitals managers prior to data collection. Objective of the study was explained and informed consent was obtained from each participant. Confidentiality was maintained at all levels of the study. Participants who were unwilling to participate in the study and those who wanted to abstain from their participation at any stage were informed to do so without any restriction.

3. Result

3.1. Socio-Demographic and Economic Characteristics

In this study, 303 adult HIV positive individuals were participated with a response rate of 100%. Of which, 189(62.4%) were females. About half (49.5%) of the study participants were in the age group of 30-40 years and the mean age of respondents was 37.92 years (SD =+/- 8.890). Two hundred three (67.0%), 142 (46.9%) and 143(47.2%) participants were orthodox Christians, single and were completed their primary education respectively. The majority (97.4%) of respondents were from urban Kebeles and did not take formal education (73.9%). The majority (95.4%) of the study participants were living in the family size less than five and the mean family size was 2.89 with standard deviation of 1.583. For above half (53.5%) of study participants, the main

source of income was from professional (Salary/remittanceand the main household sources of food for almost all (98%) of the study participants were accessed through purchasing from market (Table 1).

Table 1. Socio-demographic characteristics of HIV positive adults (18-65years) attending ART clinic in two public hospitals, Eastern Ethiopia, 2016 (n = 303).

Variable		Frequency	Percent	Variable		Frequency	Percent
Gender	Male	114	37.6	Marital status	Married	40	13.2
	Female	189	62.4		Single	142	46.9
Age	18-29 years	54	17.8		Divorced	78	25.7
	30-40 years	150	49.5		Widowed	43	14.2
	greater than 40 years	99	32.7	Educational status	Cannot read and write	31	10.2
Ethnicity	Oromo	100	33.0		Read and write only	19	6.3
	Amhara	153	50.5		Primary education	143	47.2
	Harari	9	3.0		Secondary and above	110	36.3
	Tigrea	19	6.3	Number of people in household	<5	289	95.4
	Guragea	7	2.3		>=5	14	4.6
	Others	15	5.0	Monthly family income	< 200 birr	9	3.0
Religion	Orthodox	203	67.0		200-500 birr	60	19.8
	Muslim	74	24.4		500-1000 birr	116	38.3
	Catholic	25	8.3		>1000 birr	118	38.9
	Others	1	0.3	Main source of income	Agriculture (Crop)	15	5.0
Occupation	Farmer	6	2.0		Livestock	1	.3
	Government employee	54	17.8		Trader	108	35.6
	Waiter	4	1.3		Professional (Salary/remittance earner	162	53.5
	Unemployed	11	3.6		House rent	17	5.6
	Merchant	111	36.6	Main source of food	Purchase	297	98
	Daily laborers	32	10.6		Own farm/garden	6	2.
	house wife	15	5.0				
	non-governmental employee	70	23.1				

3.2. Health Related, Behavioral and Nutritional Characteristics

Majority (80.2%) of HIV positive adults attended ART for more than two years and 175(57.8 %) of the participants took Cotrimoxazole prophylaxis. Two hundred eighty two (93.1%) participants had CD4 count of greater or equals to 200 cells/dl and 159(52.5%) participants were in WHO clinical stage I. Two hundred fifty eight (85.1%) participants were not infected with Opportunistic infections (OI), but Tuberculosis was the common OI among the HIV positive adults infected with OI. Six (2%), 7(2.3%) and 34(11.2%) of the total study participants have a habit of drinking alcohol, Cigarette smoking and Chewing chat respectively (Table 2).

Table 2. Health related and Behavioral characteristics of HIV positive adults (18-65years) attending ART clinic in two public hospitals, Eastern Ethiopia, 2016 (n = 303).

Variable		Frequency	Percent
ART status (on ART)	Yes	303	100
Duration on ART	≤ 1year	26	8.6
	1-2 years	34	11.2
	> 2 years	243	80.2
Cotrimoxazole prophylaxis	Yes	175	57.8
	No	127	41.9
Last CD4 count	≤50 cells/mm3	3	1.0
	51-199 cells/mm3	18	5.9
	≥ 200 cells/mm3	282	93.1
WHO clinical stage	stage-I	159	52.5
	stage-II	28	9.2
	stage-III	115	38.0
	stage-IV	1	.3
Opportunistic infections (OI)	Zoster	7	2.3
	bacterial pneumonia	14	4.6
	PTB	12	4.0
	EPTB	4	1.3
	thrush-oral,vaginal	2	.7
	ulcers-mouth, genital	2	.7
	diarrhea chronic/acute	3	1.0
	pneumocystis pneumonia	1	.3
	No OI	258	85.1
Cigarette smoking	Yes	7	2.3
	No	296	97.7
Drinking alcohol	Yes	6	2.0
	No	297	98.0
Chewing chat	Yes	34	11.2
	No	269	88.8

Out of the total study participants, only 41 (13.5%) were underweight and 293 (96.7%) received nutritional counseling on general feeding, ART and other drugs and opportunistic infection in ART clinic and pharmacy (Table 3).

Table 3. Nutritional related characteristics of HIV positive adults (18-65years) attending ART clinic in two public hospitals, Eastern Ethiopia, 2016 (n = 303).

Variable		Frequency	Percent
BMI	<18.5kg/m2	41	13.5
	≥18.5kg/m2	262	86.5
On RUTF(plumpy nut)	Yes	11	3.6
	No	292	96.4
RUTF(plumpy nut) use daily	Yes	11	3.6
	No	292	96.4
Sharing RUTF(plumpy nut) with others	Yes	8	72.7
	No	3	27.3
Nutritional counseling	Yes	293	96.7
	No	10	3.3

3.3. Dietary Diversity Scores of the Respondents

According to the terciles category of the total individual food scores, about half of participants (47.2 %(143/303)) had Medium IDDS (4 – 5 food groups), followed by High IDDS (6 or more food groups) (35 %(107/303)) and Low IDDS (1 – 3 food groups) 17.5 %(53/303)) per 24 hours before data collection. And according to the dichotomous category of the total individual food scores, 87(28.7%) participants had low dietary diversity (≤4 food groups) and 216(71.3%) had high dietary diversity (≥5 food groups) per 24 hours before data collection.

3.4. Number of Meals Eaten by Respondents Per Day

Of the total respondents, only 135 respondents ate meals four times within 24 hour, and almost all of the study participants ate breakfast, lunch and dinner meals within 24 hours before data collection(Figure 1 and 2).

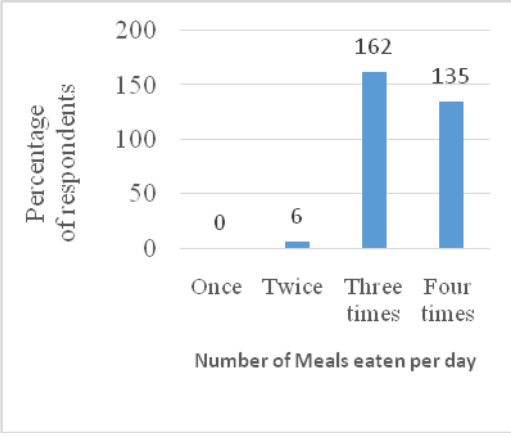

Figure 1. Frequency of meals per respondent per day of HIV positive adults (18-65years) attending ART clinic in two public hospitals, Eastern Ethiopia, 2016 (n = 303).

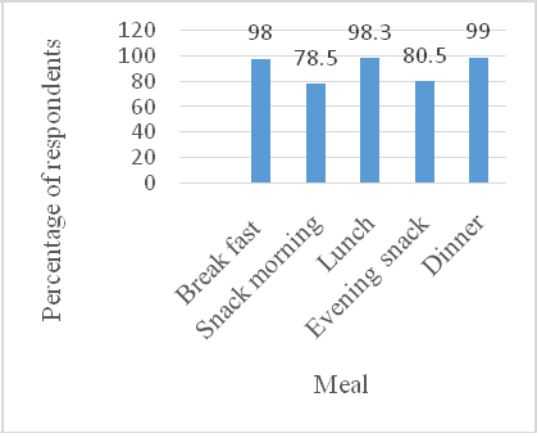

Figure 2. Meals eaten within 24 hours of HIV positive adults (18-65years) attending ART clinic in two public hospitals, Eastern Ethiopia, 2016 (n = 303).

3.5. Variety of Foods Eaten by Respondents within 24 Hours

The most commonly eaten foods within 24 hours before data collection were Cereals 303/303 (100%), Oils and fats 303/303 (100%), fruits 268/303 (88.4%), legumes, nuts and seeds 223/303 (73.6%), and the least eaten food group was fish and other sea foods (1.3 %). The food groups eaten by less than 50% of the participants were fish and other sea foods, milk and milk products, Spices, condiments and beverages and white tubers and roots (Figure 3).

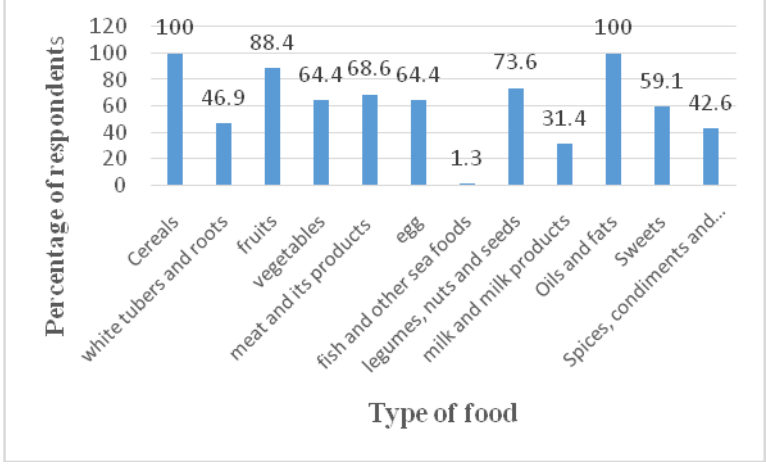

Figure 3. Variety of food eaten within 24 hours of HIV positive adults (18-65years) attending ART clinic in two public hospitals, Eastern Ethiopia, 2016 (n = 303).

3.6. Factors associated with Level of Dietary Diversity

In both bivariate and multivariate analysis the only significant factor associated with dietary diversity was duration of anti-retro-viral treatment. After controlling for possible confounders, the result of multivariate analysis revealed that duration of anti-retro-viral treatment remained significantly associated with dietary diversity of HIV positive adults. Respondents with duration of anti-retroviral treatment greater than two years was almost two time more likely high dietary diversity compare with less than a year [AOR = 0.490; 95% CI: 0.091, 0.978] (Table 4).

Table 4. Factors associated with dietary diversity of HIV positive adults (18-65years) attending ART clinic in two public hospitals, Eastern Ethiopia, 2016 (n = 303).

Variable		Individual Dietary diversity scores (DDS)		Crude OR (95% CI)	Adjusted OR (95% CI)
		Low	High **		
Sex of respondent	Male	30 (26.3)	84 (73.7)	1.2 (0.7, 2.1)	0.9(0.5, 1.5)
	Female	57(30.3)	132(69.7)	1	1
Educational status	Cannot read & write	6(19.4)	25(80.6)	2.1 (0.8, 5.8)	0.5 (0.2, 1.3)
	Read and write only	6(31.6)	13(68.4)	1.1 (0.4, 3.3)	0.9(0.3, 2.8)
	Primary education	37(25.9)	106(74.1)	1.5(0.8, 2.6)	0.7(0.4, 1.2)
	Secondary and above	38(34.5)	72(65.5)	1	1
WHO clinical staging	Stage-I	46(28.9)	113 (71.1)	0.9 (0.1, 1.0)	1.0 (0.6, 1.0)
	Stage-II	11(39.3)	17(60.7)	0.9 (0.2, 1.0)	0.9(0.2, 1.0)
	Stage-III	29(25.2)	86(74.8)	1	1
Cotrimoxazole prophylaxis	Yes	46(52.9)	41(19.00)	1.6 (0.9, 2.8)	0.6(0.4, 1.1)
	No	41(47.1)	175(81.00)	1	1
CD4count	<= 50 cells/mm3	1(33.3)	2(66.7)	0.8 (0.1, 9.8)	1.3(0.1, 15.8)
	51-199 cells/mm3	6(33.3)	12(66.7)	0.9 (0.3, 2.7)	1.2 (0.4, 3.7)
	>= 200 cells/mm3	80(28.4)	202(71.6)	1	1
Duration on ART	<= 1 year	13(48.1)	14(51.9)	0.4 (0.2, 1.0)	0.5 (0.1,1.0)
	1-2 years	14(41.2)	20(58.8)	0.4 (0.2, 1.0)	0.5 (0.0, 0.8)
	>= 2 years	60(24.8)	182(75.2)	1	
Age	18-29 years	24(44.4)	30(55.6)	0.7 (0.3, 1.6)	1.4 (0.6, 3.0)
	30-40 years	34(22.7)	116(87.3)	1.7(0.9, 3.1)	0.6(0.3, 1.1)
	Greater than 40 years	29(29.3)	70(70.7)	1	1

******** *The reference category is: high dietary diversity.*

4. Discussion

In this study Eighty seven (28.7%) of the study participants had low dietary diversity which is lower than the reports done in Metema hospital, Jimma University specialized hospital in Ethiopia and in eastern Uganda with 58.8%, 55.8% and 59%, respectively (Woldemariam*et al.*, 2015; Tiyou *et al.*, 2012; Bukusuba *et al.*, 2007). This showed that HIV positive adults attending in the present study area had adequate dietary intake

compared to the above studies because studies documented that Dietary diversity, i.e. the number of foods consumed across and within food groups over a reference period, is widely recognized as a key indicator of nutrient adequacy (Ruel, 2003; Mirmiran *et al.*, 2004; Tiyou *et al.*, 2012; Torheim *et al.*, 2004).

Duration of anti-retroviral treatment was significantly associated with dietary diversity. It was noticed that HIV positive adults who were on ART for less than one year and 1-2 years duration more likely to have low dietary diversity than those on ART for more than two year respectively. This finding was consistent with the study finding in Metema hospital that HIV positive adults who were on ART for less than one and half year (<18 months) duration were more likely to have low dietary diversity than those on ART for more than three and half years (Woldemariam *et al.*, 2015). This might be due to most ARV drugs can lead to reduced food intake or reduced nutrient absorption that exacerbates the weight loss and nutritional problems experienced by PLWHA. ARV side effects, such as nausea, taste changes, and loss of appetite may reduce food consumption, while side effects such as diarrhea and vomiting may increase nutrient losses (Tony *et al.*, 2003).

In the early periods of initiation of ART, clients may face challenges in adapting the above side-effects as compared to taking ART for longer duration. This condition might increase the likelihood of having reduced food consumption, low meal frequency and low dietary diversity (Hoffmann, 2010). Moreover, in the early period of initiation of ART, client may experience mood changes like anxiety and depression as a result of introduction to lifelong treatment, social stigma and other psycho-social factors. The above mood changes may result in suppressed appetite, which in turn may result low dietary intake and low dietary diversity (Woldemariamet al., 2015).

Studies reveal that nutrition knowledge influences the dietary diversity (Yoon *et al.*, 2000; Muthamia *et al.,* 2014). As an individual's nutrition knowledge increase, the consumption of foods from different food groups increases. As a result of this, variety of nutrients is obtained and thus nutrient adequacy is attained (Yoon *et al.*, 2000). Nutrition information should thus be a key component to the care of PLHIV and should be initiated at the entry point to the comprehensive care. Nutrition education should be continuous throughout the period of care. Nutrition interventions that educate low income families on inexpensive, healthful eating should be embraced. Changes at policy level should be well thought-out to increase affordability and accessibility of healthful food in low-income settings (Muthamia *et al.,* 2014). Even though, no statistically significant associations were observed between dietary diversity and nutritional counseling provided to clients by health providers in the present study area the great majority (96.7%) of study participants had nutritional counseling from health providers. This counseling service might contribute to high level of dietary diversity in the present study.

This study found that all study participants (100%) consumed foods made up of cereals over a 24 hour period which are generally cheaper than animal products such as meat. All participants also reported that they use fats and oils during food preparation to fry their food. This finding is similar to findings from studies conducted in Methema

(Ethiopia) and Uganda, which found that the most commonly eaten foods were cereals and Oils and fats (Woldemariam *et al.*, 2015; Carol, 2004). The other most commonly consumed foods groups were fruits (88.4%) and legumes, nuts and seeds (73.6%). This was similar to findings from a survey carried out in Methema (Ethiopia) and Tanzania (Woldemariam *et al.*, 2015; Kinabo *et al.*, 2006). The least food group eaten by the respondents in the 24 hours prior to the study was Fish (1.3%). This may be due to absence of this food source in this study area.

5. Limitation of the Study

Limitations of our study include its cross-sectional nature, which does not allow us to infer causality. Even though using 24 hour food recall method minimizes recall bias; it only provides a snap shoot of information rather than trend of dietary habit.

6. Conclusion and Recommendation

Low dietary diversity was nutritional problem among HIV positive adults attending Anti-retroviral treatment clinic in the present study area. The finding of the present study also revealed that duration of anti-retroviral treatment was significantly associated with dietary diversity. In the early periods of initiation of ART, clients may face challenges in adapting the ARV drugs side effects that can lead to reduced food intake or reduced nutrient absorption as compared to those taking ART for longer duration. Mood changes as a result of introduction to lifelong treatment may also result in suppressed appetite, which in turn may result low dietary intake and low dietary diversity. Appropriate dietary management of common side effects of ART (nausea, vomiting, diarrhea, anorexia, fever and change or loss of taste) include: take the medication with food, eat small quantity of food at frequent intervals, drink plenty of fluids and continue eating, eat small, frequent meals, drink plenty of fluids and eat energy and nutrient dense foods, use flavor enhancers such as salt, spices, or lemon, chew food well and move around in mouth to stimulate receptors. Health care providers should provide appropriate counseling and support during initiation of ART in order to overcome mood changes like anxiety and depression that result in suppressed appetite, which in turn result low dietary intake and low dietary diversity.

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8. Competing Interests

All the authors declare that they have no conflict of interest associated with the publication of this manuscript.

9. Authors' Contributions

FW participated in proposal writing, data collection, analysis, interpretation and critical review of the manuscript. HM participated in proposal writing, data collection, analysis, interpretation and critical review of the manuscript. TD participated in proposal writing, data collection, data analysis, interpretation and critical review of the manuscript. FM participated in proposal writing, data analysis, interpretation and critical review of the manuscript. They also read and approved the final manuscript.

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5. Characterization of Lactic Acid Bacteria from Camel Milk and Their Technological Properties to use as a Starter Culture

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Abstract: Proper selection and balance for starter culture is critical for the manufacture of fermented products of desirable texture and flavor. The objective of this study was to characterize lactic acid bacteria (LAB) from camel milk and elucidate their properties to use as a starter culture. Twenty-one lactic acid bacteria species were isolated from 30 samples of camel milk collected from Babile Woreda, eastern Ethiopia. Isolates were characterized phenotypically and their technological properties such as acidification, exopolysaccharide production (EPS), proteolytic and antimicrobial activities were studied following standard procedures. The results revealed that the isolated LAB strains belonged to *Lactobacillus, Lactococcus, Streptococcus* and *Enterococcus* genera. All lactic acid bacteria strains showed proteolytic activity with different degrees of clear zones. The lactic acid bacteria strains exhibited either high to low acidification activities. About 85% of the lactic acid bacterial strains had significant exopolysaccharide production (EPS). Three LAB strains showed maximum antagonistic properties against indicator organisms (*Staphylococcus aureus, Escherichia coli, Salmonella typhi,* and *Pseudomonas aeruginosa*). It could be concluded that *Lactobacillus plantarum* HUM19, *Lactobacillus acidophilus* HUM20, and *Streptococcus cremoris* HUM8 had high acidifying, antimicrobial and proteolytic activities, and EPS production among all other lactic acid bacteria isolates.

Keywords: Acidifying activity; Antimicrobial activity; Exopolysaccharide production (EPS); Fermentation; Proteolytic activity; Technological properties.

1. Introduction

Fermented foods and beverages constitute a major portion of people's diets in Africa Oyewole (1997). Microorganisms are important in dairy products. One of the most important groups of acid producing bacteria in the food industry is the lactic acid bacteria (LAB) which are used to prepare starter culture for different dairy products. The proper selection and balance for starter culture is critical for the manufacture of fermented products of desirable texture and flavor Temmerman *et al.* (2002).

Currently, LAB are a focus of intensive international research for their essential role in fermented foods as a starter culture and for their ability to produce various antimicrobial compounds promoting probiotic properties Temmerman *et al.*(2002), various production of metabolic and enzymatic substances, which contribute to flavor, aroma and texture developments Kleerebezemab *et al.* (2000), for their ability to transform lactose and improve the digestibility of fermented dairy products (Soukoulis *et al.,* 2007; Weinberg *et al.,* 2007) as well as for their preservative quality Abdelbasset and Djamila (2008).

The microbiological quality of milk and milk products is influenced by the initial flora of raw milk Ritcher and Vadamuthu (2001). When camel milk is left to stand, its acidity rapidly increases due to the presence of LAB Ohris and Joshi (1961). It has also been recognized that LAB are capable of producing inhibitory substances other than organic acids (lactate and acetate) that are antagonistic toward other microorganisms Daeschel (1989).

Ethiopia is a country where vast arid regions exist. In these regions, long spells of dry period without any rain are common. Under such conditions, the only livestock, which can successfully survive and produce substantial quantities of good quality milk, is the camel. But accessing market for camel milk is low for producers due to remoteness from towns and roads, and cannot be used in a fresh state and goes wasted. During peak production season, it can be saved and effectively utilized through converting it into fermented camel milk product by using starter culture of lactic acid bacteria Seifu *et al.* (2012). Therefore, the present study was aimed at characterizing lactic acid bacteria obtained from camel milk and elucidates their technological properties to use as a starter culture for prolonging the shelf life of the milk by preserving its taste and flavour.

2. Materials and Methods

2.1. Description of Study Area

The study was carried out in Eastern Ethiopia, Babille Woreda (district), which is predominantly an agro-pastoral Woreda Tofik (2014). The town is situated at the latitude of 09°13'N42°20'E and longitude of 07°16'N 32°13'E and elevation of 1648 meters above sea level. The town is located at the distance of 30 km east of the town of Harar and 535 km from Addis Ababa, eastward. The study sites of the pastoral areas are located at the distance of about 15 km from thetown of Babile. The rainfall pattern is bimodal but unpredictable and erratic in distribution. The mean annual temperature is between 34°C and 38°C (www.weather-forecast.com).

2.2. Sample Collection

A total of 30 samples of camel milk were collected aseptically from the pastoral households of Babille Woreda in Ethiopia. Camel milk samples were collected using sterile bottles and transported to Haramaya University, Microbiology Laboratory in an icebox for analysis. Aseptic sampling was followed as described by the Health Protection Agency HPA (2004) and the Food and Drug Administration FDA (2003). In the

laboratory, the camel milk samples were kept at the temperatures below 4°C and analyzed within 48 h of collection HPA (2004).

2.3. Isolation of Lactic Acid Bacteria (LAB)

Lactic acid bacteria (LAB) were isolated from the camel milk samples using de Man Ragosa and Sharpe (MRS) and M17 agar according to the method described by Harrigan and McCance (1976) by pour plate method in triplicates. Ten (10) ml of unpasteurized camel milk samples were homogenized with a 90 ml sterile saline solution (0.85%, w/v NaCl) to make an initial dilution (10^{-1}). The suspension was used for making suitable serial dilutions up to 10^{-8} by incorporating 1 ml into 9 ml of sterile NaCl solution (0.85%, w/v) in sterile tubes. From appropriate dilutions of 10^{-2} to 10^{-4}, 1 ml of the samples were pour plated into MRS medium, incubated anaerobically for 72 hrs at 37°C, for isolation of *lactobacilli* and M17 medium, incubated anaerobically for 48 hrs at 30°C, for isolation of *lactococci*. After incubation, colonies were enumerated and recorded as colony forming units (cfu) per ml of milk. Then desired glistening colonies were picked up from the MRS and M17 agar plates by a sterile platinum loop and sub culturing was continued until the pure culture was obtained.

The presumptive lactic acid bacteria (LAB) isolates were inoculated in MRS/M17 broth, incubated at 30°C and checked for purity by streaking on their respective isolation media until only a single type of colony was present. The preliminary isolation of lactic acid bacteria was made on the basis of Gram staining and catalase reaction followed by microscopic examination to observe cell arrangements and morphological characteristics as described by Harrigan and McCance (1976). Only Gram positive, catalase negative, non-motile, cocci and bacilli shaped isolates were considered as presumptive lactic acid bacteria according to Savadogo *et al.* (2004). The cultures were stored and maintained at -20 on MRS and M17 agar slants supplemented with 10% (v/v) glycerol for further studies.

2.4. Characterization of LAB isolates

Presumptive isolates that showed the general characteristics of lactic acid bacteria were selected randomly and subjected to different tests that included growth at different temperatures (10, 15 and 45°C), at different NaCl concentration (2%, 4%, and 6.5%), gas production from glucose, arginine hydrolysis was carried out according to the method described by Harrigan and McCance,(1976). Identification to species level was conducted by subjecting isolates to various carbohydrates fermentation (Starch, Amygdalin, Arabinose, Cellobiose, Fructose, Galactose, Glucose, Lactose, Maltose, Mannitol, Mannose, Melizitose, Melibiose, Raffinose, Rhamnose, Ribose, Sucrose, Salicin, Sorbitol, Trehalose and Xylose) in MRS/M17 broth containing 1% solution of carbohydrate and added to 0.025% bromocresol purple as indicator according to Schillinger and Lucke,(1987). Results were recorded after 48 h of incubation at 37°C. Based on the results, the isolates were then identified to species level using the species identification procedure of Bergey's manual of Determinative Bacteriology Holt *et al.* (1994), and by comparing the result with previously published scientific research work Bettache G *et al.* (2012).

2.5. Technological Properties

2.5.1. Acidifying activities

The acid production by the isolated lactic acid bacteria species was determined after inoculating the isolates into sterile reconstituted skim milk powder (10% w/v) at a rate of 1-2% inoculums /100 ml milk in sterile bottles of 200 ml capacity according to the method described by Attia *et al.* (2001). The inoculated skim milk medium was incubated at 30°C for mesophilic and at 38°C for thermophilic lactic acid bacteria (Farah *et al.,* 1990; De Vuyst and Degeest, 1999; Attia *et al.,* 2001). Change in pH was monitored at different intervals by taking samples at 0 h (initial), 12 h, 24 h, 48 h and 72 h until the pH of the medium reached 4.6 (iso-electric point) Patrignani *et al.* (2007). The isolated lactic acid bacteria species were characterized as fast acid producers (less than12 h to reach pH 4.6), medium acid producers (12-48 h to reach pH 4.6) or slow acid producers (more than 48 h to reach pH 4.6) based on their acid production potential according to Seifu *et al.* (2012).

2.5.2. Proteolytic activities

To determine the proteolytic activity of lactic acid bacteria isolates, MRS/M17 agar supplemented with 10% skim milk was poured, solidified, and then dried. Sterile Whatman paper discs were deposited on the surface of the agar. Each disc received a volume of 20 µl of a young culture. After incubation at 37°C for 24 h, proteolysis was indicated by clear zones around discs Vuillemard *et al.* (1986), which were recorded as positive activity. All strains with positive reaction in MRS/M17 with 1% skimmed milk were considered as strains with a slight proteolytic activity Lasagno *et al.* (2002).

2.5.3. Antimicrobial Activities of LAB Isolates

2.5.3.1. Indicator Strains

The indicator strains including *Staphylococcus aureus, Escherichia coli, Salmonella typhi,* and *Pseudomonas aeruginosa* were used for the antimicrobial test of the lactic acid bacteria isolates. All indicator strains were obtained from the Pasture Institute in Addis Ababa.

2.5.3.2. Preparation of cell-free supernatant (CFS)

Each LAB isolate was inoculated in 10 ml of MRS/M17 broth and incubated at 30°C for 48 hrs. After incubation, a cell-free supernatant was obtained by centrifuging the bacterial culture at 6000 rpm for 15 minutes, followed by the filtration of the supernatant through 0.20 µm pore size filters.

2.5.3.3. Screening for antimicrobial activities

The agar-well diffusion method was employed in the screening of LAB for antimicrobial activities. Indicator microorganisms were prepared by inoculating 20 ml of molten agar media seeded with $1x10^7$ cfu/ml of an overnight culture of each indicator organism and allowing them to solidify in a Petri dish. 50 µl of the filtered cell-free supernatant of test

strains was separately placed into the wells. The plates, prepared in duplicate, were kept at 4°C for 24 h according to Bonade *et al.* (2001) to allow pre-diffusion of the CFS into the agar and then incubated at 37°C for 24 h. They were then observed for possible clearing of zones (inhibition zones). The antimicrobial activity was determined by measuring the diameter of the inhibition zones around the well using a caliper in mm.

2.5.4. Exopolysaccharide (EPS) production

The screening of the isolates for EPSs production was carried out according to the method described by Guiraud (1998). The isolates cultured on MRS agar were streaked onto LTV agar (0.5% (w/v) tryptone, 1% (w/v) meat extract, 0.65% (w/v) NaCl, 0.8% (w/v) potassium nitrate, 0.8% (w/v) sucrose, 0.1% (v/v) Tween 80, and 1.7% (w/v) agar, pH 7.1± 0.2) Sawadogo- L *et al.* (2007) and incubated at 30°C for 48 h. The sticky aspect of the colonies was determined by testing them for slime formation using the inoculated loop method as described by Knoshaug *et al.* (2000). The isolates were considered positively slimy producer if the length of slime diameter was above 1.5 mm.

The positive isolates were confirmed by growing them on MRS sucrose broth and incubating them at 30°C for 24 hrs. A volume of 1.5 ml of the 24 h culture was centrifuged at 5000 rpm for 10 minute at 4°C and 1 ml of the supernatant was put in a glass tube and anequal volume of ethanol 95% was added. An opaque link formed at the interface of the tube indicated the presence of EPSs.

2.6. Data Analysis

Obtained experimental data of the study were analyzed using descriptive statistical method.

3. Results and Discussion

3.1. Isolation and Identification of LAB

In the present study, a total of 95 lactic acid bacteria colonies were isolated, of which 51 and 44 colonies were obtained from MRS and M17 agar media, respectively. A total of 9 isolates selected from MRS agar plates were found to belong to the genus *Lactobacillus*. According to the biochemical test*, Lactobacillus brevis* HUM14*, Lactobacillus paracasei subsp. tolerans* HUM15, *Lactobacillus casei subsp. casei* HUM18 and *Lactobacillus plantarum* HUM19 produced gas from glucose. This is in agreement with the results of Seifu *et al.* (2012) that all *Lactobacillus* strains isolated from *ititu* were able to produce gas from glucose. All *Lactobacillus* isolates did not produce ammonia from arginine, catalase negative, and are non-motile. Regarding growth at different temperature, *Lactobacillus paracasei subsp. tolerans* HUM15, *Lactobacillus delbrueckii subsp. bulgaricus* HUM16, *Lactobacillus amylophilus HUM17, Lactobacillus casei subsp. casei* HUM18,and *Lactobacillus plantarum* HUM19grewat 15°C. The results also showed that *Lactobacillus delbrueckii subsp. lactis* HUM13*,* and *Lactobacillus acidophilus* HUM17 *grew* at 45°C whereas *Lactobacillus delbrueckii subsp. bulgaricus* HUM20 and *Lactobacillus helveticus* HUM21 were able to grow at 15 and 45°C. According to pH resistant test, all *lactobacillus* isolates were able to grow at pH 5.0, while *Lactobacillus*

delbrueckii subsp. bulgaricus HUM20and *Lactobacillus delbrueckii subsp. lactis* HUM13were able to grow at pH 4.0. Regarding growth of isolates at different NaCl concentration, *Lactobacillus delbrueckii subsp. lactis* HUM13*, Lactobacillus brevis HUM14,* and *Lactobacillus paracasei subsp. tolerans* HUM15,grew at 2% NaCl. The growth of isolates in a medium containing 2% NaCl observed in the present study is similar to the findings of Hutkins *et al.*(1987), where all *lactobacilli* isolated from camel milk were able to grow at 2% NaCl. The results also showed that *Lactobacillus amylophilus* HUM17, *Lactobacillus casei subsp. casei* HUM 18, *Lactobacillus plantarum* HUM19 and *Lactobacillus helveticus* HUM21, were grow at 2 and 4% NaCl, whereas; *Lactobacillus delbrueckii subsp. bulgaricus* HUM20wasgrow at4 and 6.5% NaCl. Different *lactobacilli* strains isolated from camel milk are shown in Table 3, while the results of different physiological and biochemical tests are given in Table 2.

The other isolates were referred to the genus *Lactococcus*. They were identified by their morphological, cultural, physiological and biochemical characteristics. Ten isolates picked from M17 agar plates were found to belong to the genus *Lactococcus.* All *Lactococcus* were unable to produce gas from glucose, show arginine hydrolysis by some strains, catalase-negative and non-motile which is indicator of *Lactococcus* strains. Arginine hydrolysis indicated that *Lactococcus lactis subsp. lactis* HUM1, *Pediococcus acidilactici* HUM4, *Pediococcus pentosaceus* HUM5, and *Lactococcus garviae* HUM6 were able to produce ammonia from arginine. Regarding growth at different temperature, *Lactococcus lactis subsp. cremoris* HUM2 was able grow at 15°C, whereas *Lactoccoccus raffinolactis* HUM3, *Pediococcus acidilactici* HUM4, *Lactococcus garviae* HUM5, *Pediococcus pentosaceus* HUM6, *Streptococcus cremoris* HUM8, *Streptococcus lactis* HUM9, *Pediococcus damnosus* HUM10, and *Streptococcus salivarius subsp. thermophilus* HUM12 were grow at 45°C. According to growth at different pH range; *Lactoccoccus raffinolactis* HUM3 was able to grow at pH 2.0 and 4.0.On the other hand; *Lactococcus garviae* HUM5, *Streptococcus cremoris* HUM8, *Streptococcus lactis* HUM9, and *Streptococcus salivarius subsp. thermophilus* HUM12 were able to grow at pH 4.0 and 5.0, whereas; *Lactococcus lactis subsp. lactis* HUM1, *Lactococcus lactis subsp. cremoris* HUM2, *Pediococcus acidilactici* HUM4, *Pediococcus pentosaceus* HUM6, and *Pediococcus damnosus* HUM11 were able to grow at pH 5.0. Regarding growth at different NaCl concentration; *Lactococcus lactis subsp. lactis* HUM1, *Lactococcus lactis subsp. cremoris* HUM2, *Lactoccoccus raffinolactis* HUM3, and *Lactococcus garviae* HUM5 grew at 2 and 4% NaCl whereas *Pediococcus acidilactici* HUM4 and *Pediococcus pentosaceus* HUM6 were able to grow at 4.0 and 6.5% NaCl. Similar observations were reported by Togo et *al.* (2002) who indicated that Lactococcusisolates were able to grow at higher NaCl (4% and 6.5%). The different *Lactococci* strains isolated from camel milk are shown in Table 3 while the results of different physiological and biochemical tests are given in Table 1.

Two isolates selected from M17 agar plates were identified as *Enterococcus* strains, which included *Enterococcus faecalis* HUM7. This isolate was able to grow at 15 and 45°C, pH 4.0, and in a medium containing 6.5% NaCl, whereas *Enterococcus casseliflavus* HUM2 was able to grow at 15°C, pH 5.0, and in a medium containing 2% and 4% NaCl. *Enterococcus* was observed to be the only genera that showed growth at a high NaCl concentration (6.5%) which is similar with an earlier finding by El-Hadi Sulieman *et al.* (2006), Gram-positive and catalase negative bacteria that are capable of growing at

15 and 45°C, and in a medium containing 6.5% NaCl were considered to be *Enterococci* Table1.

In the current study, more growth of *Lactobacillus* species in camel milk as compared to others isolates were observed on their selective culture media and comprised 72.60% of the total lactic acid bacteria Table 5. These findings are in accordance with Khedid *et al.* (2006), who reported that *Lactobacillus* species isolated from camel milk was the dominant genus with 37.5% of the total lactic acid bacteria isolates. Bettache G *et al.* (2012) indicated that members of the genus *Lactobacillus* isolates dominated in all Dhan samples as well as in the traditional butter. Consistent with the results of this study, Abu-Tarboush (1994) reported that camel milk provided support to the growth of *L. acidophilus*.

Table1. Physiological and biochemical characteristics of *cocci* strains

Characteristics	*Lactococci* isolates											
	HUM 1	HUM 2	HUM 3	HUM 4	HUM 5	HUM 6	HUM 7	HUM 8	HUM 9	HUM 10	HUM 11	HUM 12
Gas from glucose	-	-	-	-	-	-	-	-	-	-	-	-
Cell shape	cocci	Cocci	Cocci	cocci	cocci	cocci	cocci	cocci	cocci	cocci	cocci	cocci
Ammonium from arginine	+	-	v	+	+	+	v	-	-	-	v	-
Motility	-	-	-	-	-	-	-	-	-	-	-	-
Catalase test	-	-	-	-	-	-	-	-	-	-	-	-
Aerobicity	f.a	f.a	f.a	f.a	f.a	f.a	f.a	f.a	f.a	f.a	f.a	f.a
Growth at different temperature	-	-	-	-	-	-	-	-	-	-	-	-
	-	+	-	-	v	-	+	-	-	-	+	-
10^{o}C	+	-	+	+	+	+	+	+	+	+	-	+
15^{o}C												
45^{o}C												
Growth at different pH	-	-	+	v	-	-	-	-	-	-	-	-
	-	-	+	v	+	-	+	+	+	-	-	+
2.0	+	+	-	+	+	+	-	+	+	-	+	+
4.0												
5.0												
Growth in the presence of NaCl	+	+	+	-	+	-	-	-	-	-	-	-
	+	+	+	+	+	+	-	-	-	-	-	-
2%	-	-	-	+	v	+	+	v	-	-	v	v
4%												
6.5%												

Note: + = Positive reaction,; = Negative reaction; v= Variable reaction; f.a= Facultative anaerobic; HUM1; *Lactococcus lactis subsp. lactis*, HUM2; *Lactococcus lactis. subsp.cremoris*, HUM3; *Lactococcus. raffinolactis*, HUM4; *Pediococcus acidilactici*, HUM5; *Lactococcus.garviae*, HUM6; *Streptococcus lactis*, HUM7; *Enterococcus faecalis*, HUM8; *Streptococcus cremoris*, HUM9; *Streptococcus salivarius subsp.thermophilus*, HUM10; *Pediococcus damnosus*, HUM11; *Enterococcus casseliflavus*, and HUM12; *Pediococcus pentosaceus. n=2*

Table2. Physiological and biochemical characteristics of *Lactobacillus* strains.

Characteristics	*Lactobacilli* isolates								
	HUM 13	HUM 14	HUM 15	HUM 16	HUM 17	HUM 18	HUM 19	HUM 20	HUM 21
Gas from glucose	-	+	+	-	-	+	+	-	-
Cell shape	bacilli	bacilli	bacilli	bacilli	bacilli	bacilli	Bacilli	bacilli	bacilli
Ammonia from arginine	-	-	-	-	-	-	-	-	-
Motility	-	-	-	-	-	-	-	-	-
Catalase test	-	-	-	-	-	-	-	-	-
Aerobicity	f.a	f.a	f.a	f.a	f.a	f.a	f.a	f.a	f.a
Growth at different temperature	-	-	-	-	-	-	-	-	-
10°C	-	-	+	-	+	+	+	-	+
15°C	+	-	-	+	-	-	v	+	+
45°C									
Growth at different pH	-	-	-	-	-	-	-	-	-
2.0	+	-	-	-	-	-	-	+	-
4.0	+	+	+	+	+	+	+	+	+
5.0									
Growth in the presence of NaCl	+	+	+	-	+	+	+	-	+
2%	-	-	-	-	+	+	+	+	+
4%	-	-	-	-	-	-	-	+	v
6.5%									

Note: + = Positive reaction, - = Negative reaction, v= Variable reaction, f.a= Facultative anaerobic, HUM13; *Lactobacillus delbrueckii subsp.Lactis*, HUM14; *Lactobacillus brevis*, HUM15; *Lactobacillusparacasei subsp.tolerans*, HUM16; *Lactobacillus delbrueckii subsp.bulgaricus*, HUM17; *Lactobacillus amylophilus*, HUM18; *Lactobacillus casei subsp.casei*, HUM19; *Lactobacillus helveticus*, HUM20; *Lactobacillus acidophilus*, and HUM21; *Lactobacillus plantarum. n=2*

Table3. Carbohydrates fermentation profile of lactic acid bacteria (LAB) species

Isolates number	Carbohydrates																					Species identification
	Lac	Mal	Glu	Gal	Mos	Man	Mlz	Sal	Mel	Cel	Rha	Suc	Rib	Xyl	Str	Amy	Ara	Fru	Sor	Tre	Raf	
HUM 1	+	+	+	+	+	-	-	+	-	+	-	-	+	v	+	-	-	+	-	v	-	*Lactococcus lactis subsp.lactis*
HUM 2	+	-	+	+	+	-	-	-	-	+	-	-	-	v	+	-	-	+	-	-	-	*Lactococcus lactis subsp.cremoris*
HUM 3	+	+	+	+	+	+	+	+	+	-	-	+	-	+	+	-	-	+	-	+	+	*Lactococcus raffinolactis*
HUM 4	V	-	+	+	+	-	-	-	-	+	+	+	+	+	-	-	v	+	-	+	-	*Pediococcus acidilactici*
HUM 5	+	-	+	+	+	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+	-	*Lactococcus garviae*
HUM 6	V	+	+	+	+	-	-	+	-	+	+	+	+	v	-	+	+	+	-	+	-	*Pediococcus pentosaceus*
HUM 7	+	+	+	V	+	+	+	+	+	-	-	+	+	-	+	-	-	-	+	+	-	*Enterococcus faecalis*
HUM 8	+	+	+	-	-	-	+	+	+	+	+	-	-	-	-	+	+	+	+	+	v	*Streptococcus cremoris*
HUM 9	+	-	+	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	v	*Streptococcus salivarius subsp.thermophilus*
HUM 10	-	v	+	-	+	-	v		v	+	-	v	-	-	-	-	-	+	+	-	-	*Pediococcus damnosus*
HUM 11	+	+	+	-	+	+	-	+	+	-	+	+	+	+	-	-	-	-	+	+	+	*Enterococcus casseliflavus*
HUM 12	+	-	-	+	+	+	-	v	v	-	-	+	+	+	+	-	-	-	+	v	-	*Streptococcus lactis*
HUM13	+	+	+	v	-	+	-	+	-	-	-	-	-	-	-	+	-	+	-	-	-	*Lactobacillus*

																						delbrueckii subsp.lactis
HUM 14	v		+	+	-	-	-	v	v	v	-	-	-	-	-	-	+	+	-	-	-	*Lactobacillus brevis*
HUM 15	+	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*Lactobacillus paracasei subsp.tolerans*
HUM 16	+	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	*Lactobacillus delbrueckii subsp.bulgaricus*
HUM 17	-	-	+	+	-	v	-	-	-	-	-	v	-	-	+	-	-	-	-	-	-	*Lactobacillus amylophilus*
HUM 18	-	v	+	+	+	+	V	+	+	+	-	-	-	-	-	+	-	-	+	+	-	*Lactobacillus casei subsp.casei*
HUM 19	+	+	+	+	+	+	+		-	+		-	-	+	-	+	-	+	+	+	-	*Lactobacillus plantarum*
HUM 20	+	+	+	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	*Lactobacillus acidophilus*
HUM 21	+	-	+	+	v	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*Lactobacillus helveticus*

Note: Tre: Trealose; Suc: sucrose; Amy: Amygladin; Str: Starch; Mlz: melizitose; Sor: Sorbitol; Ara: Arabinose; Gal: Galactose; Rib: Ribose; Rha: Rhamnose; Xyl: Xylose; Mal: Maltose; Cel: cellubiose; Mel: melibiose; Sal: Salicin; Man: Mannitol; Mos: Mannose; Fru: Fructose; Glu: Glucose; Lac: Lactose; Raf: Raffinose.

3.2. Acidifying Activity

To select a potential candidate starter culture, the lactic acid bacteria strains isolated from camel milk were characterized on the basis of acid production capability. The acidity was increased during the fermentation, and there was variability in acidification rate between the different strains used to inoculate the milk.

According to acidifying activity, *Lactobacillus acidophillus* HUM20*,* and *Lactobacillus plantarum* HUM19, were considered to be fast acid producer among *Lactobacilli* strains as they reached to a final pH value of 4.33 and 4.50 from an initial value of 6.75 and 6.77, respectively within 8 h of incubation. This is in agreement with the results of Fguiri *et al.* (2016) that *Lactobacillusplantarum* was selected as fast acid producer *Lactobacillus* isolate from camel milk. On the other hand, *Lactobacillus brevis* HUM14, *Lactobacillus helveticus* HUM16, *Lactobacillus delbrueckii subsp. bulgaricus* HUM2*,* and *Lactobacillus casei subsp. casei HUM18* were found to be medium acid producers from an initial value of (6.77, 6.73, 6.67, and 6.79 to a final pH value of 4.44, 4.43 4.34 and 4.40, respectively) within 48 h of incubation. This is in accord with the findings of Seifu *et al.* (2012) who reported that *Lactobacillus delbrueckii subsp. bulgaricus*, showed medium acidification activity and reduced the pH of the skim milk powder from an initial values of 6.77 to a final pH values of 4.57 within 48 h of incubation. On the other hand, *Lactobacillus paracasei subsp. tolerans* HUM15, *Lactobacillus delbrueckii subsp. lactis* HUM13and *Lactobacillus amylophilus* HUM17 reduced the pH of the skim milk from an initial value of 6.75 to a final pH value of 4.42, 4.46, and 4.6, respectively, within 72 h of incubation.

Among *Lactococcus* strains, all *Lactococcus* isolates were slow acid producers except, *Pediococcus pentosaceus* HUM6, and *streptococcus cremoris* HUM8reduced the pH of the skim milk fast from an initial value of 6.78 and attained a final pH value of 4.56, and 4.38 respectively, within 10 h of incubation. This is in agreement with the results of Fguiri *et al.* (2016) who reported that *pediococcus pentosaceus* was selected as fast acid producer among *Lactococcus* isolate from camel milk.

The difference observed in acidifying activities between each strain of lactic acid bacteria species may be associated with specific capacity to break down the carbon and nitrogen substrates in the medium and the capability to assimilate the nutrients essential for growth Badis *et al.* (2004). On occasions, differences are also due to the presence or absence of nutrient transport systems Albenzio *et al.* (2001).

3.3. Proteolytic Activity

According to proteolytic test all investigated, lactic acid bacteria isolates showed different diameter of a clear zone around the discs. According to Vuillemard *et al.* (1986), a strain is called proteolytic if it has a zone of lysis of diameter between 15 and 21 mm. Compared to these data, our strains revealed that proteolytic zone diameters were between 15 and 21 mm. The results obtained during the investigation of Proteolytic test are shown in Table 4.

Table 4. Proteolytic activities of lactic acid bacteria species

Isolates	Diameter of inhibition zone (mm)
Lactococcus lactissub sp.lactis HUM1	16±0.03
Lactococcus lactissub sp.cremoris HUM2	16±0.00
Lactococcus raffinolactis HUM3	15±0.10
Pediococcus acidilactici HUM4	15±0.31
Lactococcus garviae HUM5	17±1.40
Pediococcus pentosaceus HUM6	17±3.00
Enterococcus faecalis HUM7	15±0.00
Streptococcus cremoris HUM8	21±0.01
Streptococcus salivariussub sp.thermophilus HUM9	15±0.00
Pediococcus damnosus HUM10	16±0.00
Enterococcus casseliflavus HUM11	15±0.00
Streptococcus lactis HUM12	15±0.01
Lactobacillus delbrueckiisub sp.lactis HUM13	15±0.40
Lactobacillus brevis HUM14	18±0.03
Lactobacillus paracaseisub sp.tolerans HUM15	15±0.00
Lactobacillus delbrueckiisub sp.bulgaricus HUM16	18±0.00
Lactobacillus amylophilus HUM17	15±1.30
Lactobacillus caseisub sp.casei HUM18	16±0.02
Lactobacillus plantarum HUM19	19±0.10
Lactobacillus acidophilus HUM20	20±0.00
Lactobacillus helveticus HUM21	17±2.30

Table indicated that, means ± *SD* and *n=4.*

Among all lactic acid bacteria isolates, *Lactobacillus acidophilus* HUM20, *Lactobacillus plantarum* HUM19, and *Streptococcus cremoris* HUM8 had a high proteolytic activity with different diameters of clear zones. Proteolytic activity is essential for the development of organoleptic properties of different fermented milk products (Axelsson 1998; Christensen *et al.,* 1999). The production of high-quality fermented dairy products is dependent on the proteolytic systems of starter bacteria, as the peptides and amino acids formed have a direct impact on flavour or serve as flavour precursors in these products (Axelsson 1998; Christensen *et al.,* 1999). Several peptidases with different specificities have been identified in lactic acid bacteria; all peptidases have been found to be intracellular and liberated in fermented milk products after cell lysis (Law and Haandrikman, 1997; Axelsson, 1998).

3.4. Antimicrobial Activities

The antimicrobial properties of lactic acid bacteria isolates from camel milk are shown in Table 5. The LAB strains were able to inhibit the selected indicator organisms to varying degrees of the zones of inhibition. Similar to our findings (Kivanc, 1990; Tadesse *et al.,* 2005) observed varying degrees of inhibition of various food borne pathogens by cell-free filtrates of LAB. Afolabi *et al.* (2008) showed that antimicrobial producing microorganisms had the ability to inhibit the growth of other bacteria which included both Gram-negative and Gram positive bacteria. Such antimicrobial activities were also demonstrated in the works of other researchers such as Adesokan *et al.* (2008) where LAB species were tested against *Staphylococcus aureus, Pseudomonas aeruginosa, Candida*

albicans, Escherichia coli, and *Proteus vulgaris*. It has been also demonstrated that, the antimicrobial compounds produced by LAB can inhibit the growth of pathogenic bacteria of possible contaminants in fermented products (Raccah *et al.,* 1979; Smith and Palumbo, 1983; Cintas *et al.,* 1998).

The ability to inhibit other organisms is due to the fact that LAB produces substances which are injuriousto the indicator organisms depending on the concentration or quantity produced (Axelsson 1998; Christensen *et al.,* 1999). These substances serve as competitive advantage to LAB when in mixed culture especially during fermentation and hence the dominance of LAB during fermentation of milk, cereals and vegetables Afolabi *et al.* (2008). Wakil and Osamwonyi (2012) indicated that LAB isolates showing antimicrobial activity were discovered to produce antimicrobial substances like lactic acid, hydrogen peroxide, and diacetyl, showing that the ability to inhibit other organisms was directly related to the ability of these organisms to produce these substances. Daeschel, (1993) reported the ability of LAB to produce lactic acid, thereby reducing the pH of the fermenting medium. The lactic acid produced serves to reduce the pH of the medium, thereby making it acidic which is not conducive for the survival of spoilage bacteria which may have found their way into the fermenting substrate during spontaneous fermentation. Lactic acid is a natural preservative that inhibits putrefying bacteria and is responsible for the improved microbiological stability and safety of the food Raccah *et al.,* (1979).

Table 5. Antimicrobial activities of lactic acid bacteria species against pathogenic micro organisms.

LAB isolates	Indicator strains			
	S.aureus	*S.typhi*	*E.coli*	*P.aeruginosa*
Lactococcus lactissub sp.lactis HUM1	+	+	+	+
Lactococcus lactissub sp.cremoris HUM2	+	+	+	++
Lactoccoccus raffinolactis HUM3	++	+	+	+
Pediococcus acidilactici HUM4	+	++	+	+
Lactococcus garviae HUM5	++	+	+	++
Pediococcus pentosaceus HUM6	+	++	+	+
Enterococcus faecalis HUM7	+	+	+	+
Streptococcus cremoris HUM8	+++	+ +	+++	++
Streptococcus salivariussub sp.thermophilus HUM9	+	+	+	++
Pediococcus damnosus HUM10	++	++	+	++
Enterococcus casseliflavus HUM11	+	+	+	+
Streptococcus lactis HUM12	++	+	+	++
Lactobacillus delbrueckiisub sp.lactis HUM13	+	++	+	+
Lactobacillus brevis HUM14	++	+	+	++
Lactobacillus paracaseisub sp.tolerans HUM15	++	++	+	+
Lactobacillus delbrueckiisub sp.bulgaricus HUM16	++	+	+	+
Lactobacillus amylophilus HUM17	+	+	+	+
Lactobacillus caseisub sp.casei HUM18	++	+	+ +	++
Lactobacillus plantarum HUM19	++	+ +	+++	+ ++
Lactobacillus acidophilus HUM20	+++	+ +	+++	++
Lactobacillus helveticus HUM21	+	+	+	+

**(+); [1–4 mm], (++); (4–8 mm], (+++); (8–12 mm] (Fortune Akabandaet al., 2014).*

3.5. Exopolysaccharide Production (EPS)

The results showed that all the groups of LAB strains tested produced exopolysaccharide (EPS) with slime length diameter above 1.5 mm. This finding is in (2013), who reported most of the LAB producing EPS belonged to the genera *Streptococcus, Lactobacillus, Lactococcus, Leuconostoc,* and *Pediococcus*. According to Bridget and Lordsday (2011) a total of 77% of LAB strains produced exopolysaccharides under the experimental condition from Nigerian yoghurt.

Exopolysaccharide production is a desirable feature of bacteria applied in dairy products because EPSs act as natural biothickener leading to higher consistency and viscosity of the product and reduced syneresis Ruas-Madiedo *et al.* (*2006*). However, most of them are chemically or enzymatic ally modified in order to improve rheological properties (e.g., cellulose, starch, pectin Ruas-Madiedo *et al.* (*2006*), and alginate) and, therefore, their use is strongly restricted for food applications. The EPSs of microbial origin have uniquerheological properties because of their capability of forming very viscous solutions at low concentration and their pseudoplastic nature Becker *et al.* (1998). Some strains of LAB have been reported to produce EPS and gain increasing attention over the last few years because of their contribution to the rheology and texture of fermented milk and food products Cerning and Marshall (1999). EPS-producing LAB has a greater ability to withstand technological stresses and survive the passage through the gastrointestinal tract compared to their nonproducing bacteria Stack (2010). Hence, the choice of EPS-producing starter culture seems to give several advantages over nonproducing ones.

Table 6. Grouping of the lactic acid bacteria species isolated from the raw camel milk based on their carbohydrate fermentation profile.

Genus	Species	Number of isolates	% of total isolates
Lactobacillus	*Lactobacillus delbrueckiisub sp.lactis*	12	8.22
	Lactobacillus brevis	2	1.37
	Lactobacillus paracaseisub sp.tolerans	5	3.42
	Lactobacillus delbrueckiisub sp.bulgaricus	8	5.48
	Lactobacillus helveticus	2	1.37
	Lactobacillus caseisub sp.casei	9	6.16
	Lactobacillus plantarum	18	12.33
	Lactobacillus acidophillus	35	23.97
	Lactobacillus amylophilus	15	10.27
Lactococcus	*Lactococcus lactissub sp.lactis*	5	3.42
	Lactococcus garviae	3	2.05
	Lactoccoccus raffinolactis	4	2.74
	Lactococcus lactissub sp.cremoris	2	1.37
Streptococcus	*Streptococcus cremoris*	4	2.74
	Streptococcus lactis	3	2.05
	Streptococcus salivariussub sp.thermophilus	5	3.47
Enterococcus	*Enterococcus faecalis*	2	1.37
	Enterococcus casseliflavus	2	1.37
Pediococcus	*Pediococcus pentosaceus*	2	1.37
	Pediococcus damnosus	5	3.42
	Pediococcus acidilactici	3	2.05
Total		146	100

4. Conclusion

This study has demonstrated that 21 species of lactic acid bacteria were isolated from camel milk. The most dominant lactic acid bacterial species was *Lactobacillus* that comprised 72.6% of the total lactic acid bacteria isolates. Based on the overall technological properties, *Lactobacillus acidophilus* HUM20, *Lactobacillus plantarum* HUM19, and *Streptococcus cremoris* HUM8 were high in acidifying and proteolytic activities, exopolysaccharide production (EPS), and antimicrobial activities, implying that these bacteria could be used as starter cultures for the industrial processing of camel milk under controlled environments in the future.

5. Recommendation

Further research should be conducted to elucidate performance in mixed cultures, EPS quantification and lipolytic activities, aroma production and otherdesirable characteristics of the isolates as well as their molecular attributes to determine their suitability for commercial production of fermented camel milk products.

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6. Knowledge and Utilization of Partograph for Prompt Decision and Associated factors among Health Professionals for Quality Obstetric Care at Public Health Institutions in Dire Dawa, Harar and East Hararghe Zone; a Cross-sectional Study

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Abstract: Maternal mortality remains unacceptably high. Worldwide more than 350,000 women die annually from complications during pregnancy or childbirth. Almost all (99%) of them are in developing countries. Maternal mortality rate is declining slowly, even though the vast majority of deaths are avoidable. Partograph is a vital tool for health care providers who need to be able to identify pathological labor and complications in childbirth in a timely manner and refer women to an appropriate facility for better management. Institutional based cross sectional quantitative study method was utilized to assess knowledge and utilization of partograph among obstetrics care givers of Dire Dawa city administration, Harari regional state and East Hararghe zone of Ethiopia using self-administered questionnaire and document review method. The collected data was analysed using SPSS version 16.0. Logistic regression analysis was used to identify factors associated with knowledge and use of partograph among obstetric care givers. The study revealed that a total of 196(45.4%) respondents had fair knowledge of partograph, 59.5% of the respondents knew how to diagnosis the presence of prolonged labor by using partograph, and 78.7% of them knew about the assessment of satisfactory progress of labor. Four hundred (92.6%) of the participant used the modified WHO partograph to monitor women in labor. The utilization of partograph was significantly higher among obstetric caregivers who had been previously trained on the partograph compared to those who had not been previously trained [Adjusted OR = 3.1 (95% CI :(1.35-4.98)]. Presence of in-service obstetric care training, type of health institution and profession were the variables found to have significant association with knowledge of partograph, lack of training of obstetric care givers and lack of positive attitude towards the use of the partograph were significantly related to the utilization of the partograph. The habit of recording and documentation of labor parameter in the study area was quite low. Periodic on-job training of obstetric care givers

on the use of the partograph, Regular supportive supervision, motivating staffs to utilize the partograph and record their findings should be given emphasis

Keywords: knowledge; Partograph; Utilization; obstetric care; Ethiopia

1. Introduction

Maternal mortality remains unacceptably high. Worldwide more than 350,000 women die annually from complications during pregnancy or childbirth, almost all of them (99%) arein developing countries. The maternal mortality rate is declining only slowly, even though the vast majority of deaths are avoidable. In sub-Saharan Africa, maternal mortality risk is 1 in 30, compare to 1 in 5,600 in developed regions (UN, 2010). On the other hand, an estimated 536, 000 maternal deaths occured worldwide in 2005 which is slightly more than half of the maternal deaths (270, 000) occurs in the sub-Saharan Africa region alone. Generally, sub-Saharan Africa and South Asia accounted for 86% of global maternal deaths (WHO, 2005). Maternal mortality ratio in developing regions is 290 per 100,000 live births in 2008. In sub-Saharan Africa, a woman's risk of dying from preventable or treatable complications of pregnancy and childbirth over the course of her life time is 1 in 31 compared to only 1 in 4300 in the developed regions (UN, 2010). The majority of maternal deaths and complications attributable to obstructed and prolonged labor can be prevented by cost-effective and affordable health interventions using partograph (Magon.N, 2011; WHO, 1994).

Most partographs have three distinct sections where observations related to maternal, fetal condition and labor progress. The World Health Organization (WHO) recommends partograph to follow labor with the objectives to improve health care and reduce fetomaternal morbidity and death (WHO, 1994). A partograph has clear demarcations which if arrived at or exceeded clearly indicate the need to address existing or imminent complications like poor progress of labor, prolonged labor, fetal distress, obstructed labor and ruptured uterus. Early detection of prolonged or obstructed labor greatly contributes to prevention of complications such as postpartum haemorrhage, ruptured uterus, puerperal sepsis and obstetric fistula (Mathai.M, 2009). The partograph provides health professionals with a pictorial overview of the labor to allow early identification and diagnosis of the pathological labor (Wandabwa et al, 2014). The partograph is a vital tool for providers who need to be able to identify complications in childbirth in a timely manner and take timely decision making for better interventions. Prolonged labor is a leading cause of death among mothers and newborns in the developing world. So it helps providers identify prolonged labor and know when to take appropriate actions (Ganesh D, 2007).

Nearly 358,000 women died in pregnancy and childbirth worldwide in 2008. Most maternal and newborn deaths occur around the time of delivery. Prolonged and obstructed labors are major causes of maternal and newborn morbidity and mortality. However, information about prolonged and obstructed labor is incomplete. Partograph

is a tool used to monitor labor and prevent prolonged and obstructed labor. The WHO partographs are probably the best known and most widely used in low resource countries. The most important barrier to partograph use are low-resource settings, shortage of human resources, low competence, lack ongoing facilitative supervision, acceptability of the tool and lack of functioning referral mechanisms present major challenge to effective use of partograph [Levin K, Kabagema,2011]. According to WHO multicenter trial, partograph introduce into clinical practice along with a management protocol, labor outcomes were greatly improved. It facilitates need of augmentation of labor with oxytocin, caesarean section, and minimize incidence of infection. As a result of this, WHO recommends to use partograph for monitoring all labor to help early identification of abnormal progress and prompt interventions (Ganesh D, 2007) .

According to the Ethiopian demographic and health survey 2000, maternal mortality ratio was 871 deaths per 100,000 live births in Ethiopia (CSA, 2001). Slight reduction was observed in maternal mortality ratio in 2005. In this year, maternal mortality ratio was 673 deaths per 100,000 live births (CSA, 2006). After five years, it became 676 deaths per 100,000 live births through direct estimation procedure. There is no evidence to suggest that the maternal mortality ratio decreased in Ethiopia between 2000 and 2011 (CSA, 2012). A study done in Ethiopia reveals that the majority (99%) of the participants know about partograph. However, only 21.8% of them indicate utilization of partograph reduces maternal and newborn mortality (Fantu et al ,2013).

Partograph utilization is recommended to have quality maternity care. Providing quality maternity care reduces labor pain of mothers and saves lives of the mother and the newborn. Saving the life of the mother and the baby is the two main goals of the MDGs that will be achieved in 2015. Therefore, this study aim to assess knowledge and Partograph utilization for prompt decision among health professionals for quality maternity care at selected public health institutions in Eastern Ethiopia

2. Materials and Methods

2.1. Study Setting

The study was conducted from Dire Dawa city administration, Harar and East Hararghe zone from March 1st to April 30, 2015. Harar is located on a hilltop in the eastern extension of the Ethiopian highlands about 526 Km from Addis Ababa at an elevation of 1,885 meters. According to the central statistical agency 2007, Harari regional state has an estimated total population of 122,000, of whom 60,000 were male and 62,000 were females. Harar town has two public Hospitals and 8 health centers. The health service coverage of the region reached to 100% according to the Federal Ministry of Health. Dire Dawa was found in 1902 when the railroad from Djibouti reached the area. Dire Dawa is center of Dire Dawa city administration and the second large city in Ethiopia located 515 Km from Addis Ababa on the Addis Ababa–Djibouti railroad. Based on the 2007 central statistical agency of Ethiopia, Dire Dawa has a population of 341,834, of whom 171,461 are men and 170,461 women; 233,224 (68.23%) of the population are urban inhabitants. Dire Dawa has two public hospitals and 16 health centers. East Hararghe is one of the Zones of the Oromia regional state. East Hararghe

is bordered on the southwest by the Shebelle River which separates it from Bale, on the west by West Hararghe, on the north by Dire Dawa and on the north and east by the Somali Region. The zone has 4 hospitals and 83 health centre.

2.2. Population and Design of the Study

A cross-sectional quantitative study design was used to examine knowledge and utilization of partograph among obstetric care givers in Dire Dawa city administration Harar and East Hararghe zone.

2.3. Study Population

Health professionals working in maternity unit at public health institution in Dire Dawa city administration, Harari regional state and East Hararghe zone were randomly selected and involved in this study. In addition, randomly selected maternity cards were reviewed to assess utilization of partograph.

2.4. Sample Dize Determination and Sampling Procedure

The sample size in this cross-sectional survey was determined using a single proportion formula [n= (Zα/2)2 p (1-p)/ d2] The minimum sample size required for the self-administered questionnaire was estimated to be 441 using the above formula where n is the sample size, z is the standard normal deviation at 1.96 (for 95% confidence level), the desired degree of accuracy (taken as 0.05) and p is the estimate of the proportion of our target population who use partograph (assumed to be 53.3% as obtained from study done in the Adiss Abeba on Knowledge and utilization of the partograph among obstetric caregivers). Sample size for the document review was calculated based on the same assumptions except the prevalence of partograph utilization in Addis Ababa was 80.4% [26]. The 378 labor ward clients' card attached with partograph were reviewed from selected public health institutions. The sample was allocated to the institutions and included in the study proportional to the number of health professionals working in the maternity units of the respective health institutions

2.5. Data Collection

Data were collected using pretested structured self-administered questionnaire on knowledge and utilization of partograph and document review checklist adapted from previous study and relevant literature [26, 27]. The adapted questionnaire was contextualized or modified to the local situation and to the research objectives. It consisted of the socio-demographic characteristics of the study participants, other variables related to routine obstetric care and the content of the partograph to be filled during laboring mother follow up. The content of the WHO modified partograph was used directly for knowledge and utilization assessment. To assess the depth of participant knowledge and utilization of partograph a scoring method was devised and a knowledge score for each of the personnel was obtained by adding up the scores for

correct answers given to selected questions in the questioner. The criteria for scoring knowledge are displayed in table 1.

Table 1. Criteria for partograph knowledge score.

Parameters	No	Yes
Foetal heart rate	0	3
Colour of liquor	0	4
Cervical dilatation	0	3
Descent of the presenting part	0	5
Uterine contraction	0	5
Maternal blood pressure	0	2
Maternal pulse	0	1
Maternal temperature	0	1
Intravenous fluids & drugs	0	1
Moulding	0	5

Based on the overall knowledge score, the respondents' level of knowledge of the partograph was rated as minimum score, 0; maximum score: 30. 0-10, poor level of knowledge; 11-20, fair level of knowledge; 21-30: good level of knowledge.

A score of 0-30 is obtainable if the respondents had this basic knowledge in addition to knowing the important observations on the partograph such as foetal heart rate (3), uterine contractions (5), descent of the presenting part (5), maternal pulse (1) and maternal blood pressure (2), colour of the liquor (5), moulding (5), temperature (1) and intravenous fluid and drug (1). A score of 30 is obtained if the respondents' knew almost all of the observations recorded on the partograph.

The final scores were computed to give a composite scale with category (mean score or more= good or otherwise= poor) based on the cut of point ≥ 18.4282 = good and < 18.4282 poor.

The checklist was designed to obtain information on the main variables included as components of the modified WHO partograph. In order to produce a more objective assessment, the components were assessed to determine whether they had been monitored according to standard protocol (Engida et al 2013; WHO, 2013).

Standard protocols were defined based on the time interval as follows:- (1) cervical dilatation, moulding, descent of the presenting part, and blood pressure were monitored every four hours; (2) foetal heart rate, maternal pulse and uterine contractions were monitored every 30 minutes;(3) Condition of the baby after birth was regularly recorded on the card. Records not meeting any one of the protocol standards or with parts misplaced/missing or inadequate for each parameter of the partograph were judged as substandard or not recorded, if no information was documented on the parameters of the partograph or completely absent from the file and standard, or if all the criteria are met for each parameter on the partograph.

2.6. Data Analysis

Data entry and analysis were performed using Epi Info Version 3.5.1 software and SPSS version 16. The data entered were checked for their consistency. Data cleaning was done using SPSS window version 16 by executive frequency. Frequency distributions and cross tabulations were used to describe the variables of the study. The relationship between selected independent variables and the respondents' utilization of partograph and level of knowledge were explored using bivariate and multivariate logistic regression analysis. The presence and magnitude of association was checked using the odds ratio (OR) with 95% CI. Observed differences between samples were considered statistically significant where the confidence limits did not embrace unity or $p < 0.05$.

2.7. Ethical Considerations

Ethical clearance was obtained from Haramaya University; College of health and medical sciences Institutional Health Research Ethical Review Committee. Permission and letter of cooperation was presented to the health institutions administrative bodies. Informed consent was obtained from study participants after brief explanation about the purpose of the study. The subjects were told any information they provided would be kept confidential. At each of the selected study sites, the matron/medical director was contacted for permission and necessary information before the commencement of the study.

3. Result

This study represents participant that were working in a sampled of 107 health centres and 8 hospitals found in Dire Dawa, Harar and East Hararghe zone. Out of the 441 self administered questions in the questionnaire, 432 were correctly completed making a response rate of 98 %.

3.1. Socio Demographic Characteristics of the Study Participants

The mean and standard deviation of the age of the respondents were 26.8 and 4.07 years, respectively. The median age was 26 years (range: 20–48years). The majority 228(52.8) of the participant were female.

The respondents comprised of 113(26.2%) diploma nurses 165(38.2%) diploma midwives, 64(14.8%) B.Sc midwives, 54(12.5%) B.Sc nurses, 20(4.6%) public health officers and 16(3.7%) general practitioners. Two hundred fifty nine (60%) of the respondents were from health centres and 173 (40. %) were from hospitals.

The duration of participant in health care delivery was found to be ranging between one and 25 years with the mean (±standard deviation) and median duration of 4.28 (±3.68) and 3 years, respectively. The majority (329, 76.2 %) of the participants had been practicing for < 5 years, while 77 (17.8 %), 18 (4.2 %) and 5 (1.2%) of them had been in practice for 5–10, 11–15 and 16– 20 years, respectively. Some 3 participants (.7 %) had been in practice for over 21 years. 222 (51.4%) of the participant received in-service trainings on partograph and the rest had no in service training.

Table 2. Socio demographic characteristics of the study participants in public health institutions of Harar Dire Dawa city administration,Hararand East Hararghe zone, March 1st to April 30, 2015.(n=432).

Variables	Number	%
Age		
20-29	361	83.6
30-39	63	14.6
40+	6	1.9
Marital status		
Single	195	45.1
Married	214	49.5
Divorced	21	4.9
Widowed	2	.5
Sex		
Male	204	47.2
Female	228	52.8
Professional qualification		
Diploma Nurse	113	26.2%
Diploma Midwife	165	38.2%
Bsc Nurse	54	12.5%
Bsc Midwife	64	14.8%
Health officer	20	4.6%
MD (GP)	16(	3.7%
Currently working in		
Hospital	176	40
Health centre	259	60
Year of service		
Less than 5 years	329	76.2
5-10 years	77	17.8
11-15 years	18	4.2
16-20 years	5	1.2
21 or more years	2	7
Receive training on partograph		
Yes	222	51.4
No	210	46.6

Knowledge of obstetric care givers about assessment of labor with the partograph was also investigated. Only 231(53.5. %) of the participant indicated diagnosing foetal distress using partograph while the majority 384(80.5%) of them knew the pattern of abnormal foetal heart rate by using partograph. Three hundred fourty (78.7%) of the respondents knew about the assessment of satisfactory progress of labor on partograph.

Table 3. The proportion of obstetrics care giver who correctly identified the component of labor assessment in public health institutions of DireDawa City Administration, Harar and East Hararghe zone (n=432).

Knowledge of assessment of labor with partograph	Frequency	%
	N=432	
Prolonged labor	257	59.5
Obstructed labor	316	73.1
Poor progress of labor	259	60
Inefficient uterine contraction	305	70.6
Suspected fetal distress	231	53.5
Abnormal fetal heart rate	384	80.4
Satisfactory progress of labor	340	78.7
Need of augmentation	257	63.7

One hundred ninety six (45.4%) of respondents had fair knowledge of partograph, while 187(43.2%) of them had good knowledge of it. Only 49((11.3%) had poor knowledge of partograph. One thread of B.Sc midwifes had having good level of knowledge while only 11(9.7%) of diploma nurses had good level of knowledge and none of the medical doctors had poor level of knowledge. Pre service training was reported as a primary source of knowledge by the majority (299, 71%) of the respondents. Above half (159, 53.2%) of them had good level of knowledge.

3.2. Bivariate and Multivariate Logistic Regression Analysis of Factors associated with Knowledge of Obstetric Care Givers about Partograph

On bivariate analysis type of health institution, previous training and professional level were the variables found to have significant association with knowledge of components of partograph. Obstetric care givers working at health centre had poor level of knowledge about the partograph compared to those working in hospitals [Crude OR = 0.28 (95% CI (.181-.428)]. But, on multivariate logistic regression analysis, this association is different from those working in health centre. Those who were working at health centres are 3 times more likely to have good knowledge on components of partograph than respondent working in hospitals [Adjusted OR = 3.263 (95% CI: 2.142-4.971)]. Participants who had previous training on partograph 2 times more likely to have good level of knowledge compared to those who never had formal training [Adjusted OR=2(95% CI (1.651, 2.051)]

On crude analysis, diploma nurses compared to medical doctors had a lesser likelihood of having a good level of knowledge about the partograph [Crude OR = 0.59 (95% CI: 0.17, 0.2057)]. However, on multivariate logistic regression analysis, this association was not significant [Adjusted OR = .064 (95% CI: (.18-2.36))], but B.Sc Midwives were 2.8 times more likely to have good level of knowledge than medical doctors. Other variables such as sex and professional tenure and attitude towards partograph didn't

show any statistically significant association with the level of knowledge of the obstetric care givers about the partograph.

Table 4. Bivariate and multivariate logistic regression analysis of the knowledge on partograph.

Characteristics	Overall knowledge		Crude OR at 95% CI	Adjusted OR (95% CI
	Poor n (%)	Good n (%)		
Sex				
Male	102(50)	102(50)	0.8(.5-1.1)	
Female	98(43)	130(57)	1	
Type of institution				
Health centre	151(58.3)	108(41.7)	0.3(.2,.4)	3.3(2.1, 5.0)
Hospital	49(28.3)	124(71.4)	1	1
Year of service				
5 year and less	158(48%)	171(52)	0.8(0.5-1.2)	
Over 5 year	42(40.8)	61(59.2)	1	
Previous training				
Yes	78(35.1)	144(64.9)	2.6(1.7, 3.8)	2 (1.7,.2.1)
No	122(58.1)	88(41.9)	1	
Profession				
Diploma nurses	96(85)	17(15)	0.1(0.2-0.2)	0.1(0.2-2.4)
Diploma midwife	66(40)	99(60)	0.5(0.2-10.6)	1.3(0.4-4.5)
Bsc nurses	30(55.6)	24(44.4)	0.4(0.1-1.7)	1.5(.4-5.6)
Bsc midwife	2(9.4)	62(90.6)	3.2(4.2, 7.0)	2.8(1.6,5.6)
Health officers	6(30)	14(70)	0.8(0.2-3.4)	0.2(0.2-3.4)
MD(GP)	9(56.3)	7(43.7)	1	
Likes to use partograph				
Yes	78(33.8%)	153(66.2%)	3.0(2.0,4.5)	0.5(0.3-1.8)
No	122(60.7%)	79(39.3%)	1	

3.3. Bivariate and Multivariate Logistic Regression Analysis of Factors Associated with Partograph Utilization

On crud analysis obstetric care givers working in health centers had lesser odds of utilizing the partograph compared to those working in hospitals [Crud OR = .256 (95% CI: (.096-.678)] while more of those obstetric caregivers who had been previously trained on the partograph had higher odds of utilizing the partograph compared to those who had not been previously trained [Adjusted OR = 3.1 (95% CI:(1.35-4.98)].

Although , obstetric care givers who have positive attitude about the partograph had higher odds of utilizing the partograph in monitoring of mothers in labor compared to those who lacked positive attitude towards the partograph [Adjusted OR = 2.9 (95% CI: (1.3, 6.3)].

Table 5. Bivariate and multivariate logistic regression analysis of factor associated with partograph utilization

Characteristics		Utilization	Crude OR at 95% CI	Adjusted OR at 95% CI
	Utilized n (%)	Not utilized n (%)		
Sex				
Male	187(91.7)	17(8.3)	1.29(.627-2.656)	
Female	213(93.4)	15(6.6)	1	
Type of institution				
Health centre	232(89.6)	27(10.4	.256(.096,.678)*	1.5(.0528-4.378)
Hospital	168(97.1)	5(2.4)	1	
Previous training				
Yes	215(96.8)	7(3.2)	4.1(1.75,9.817)*	3.1(1.35,4.98)*
No	185(88.1)	25(11.9)	1	
Year of service				
5 year and less	303(92.1)	26(7.6)	.721(.288-1.8)	
Over 5 year	97(94.2)	6(5.8)	1	
Do you like partograph				
Yes	229(99.1)	2 (.9)	20(4.736,85.20)*	2.9 (1.3, 6.3)*
No	171(85.1)	30(14.9)	1	

Three hundred seventy eight partograph that had been used for labor management were reviewed. The number of delivery from April to March 2015 were collected through document review from all health centre and hospitals according to the proportional allocation of sample were taken

As indicated in table below the mean age of the laboring women was 25 and standard deviation of 5.9. 179(47.4%) of the women was multipara while only 45(11.9%) was grand multipara

Table 6. Frequency distribution of the socio-demographic characteristics of study reviewed document public health institutions of Dire Dawa city administration, Harar and East Hararghe zone, March 1stto April 30, 2015.

Age group	Frequency	Percentage	Mean and SD
< 18	30	7.9	25 + 5.9
18-35	317	83.9	
>35	31	8.2	
status of the women			
Primigravida	154	40.7	
Multipara	179	47.4	
Grand multipara	45	11.9	

From the reviewed labor partograph fatal heart rate was not recorded in 130(34.4%) and records were judged to be substandard in 151(39.9%) while records up to the recommended standard in 97(25.7%).

Moulding of fetal head was not recorded in 182(48.2%) while in 106(28%), 90(23.8%) it was plotted below the standard and the recommended standard, respectively. The status of the membrane was recorded in 205(54.2%) of the partograph reviewed while not recorded at all in 173(45.8%) of them.

Table 7. Recording of parameters of feotal wellbeing, public health institutions of Dire Dawa city administration, Harar, and East Hararghe zone, March 1st to April 30, 2015.

Parameter of labor	Frequency n =378	%
Feotal heart rate		
Not recorded	130	34.4
Substandard	151	39.9
Monitored to standard	97	25.7
Moulding		
Not recorded	182	48.2
Substandard	106	28
Monitored to standard	90	23.8
Was the status of the membrane recorded		
Yes	205	54.2
No	173	45.8

Descent of the presenting part was not recorded 109(28.9%) and recorded as per the standard in 70(18.5%) and the other was recorded but substandard.

Measurement of cervical dilatation was recorded as per the standard in 233(61.6%) while 119(31.5%) of the recorded partograph judged to be sab standard and 26(6.9%) was not recorded at all. Uterine contraction was not recorded in 31(8.5%) of the partograph, while sub-optimally recorded in 236(62.4%) and recorded to the standard in 110(29.1%) of the partograph. blood pressure was recorded as per standard in only 92(24.3. %) of the partograph reviewed while not recorded at all in 70(18.5%), in about 111(29.9%) of the reviewed documents the pulse rate was monitored according to the standard while in 86(22%) the pulse rate was not recorded at all and temperature is recorded in 126(33.3%) of the reviewed partograph

The condition of the baby after birth was assessed using the Apgar score system. the Apgar score was not recorded in 21(5.6%) of the studied partograph , three hundred fifty seven of the babies' conditions were recorded, live babies were considered to have been born in a good condition if (the Apgar score 7-10) 280 of the reviewed partograph the condition of the babies was good.

From labor parameters monitored on the reviewed partograph, cervical dilatation was better monitored (61.6%). The least standard monitored parameter was fatal heart rate which was only recorded in 25% of the partograph.

Table 8. Recording of parameters of maternal and foetal conditions, public health institutions of public health institutions of Dire Dawa city administration, Harar and East Hararghe zone, March 1stto April 30, 2015.

Parameter of labor	Frequency n =378	%
Descent of foetal head		
Not recorded	109	28.9
Substandard	199	52.6
Monitored to standard	70	18.5
Cervical dilatation		
Not recorded	26	69
Substandard	119	31.5
Monitored to standard	233	61.6
Uterine contraction		
Not recorded	31	8.5
Substandard	236	62.4
Monitored to standard	110	29.1
Action line crossed		
Yes	31	8.2
No	347	91.8
Blood pressure		
Not recorded	70	18.5
Substandard	216	57.2
Monitored to standard	92	24.3
Temperature		
Recorded	126	33.3
Not recorded	252	66.7
Pulse rate		
Not recorded	86	22.8
Substandard	181	47.9
Monitored to standard	111	29.9
Condition of the baby after birth		
Not recorded	21	5.6
Recorded	357	94.4
Good	280	74.1
Not good	64	16.9
Still birth	13	3.4

From labor parameters monitored on the reviewed partograph , cervical dilatation was better monitored 61.6%. The least standard monitored parameter was descent of fatal head which was only recorded in 18.5% of the partograph.

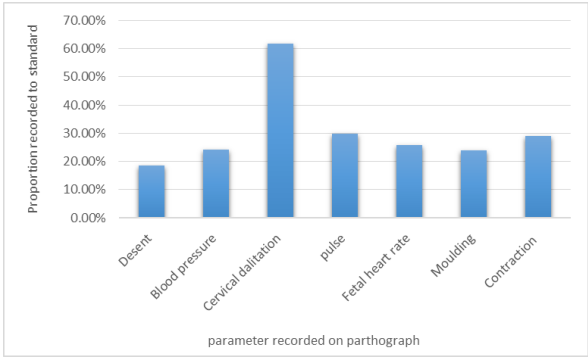

Figure 1. Proportions of partographs on which parameters were recorded to standard, public health institutions of Dire Dawa city administration, Harar and East Hararghe zone, March 1stto April 30, 2015.

4. Discussions

This study focused on obstetric care givers in public health institutions of Dire Dawa city administration, Harar and East Hararghe zone of Ethiopia, specifically, at delivery units. The study participants were selected from hospitals and health centres. We tried to find out the level of knowledge of the participants about components the partograph, and utilization status of the partograph was also assessed.

In this study, all of the 419 (97%) respondents knew what a partograph was and 196(45.4%) of respondents had fair knowledge of partograph, while 187(43.2%) of them had good knowledge of it and only 49((11.3%) had poor knowledge of partograph. This result implies that knowledge of obstetric care givers on partograph may be inadequate for better utilization of partograph in public health institutions and this seems somewhat comparable with the same study done in Addis Ababa and Nigeria. (Fawole et al , 2008; Engida et al, 2013)

The result revealed the existence of significant association between type of health institution and level of knowledge of components of the partograph. The odds of having good knowledge about components of the partograph were higher in obstetric care giver working in health centre than hospitals. However, the result is not in agreement with others studies done in Addis Ababa (Engida et al 2013) in which type of health institution has shown no difference with knowledge of components of the partograph. This might be because of obstetrics care giver who was working in hospital had extra burden and busy with client flow.

Another predictor of knowledge of components of the partograph was the presence of previous training on obstetric care. Those received training were able to explain components of the partograph better than those who did not. This finding may support the idea that training improves the status of existing knowledge. Still this finding is consistent with previous studies done in, Nigeria and Ethiopia (Fantu et al, 2013; Fawole et al., 2008; Engida et al., 2013). This finding points to the need that obstetric care givers should get periodic on-job refresher trainings on the obstetric care.

In this study, the participants' overall knowledge of obstetric care was found to be good. About 53.7% had a mean score or more on the knowledge questions used to assess the level of knowledge of partograph. BSc midwives were more likely to have good knowledge than, general practitioners. This might be explained by the fact that they might have better chance of exposure to obstetric training and practice than general practitioners. This finding is inconsistent with the study done in Ethiopia (Fantu et al, 2013), in which general practitioners were good knowledge about the partograph than midwives. This finding emphasizes the need for general practitioners to be considered equally to receive in-service obstetric training.

In this study, the utilization of the partograph was significantly higher among obstetric care givers who had in-service training than those who had no training [Adjusted OR = 3.1 (95% CI: 1.35, 4.98)]. This finding is consistent with the study done in Ethiopia (Engida et al, 2013).

Although the result revealed existence of significant association between participants attitude towards partograph and utilization of obstetric care givers who have positive attitude about the partograph had higher odds of utilizing the partograph in monitoring of mothers in labor compared to those who lacked positive attitude towards the partograph [Adjusted OR = 2.9 (95% CI: (1.3, 6.3)]. This is in agreement with the studies done in Nigeria and Ethiopia [13,16, 26], that support the idea that partograph to be an efficacious tool for monitoring labor and identify women requiring further interventions.

Additionally, 59.5% of the respondents in our study knew how to diagnosis the presence of prolonged labor by using partograph and 78.7% of them knew about the assessment of satisfactory progress of labor. This is in line with the finding that showed the partograph has a clear indicate the need to address prolonged and poor progress of labor(Mathai.M, 2009).

High proportions of unrecorded parameters of labor on the modified WHO partograph and substandard monitoring of the progress of labor among public health institutions in Dire Dawa City Administration, Harar and East Hararghe zone. Lack of records for the descent of the presenting part in 28.9%, moulding in 48.2 % and the foetal heart rate in 34.4 % of the studied partograph indicates poor documentation, and perhaps monitoring and supervision of labor. In order to achieve good foetal outcome, it is extremely important to monitor foetal condition during labor (Engida et al, 2013). It was hoped that completion of this instrument would help towards achievement of that goal.

The present study also found that all health units did have the modified WHO partographs available but were not completing them properly. Among 378 of the modified WHO partographs reviewed across all the health units, foetal heart rate was not recorded in 130 (34.4%) and was sub-standard in 151(39.9%) while monitored up to the recommended standard in 97(25.7%) of the partographs. This finding reported lesser figure than the study done in Addis Abeba, Ethiopia (Engida et al, 2013). This difference may be due to differences in the health system obligatory policy on the use of a partograph during labor.

The study revealed that only 25.7%, 61.1% 29.1% of the fatal heart rate, cervical dilation, and uterine contraction, respectively were recorded according to the standard for monitoring of these three labor parameters. This is indicative of poor monitoring of parameters on the partograph against standards. The findings of similar studies done in Addis Ababa, Ethiopia Tanzania, Uganda and Benin and (Engida et al, 2013 ; Nyamtem AS et al, 2008 ; Ogwang S et al ,2009 ; AzandegbeN et al 2004) also showed poor monitoring of the parameters of labor against the accepted standards. This necessitates the need for regular pre-service and on-job training of obstetric care givers on completion of the partograph and perhaps a mandatory health facility policy on the completion of the partograph.

5. Conclusion

Only 196(45.4%) of respondents had fair knowledge of partograph obstetric care givers in public health institutions of Dire Dawa city administration, Harar and East Hararghe zone. Presence of in-service obstetric care training, type of health institution, profession, were the variables found to be significant association with knowledge of partograph.

Use of the partograph during labor was affected by factors, lack of training of obstetric care givers and lack of positive attitude towards the use of the partograph was significantly related to the utilization of the partograph. The habit of recording and documentation of labor parameter in the study area was quite low.

6. Limitation of the Study

Firstly, there might be social desirability bias which may cause the obstetric care givers who took part in this study to overstate their use of the partograph.

This cross sectional study by its very nature cannot establish cause and effect relationship. Inclusion of private health care providers would have given comprehensive picture and make generalization possible. However, findings from this study can be regarded as a snapshot of current knowledge and practice of partograph utilization within the study area.

6. Recommendation

Based on the findings of this study, periodic on-job training of obstetric care givers on the use of the partograph, Regular supportive supervision, provision of guidelines and mandatory health facility policy, motivating staffs to utilize the partograph and record their findings accordingly are recommended for the safety of mothers in labor in Dire Dawa city administration, Harar and East Hararghe zone Ethiopia.

To have a complete picture of the situation, it is recommended to involve private health care providers. Increasing the sample size and employing other methods may furnish better results and complement our findings.

7. Competing Interests

All authors declare that they do not have competing interests.

8. Authors' Contributions

HM, AS had made substantial contribution to conception, design, acquisition and interpretation of data. AS and BM had revised the paper critically for important intellectual contents. All authors read and approved the final manuscript.

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7. Knowledge, Attitude, and Practice on Voluntary Blood Donation among Adult Residents of Harar Town, Eastern Ethiopia: A Community Based Study

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Abstract: Blood transfusion is the transfer of blood or blood components from one person into the bloodstream of another person. Limited number of voluntary blood donation and blood safety issue are the major Challenges in Ethiopia. The majority of blood donors in Ethiopia indicated as replacement or paid donors with one or more of the risk factors for TTIs implying that blood transfusion is unsafe. Community's voluntary blood donation practice and intention to donate blood in some parts of Ethiopia was found to be badly low and members of the Ethiopian Jewish community displayed an extremely limited intention to donate blood. Some studies in Ethiopia indicated that Knowledge, attitude and subjective norms were main predictors of blood donation. Therefore, this study was aimed to assess the level of Harari regional state community knowledge, attitude and the practice on voluntary blood donation. Community based cross sectional study was conducted in Harari people's regional state from July 1 to 31, 2015. A total of 845 participants ages between 18 and 60 years during data collection time was included randomly and interview was made using pre-tested structured questionnaire through a home to home visit. Bivariate and multivariable logistic regressions were used to identify potentially associated factors. The overall knowledge of respondents towards voluntary blood donation was 43.55%. Study participants under 31-45 age category (AOR= 0.50, 95% CI: 0.34-0.74, >45 years old (AOR=0.60, 95% CI: 0.38-0.95), male (AOR= 1.69, 95% CI: 1.19-2.39), 5-8 grade (AOR=2.51, 95% CI: 1.09-5.78), 9-10 grade (AOR=4.22, 95% CI: 1.80-9.88), 11-12 grade (AOR=6.96, 95% CI: 2.86-16.91), College graduates (AOR=5.58, 95% CI: 2.25-13.85) were significantly associated ($p<0.05$)with comprehensive knowledge about voluntary blood donation. Only 278 (32.90%) of them have positive attitude towards voluntary blood donation. Study participants able to read and write (AOR= 0.01, 95% CI: 1.33-11.28), 5-8 grade (AOR=2.45, 95% CI:1.10-5.43), 9-10 grades (AOR= 3.08, 95% CI:1.38-6.94), 10-12 grade (AOR=3.47, 95%

CI: 1.47-8.19), College level (AOR=3.06, 95% CI: 1.26-7.44), University level (AOR=13.05, 95% CI:4.12-41.29) were significantly associated (P<0.05) with attitude towards voluntary blood donation. Only 191(22.6%) of study participants had ever donated blood before. Among 191 respondents who ever donated blood before 96 (50.3%) of them were donated voluntarily. However, the proportion of study participants donated blood voluntarily with good knowledge about voluntary blood donation was significantly lower than the study participants who donated blood voluntarily with low knowledge about voluntary blood donation (28.6% vs 54%, X2=6.1746, P=0.013). Among non blood doors about 429(65.8%) reasoned out that they were not informed or not asked to donate and 252(38%) replied that there was no opportunity as the major barrier to donate blood. In general, this study showed a good overall community knowledge; however, unfavorable attitude towards blood donation and poor blood donation practice. Therefore, it is important to increase the attitude and practices of voluntary blood donation in the community through different strategies such as school mini Medias, Youth Centers, community health worker/health extension workers by incorporating with Health Education and Communication package.

Keywords: Community; KAP; voluntary blood donation

1. Background

Blood transfusion is the transfer of blood or blood components from one person (the donor) into the bloodstream of another person (the recipient). It may be done as a lifesaving scheme to replace blood cells or blood products lost through bleeding or due to depression of the bone marrow(MedicineNet.com,2012.). It contributes to saving lives patients in both routine and emergency situations and dramatically improves the life expectancy and quality of life of patients in acute and chronic conditions(WHO,2010).

The biggest challenge in most countries is donor counseling guidelines that have not been fully implemented and Confidential treatment of transfusion transmissible infections (TTI) test results especially HIV is very crucial because of the stigma and discrimination following a positive diagnosis(CDC,2011).Limited number of voluntary blood donation and blood safety issue are the major Challenges in the Ethiopian context (WHO ,2014). For instance, each year about 25 to 40 % of Ethiopian mothers are died due to lack of enough blood from donors. According to the National Blood Bank of Ethiopia, the amount of blood collected from donors by 2014 was about 88,000 units of blood though the country's annual demand amounts up to 250,000 units. Similarly the Harar blood bank needs 37,000 unit blood/year, but only 4,000unit /year were secured in 2013/14(HRBB, 2013).Ensuring availability of safe blood at all health facilities would contribute to Ethiopia's efforts to meet MDG 5 relating to the reduction of

maternal deaths by ensuring that the lives of expecting mothers will not be endangered in case of emergencies for lack of blood for life-saving transfusion(WHO ,2014). A thorough process to assess the suitability of prospective donors is essential to protect the safety and sufficiency of the blood supply, and safeguard the health of recipients of transfusion and blood donors themselves.

The majorities of blood donors in Ethiopia are indicated as replacement or paid donors with one or more of the risk factors for TTIs implying that blood transfusion is unsafe. Community voluntary blood donation practice and intention to donate blood in some parts of Ethiopia was found to be badly low and similarly members of the Ethiopian Jewish community displayed an extremely limited intention to donate blood. Some studies in Ethiopia indicated that knowledge, attitude and subjective norms were main predictors of blood donation (Mirutse.G., et al. 2014; Ingale.L, et al. 2015; Salaudeen.AG, et al. 2011).In addition to the aforementioned gaps, majority of the study conducted in Ethiopia were not community based. Therefore, this aimed aimed to assess the level of knowledge, attitude, and the practice of Harari regional state community on voluntary blood donation.

2. Materials and Methods

2.1. Study Setting and Period

A Community based cross sectional study was conducted in Harar Town from July 1 to 31, 2015. The town of Harar, the capital of Harari people's regional state, is located in the eastern part of Ethiopia at a distance of 510 Km from Addis Ababa, the capital city of Ethiopia. The town has nine districts. In the town there are four Public Hospitals, four Health Centers, two Private Hospitals and one Blood Bank.

2.2. Study Population

A total of 845 people ages between 18 and 60 years during data collection time were included as subjects of the study. Three districts in Harar town were selected randomly, namely Abadir, Shenkor and Hakim districts. Then one kebele was selected randomly from each district and households were selected by systematic random sampling. When there is more than one eligible subject in the household, one eligible individual member was selected by simple random sampling. .

2.3. Data Collection and Processing

A pre-tested questionnaire was prepared in English language, based on information from available literatures. Then, it was translated to Amharic language. A total of 6 data collectors who had diploma in health sciences and 2 supervisors who were senior health professionals were involve in data collection process. Interview was made home to home visit. Information on the socio-demographic characteristics of the study participants, knowledge (12 questions), attitude (6 questions) and practices (12 questions) related questions on blood donation were included in the questionnaire. A scoring mechanism was used to assess the overall knowledge level; a score of one has

given for each correct response and zero for wrong response. According to this study, respondents with all correct response got above the mean value indicated good knowledge and score less than the mean value indicated low knowledge.Respondents with all correct response got above the mean value, higher points above the mean value were considered as having Positive attitude towards blood donation while those who scored below the mean value were considered as having negative attitude towards voluntary blood donation. Practice of blood donation means that the condition in which the study subjects were volunteer blood doners regardless of the time and the place of donation before this study.

2.4. Statistical Analysis

The collected data were entered into Epi data version 3.1 software program and checked for completeness and consistency. Then, the data were exported to STATA version 11 for analysis. Then, the data were analyzed using appropriate descriptive and bivaraite statistical tests such as proportion, mean, crudes odds ratio, and Pearson Chi-square tests. Finally, multivariate logistic regression model was used to determine predictors of the outcome; and control of confounding variables. Both the Crude and Adjusted ORs were reported with its 95% CI; and P value ≤ 0.05 was considered as cutoff point for statistical significance for all statistical tests.

2.5. Ethical Consideration

The study protocol were reviewed and approved by Haramaya University Institutional Health Research Ethics Review Committee (IHRERC). Permission was obtained from the regional and district health offices and other local administrative offices. Written voluntary informed consent was obtained from all participants and signed prior to the commencement of the interview. The aim of the study was described to each study participant. To ensure their confidentiality, study participants were represented by codes.

3. Results

3.1. Socio Demographic Characteristics of the Study Participants

A total of 845 study participants (age range from 18 to 60 years) were involved in the study which gives 100% response rate. About two-third 549 (64.97%) of respondents were female and more than half 444 (52.54%) of the study participants were married, 456 (53.96%) were Orthodox religion followers, and about 396 (46.86%) were from Amhara ethnic group (Table 1).

Table 1. Socio-demographic characteristic of study participant among households in three districts of Harar Town, July 1 to 31, 2015.

Variables	Respondents category	Frequency	Percentage (%)
Age of respondent			
	18-30	215	25.44
	31-45	338	40.00
	46-60	292	34.56
Gender	Female	549	64.97
	Male	296	35.03
Marital status	Never married	298	35.27
	Married	444	52.54
	Divorced	25	2.96
	Widowed	41	4.85
	Separated	37	4.38
Religion	Muslim	295	34.91
	Orthodox	456	53.96
	Protestant	87	10.30
	Others	7	0.83
Ethnicity	Oromo	197	23.31
	Amhara	396	46.86
	Harari	67	7.93
	Guraghe /Welene	185	21.89
Educational status	Illiterate	43	5.14
	Read and write	40	4.78
	1-4grade	49	5.85
	5-8grade	163	19.47
	9-10grade	165	19.71
	11-12 grade	140	16.73
	Diploma	164	19.59
	Degree and above	73	8.72
Occupation	Students	122	14.45
	Employer	208	24.64
	Merchant	127	15.05
	Household	189	22.39
	Others	198	23.46
Monthly income	<1500 birr	280	38.89
	1500-3000 birr	361	50.14

3.2. Knowledge of Study Participants about Voluntary Blood Donation

Among 845 study participants who meet the eligibility criteria, the majority 792 (93.7%) of the respondents heard about blood donation before the study. Out of those who heard about blood donation, most 616 (77.78%) of them stated mass media as their

main source of information followed by Health institution 102 (12.88%). In this study, about (60%) respondents suggested that information dissemination through mass media and (52.43 %) health institution as effective way of strategy in increasing the number of voluntary blood donation participants.

Most 591 (70%) of study participants know the most common blood group types. However, the proportion of female study participants who know types of blood group are lower than that of male respondents (63.6% vs 81.8%, X^2 =30.2555, P<0.05). On the other hand, out of 845 study participants, only 337 (39.9%) of them knew about their own blood type during the study period while the proportion of female study participants who knew their own blood group type was significantly lower than male study participants (35.5% vs 48.3%, X^2 =13.5009, P<0.05). In the meantime, 392 (46.4%) of study participants replied that blood donors can donate their blood every three months though the proportion of female study participants who replied blood donors can able to donate their blood every three months was significantly lower than male study participants (42.8% vs 53%, X^2=8.1012, P=0.004). Among 845 study participants, only 221 (26.2%) study participants replied correct volume of blood to be donated at a time. However, the proportion of male study participants replied correct volume of blood to be donated at a time is significantly higher than female study participants (37.8% vs 19.8%, X^2=32.2029, P<0.05). Out of 485 study participants, only 266 (31.5%) study participants replied correct answer about the approximate time interval taken by blood donation process while male study participants who replied correct answer about the approximate time interval taken by blood donation process were significantly higher than female study participants (37.2% vs28.4%, X^2=6.8213, P=0.009) .Only about one-third(n=259) of study participants correctly knew that through unscreened blood transfusion one can be infected with diseases.

The overall knowledge of respondents towards voluntary blood donation was 43.55%. Crude and adjusted effects of selected covariates obtained from logistic regression are summarized in Table 2 for the overall knowledge about voluntary blood donation. Study participants under 31-45 age category (AOR= 0.50, 95% CI: 0.34-0.74, P<0.05), >45 years old (AOR=0.60, 95% CI: 0.38-0.95, P=030), male study participants (AOR= 1.69, 95% CI: 1.19-2.39, P= 0.003), 5-8 grade (AOR=2.51, 95% CI: 1.09-5.78, P=0.029), 9-10 grade (AOR=4.22, 95% CI: 1.80-9.88, P=0.001), 11-12 grade (AOR=6.96, 95% CI: 2.86-16.91, P<0.05), College graduates (AOR=5.58, 95% CI: 2.25-13.85, P<0.05) were significantly associated with comprehensive knowledge about voluntary blood donation (Table 3).

Table 2. Study participants' knowledge about voluntary blood donation among households in Harar town from July 1, 2015 to July, 31, 2015.

Variables	Respondent sex		
	Male, n (%)	Female, n (%)	Total, n (%)
Have you heard about blood donation before the study?			
Yes	285 (96.2.8)	507 (92.35)	792 (93.73)
No	11 (3.72)	41(7.47)	52(6.15)
Not sure	0(0.0)	1(0.18)	1(0.12)
Do know the most common blood group types?			
Yes	242(81.76)*	349 (63.57)*	591 (69.94)
No	54 (18.24)	200 (36.43)	254 (30.06)
Do you know your own blood group type?			
Yes	143(48.31)*	194 (35.34)*	337 (39.88)
No	153 (51.69)	355 (64.66)	508 (60.12)
At what interval blood donors can able to donate?			
Once every three months	157(53.04)*	235 (42.81)*	392 (46.39)
Other (once a week, month, six months, year)	139 (46.96)	314 (57.19)	453 (53.61)
During blood donation, how much amount of blood should be donated by a donor?			
250 ml-500ml	112(37.84)*	109 (19.85)*	221 (26.15)
<250 ml, >500 ml and I don't know	184 (62.16)	440 (80.15)	624 (73.85)
Do you know how much time required for blood donation process?			
Less than 20 minutes	110(37.16)*	156 (28.42)*	266 (31.48)
Greater than 20 minutes and no idea	186 (62.84)	393 (71.58)	579 (68.52)

**Presence of statistically significant difference.*

Table 3. Association of study participant socio-demographic characteristics and an overall knowledge about voluntary blood donation among households in Harar from July 1 to 2015.

Variable		Overall knowledge about voluntary blood donation			
		High, n (%)	Low, n(%)	COR (95% CI)	AOR (95%)
Age	18-30 years	74 (20.1)	141 (29.5)	R	
	31-45 years	164 (44.6)	174 (36.5)	0.56 (0.39-0.79)*	0.49 (0.33-0.74)*
	>45 years	130 (35.3)	162 (34)	0.65 (0.45-0.94)*	0.60 (0.38-0.95)*
Sex	Female	273 (74.2)	276 (57.9)	R	
	Male	95 (25.8)	201 (42.1)	2.09 (1.56-2.81)*	1.68 (1.18-2.39)*
Marital status	Never married	110 (29.9)	188 (39.4)	R	
	Married	209 (56.8)	235 (49.3)	0.66 (0.49-0.89)	0.98 (0.65-1.48)
	Divorced	10 (2.7)	15 (3.1)	0.88 (0.38-2.02)	1.83 (0.69-4.84
	Widowed	23 (6.2)	18 (3.8)	0.46 (0.24-0.89)	1.11 (0.48-2.54)
	Separated	16 (4.4)	21 (4.4)	0.77 (0.38-1.43)	1.21 (0.53-2.77)
Religion	Muslim	137 (37.2)	158 (33.1)	R	
	Orthodox	201 (54.6)	255 (53.5)	1.10 (0.82-1.48)	0.91 (0.58-1.44)
	Protestant	26 (7.1)	61 (12.8)	2.03 (1.22-3.39)	1.37 (0.74-2.57)
	Other	4 (1.1)	3 (0.6)	0.65 (0.14-2.96)	0.37 (0.07-1.96)
Ethnicity	Oromo	84 (22.8)	113 (23.7)	R	
	Amhara	157 (42.7)	239 (50.1)	1.13 (0.79-1.60)	1.09 (0.68-1.74)
	Harari	26 (7.1)	41 (8.6)	1.17 (0.66-2.07)	0.86 (0.46-1.64)
	Other	101 (27.4)	84 (17.6)	0.62 (0.41-0.93)	0.92 (0.57-1.48)
Occupation	Student	45 (12.2)	77 (16.1)	R	
	Government employee	53 (14.4)	155 (32.5)	1.71 (1.05-2.77)	1.45 (0.78-2.72)
	Merchant	66 (17.9)	61 (12.8)	0.54 (0.32-0.89)	0.87 (0.47-1.63)
	Housewife	109 (29.6)	80 (16.8)	0.43 (0.27-0.68)	1.06 (0.57-1.97)
	Other	95 (25.9)	103 (21.6)	0.63 (0.39-1.00	0.97 (0.55-1.71)
Educational status	Unable to read & write	34 (9.3)	9 (1.9)	R	
	Able to read and write	27 (7.4)	13 (2.7)	1.82 (0.68-4.89)	1.63 (0.59-4.54)

	1-4 grade	38 (10.4)	11 (2.3)	1.09 (0.40-2.96)	1.07 (0.39-2.96)
	5-8 grade	92 (25)	71 (14.9)	2.91 (1.31-6.47)*	2.51 (1.09-5.79)*
	9-10 grade	70 (19.1)	95 (19.9)	5.13 (2.31-11.37)*	4.26 (1.82-10.03)*
	11-12 grade	43 (11.7)	97 (20.4)	8.52 (3.76-19.31)*	6.99 (2.87-17.04)*
	College completed	49 (13.3)	115 (24.1)	8.87 (3.95-19.87)*	5.78 (2.32-14.40)*
	Above college	11 (3)	62 (13)	21.29 (8.03-56.46)*	15.34 (5.01-46.91)*
Monthly income	<1500 birr	148 (47.2)	132 (30.9)	R	
	1500-3000 birr	137 (43.6)	224 (52.5)	1.83 (1.33-2.51)	1.19 (0.82-1.74)
	>3000 birr	29 (9.2)	71 (16.6)	1.93 (1.16-3.23)	0.84 (0.43-1.61)

COR= Crude odds ratio , AOR= Adjusted odd ratio, CI= Confidence interval, R= Reference category

**Presence of statistically significant difference.*

3.3. Attitude of Study Participants towards Voluntary Blood Donation

Among 845 study participants 798 (94.4%) of the study participants thought that voluntary blood donation is good. The majority 741 (87.6%) of respondent think that voluntary non remunerator donors as the best source of donor blood. Most 682 (80.7%) participant believes that family of the recipients should donate blood to save life. About 72.66% and22% of study participant responds that creating awareness among community and creating opportunity could improve blood services respectively. The majority (81.7%) respondents have intention to donate at least once in their life for the future if there is opportunity and about (78.8%) study participants were willing to be regular donor in the future. Majority (90 %) of respondents suggested that no one can influence to donate blood in the future.

Table 4. Study participants' attitude about voluntary blood donation among households in Harar town from July 1, 2015 to July, 31, 2015.

Variable	Respondent sex		
	Male, n (%)	Male, n (%)	Total, n (%)
What do you think about voluntary blood donation?			
Good	521 (94.90)	277 (93.58)	798 (94.44)
Not good	10 (1.82)	5 (1.69)	15 (1.78)
Not good not bad	14 (2.55)	12 (4.05)	26 (3.08)
I don't know	4 (0.73)	2 (0.68)	6 (0.71)
Among different blood donation types which one do you think the best?			
Voluntary blood donation	486 (88.52)	255 (86.15)	741 (87.69)
Replacement blood donation	20 (3.64)	7 (2.36)	27 (3.20)
Paid/ Professional blood donors	3 (0.55)	6 (2.03)	9 (1.07)
Blood donation for self	40 (7.29)	28 (9.46)	68 (8.05)
Other	-	-	-
Do you think that something which can affect your health could happen after blood donation?			
Yes	196 (35.70)	125 (42.23)	321 (37.99)
Could not happen	281 (51.18)	139 (46.96)	420 (49.70)
Not sure	72(13.11)	32 (10.81)	104 (12.31)
Do you think family blood donation is best for recipient of the same family?			
Yes	448 (81.60)	234 (79.05)	682 (80.71)
No	84 (15.30)	57 (19.26)	141 (16.69)
Not sure	17 (30.10)	5 (1.69)	22 (2.60)

Among 485 study participants, only 278 (32.90%) of them had positive attitude towards voluntary blood donation. Crude and adjusted effects of selected covariates obtained from logistic regression are summarized in Table 3 attitude towards voluntary blood donation. Study participants able to read and write (AOR= 0.01, 95% CI: 1.33-11.28,

P=0.013), 5-8 grade (AOR=2.45, 95% CI:1.10-5.43, P=0.028), 9-10 grades (AOR= 3.08, 95% CI:1.38-6.94, P= 0.007), 10-12 grade (AOR=3.47, 95% CI: 1.47-8.19, P=0.004), College level (AOR=3.06, 95% CI: 1.26-7.44, P=0.014), University level (AOR=13.05, 95% CI:4.12-41.29, P<0.05) were significantly associated with attitude towards voluntary blood donation (Table 3).

3.4. Study Participants Practice on Voluntary Blood Donation

Out of 845 study participants, 191 (22.6%) of them ever donated blood before. However, the proportion of study participants who ever donated blood before with good knowledge about voluntary blood donation was significantly lower than study participants who ever donated blood before with low knowledge about voluntary blood donation (7.6% vs 34.2, X2= 83.7863, P<0.05). Among 191 respondents who ever donated blood before, 96 (50.3%) of them were donated voluntarily. However, the proportion of study participants donated blood voluntarily with good knowledge about voluntary blood donation was significantly lower than study participants donated blood voluntarily with low knowledge about voluntary blood donation (28.6% vs 54%, X2=6.1746, P=0.013).

Among 191 study participants who ever donated blood before, the proportion of study participants who ever donated blood with positive attitude about voluntary blood donation was significantly lower than study participants who ever donated blood with negative attitude towards voluntary blood donation (15.5% vs 26.1%, X2=12.0593, P=0.001) (Table 4).

None of the blood doors reasoned out that they were not informed or asked to donate, 429(65%) and opportunity 252(38%) as the major barrier not to donate blood.

Table 5. Association of study participant socio-demographic characteristics and attitude towards voluntary blood donation among households in Harar from July 1, 2015 to July, 31, 2015.

Variable	Respondents category	Attitude towards voluntary blood donation			
		Positive, n (%)	Negative, n(%)	COR (95% CI)	AOR (95%)
Age	18-30 years	71(25.54)	144 (25.40)	R	R
	31-45 years	119 (42.81)	219 (38.62)	0.91(0.63-1.30)	1.12 (0.74-1.71)
	>45 years	88 (31.65)	204 (35.98)	1.14 (0.78-1.67)	1.09 (0.52-1.78)
Sex	Female	175 (62.95)	374 (65.96)	R	R
	Male	103 (37.05)	193 (34.04)	088 (0.65-1.18)	0.76 (1.52-1.10)
Marital status	Never married	107 (38.49)	191 (33.69)	R	R
	Married	138 (49.64)	306 (53.97)	1.24 (0.91-1.69)	1.25 (1.80-1.94)
	Divorced	9 (3.24)	16 (2.82)	0.99 (0.42-1.33)	1.03 (0.39-3.00)
	Widowed	13 (4.68)	28 (4,94)	1.21 (0.59-2.43)	1.53 (0.62-3.73)
	Separated	11 (3.96)	26 (4.59)	1.32 (0.63-2.78)	1.09 (0.46-2.58)
Religion	Muslim	102 (36.69)	193 (34.04)	R	R
	Orthodox	139 (50.00)	317 (55.91)	1.20 (0.88-1.64)	0.75 (0.45-1.23)
	Protestant	33 (11.87)	54 (9.52)	0.86 (0.53-1.42)	0.53 (0.28-1.01)
	Other	4 (1.44)	3 (0.53)	0.39 (0.09-1.80)	0.37 (0.05-2.55)
Ethnicity	Oromo	70 (25.18)	127 (22.40)	R	R
	Amhara	118 (42.45)	278 (49.03)	1.29 (0.90-1.87)	1.44 (0.87-2.40)
	Harari	27 (9.71)	40 (7.05)	0.82 (0.46-1.44)	0.63 (0.32-1.24)
	Other	63 (22.66)	122 (21.52)	1.07 (0.70-1.62)	1.33 (0.79-2.23)
Occupation	Student	47 (16.91)	75 (13.25)	R	R
	Government employee	47(16.91)	161 (28.45)	2.15 (1.32-3.49)*	1.65 (0.83-3.29)
	Merchant	41 (14.75)	86 (15.19)	1.31 (0.78-2.21)	1.77 (0.88-3.55)
	Housewife	70 (25.18)	119 (21.02)	1.06 (0.67-1.70)	1.03 (0.52-2.01)
	Other	73 (26.26)	125 (22.08)	1.07 (0.67-1.71)	1.15 (0.62-2.11)

Educational status	Unable to read & write	23 (8.33)	20 (3.57)	R	R
	Able to read and write	10 (3.62)	30 (5.35)	3.45 (1.36-8.77)*	3.88 (1.33-11.28)*
	1-4 grade	20 (7.25)	29 (5.17)	1.67 (0.73-3.81)	1.73 (0.69-4.36)
	5-8 grade	59 (21.38)	104 (18.54)	2.03 (1.03-3.99)*	2.44 (1.10-5.43)*
	9-10 grade	62 (22.46)	103 (18.36)	1.91 (0.97-3.76)	3.08 (1.36-6.94)*
	11-12 grade	44 (15.94)	96 (17.11)	2.51 (1.25-5.03)*	3.47 (1.47-8.19)*
	College completed	48 (17.39)	116 (20.68)	2.78 (1.39-5.52)*	3.06 (1.26-7.45)*
	Above college	10 (3.62)	63 (11.23)	7.24(2.96-17.76)*	13.05(4.12-41.29)*
Monthly income	<1500 birr	114 (47.11)	166 (34.73)	R	R
	1500-3000 birr	99 (40.91)	262 (54.81)	1.81 (1.30-2.53)*	1.45(0.99-2.13)
	>3000 birr	29 (11.98)	50 (10.46)	1.18 (0.71-1.98)	0.59 (0.31-1.16)

COR= Crude odds ratio , AOR= Adjusted odd ratio, CI= Confidence interval, R= *Reference category*

**Presence of statistically significant difference.*

Table 6. Association of study participant knowledge and attitude towards voluntary blood donation practice among households in Harar from July 1, 2015 to July, 31, 2015.

Variable	Study participants practice towards voluntary blood donation		
	Yes, n (%)	No, n (%)	Total, n (%)
Overall knowledge towards voluntary blood donation			
Good knowledgeable	8 (8.3)*	20 (21.1)*	28 (14.7)
Low knowledgeable	88 (91.7)	75 (78.9)	163 (85.3)
Attitude towards voluntary blood donation			
Positive attitude	25 (26)	18 (18.9)	43 (22.5)
Negative attitude	71 (74)	77 (81.1)	148 (77.5)

**Presence of statistically significant difference.*

4. Discussion

Studies conducted in Ethiopia so far focus on specific target population like students and health worker. However, the current study aimed to assess the level of knowledge, attitude and practice about voluntary blood donation at community level. In the present study, the majority,792 (93.7%), of the respondents heard about blood donation before the study. This was consistence with other study conducted in Ado-Ekiti, South -West Nigeria where 199 (96.9%) respondents heard about blood donation (Olubiyi. SK, et al. ,2014). Out of those who heard about blood donation, most 616 (77.78%) of them replied mass media as their main source of information. This result is supported by a study conducted in Nigeria showedFriends, encouraging media, and religion was influential factors affecting their knowledge. In contrast to our result, study done in Pakistan revealed thatmain source of information on blood donation was friends and family (65%)(Waheed. U, *et al.* ,2015).In this study, the overall knowledge of respondents towards voluntary blood donation was 43.55% which is higher than study conducted in Jordan which indicated inadequate knowledge about blood donation. It was found as only 28.6% of participants scored their knowledge above the average(Abderrahman. B and Saleh. M , 2014). This is lower than the findings of the study conducted in Nigeria that revealed the majority (96.9%) of the respondents had adequate knowledge of blood donation (Olubiyi. SK, et al., 2014).

In the present study, age under 31-45years (AOR= 0.50, 95% CI: 0.34-0.74, >45 years old (AOR=0.60, 95% CI: 0.38-0.95) and 5-8 grade (AOR=2.51, 95% CI: 1.09-5.78), 9-10 grade (AOR=4.22, 95% CI: 1.80-9.88), 11-12 grade (AOR=6.96, 95% CI: 2.86-16.91), College graduates (AOR=5.58, 95% CI: 2.25-13.85)were significantly associated($p<0.05$) with comprehensive knowledge about voluntary blood donation which is supported by other study indicated knowledge about blood donation level was increasing steadily with the increase in the educational level andmaleshad higher blood donation knowledge level rank compared to females in the study andthe highest level of knowledge about blood

donation was reported among individuals in the age group of 20–30 yearsage compared to reported among those aged less than 20 years($P = 0.004$)(Alfouzan.N,2014) .

In this study, only 278 (32.90%) of participants had positive attitude towards voluntary blood donation and level of education were significantly associated($P<0.05$) with attitude towards voluntary blood donation which is not in agreement with other study that showed level of education was not significantly associated with attitude of the participant towards blood donation, $P> 0.05$(Alfouzan.N,2014).

In the present study, only 191(22.6%)of respondents ever donated blood before this study which lower than study conducted in Saudi Arabia where, 45.8% of the participants claimed that they have a history of blood donation (Alfouzan.N,2014) and 29% had donated blood voluntarily(Waheed. U, *et al*., 2015). But higher than result conducted in Ethiopia showed that only 107(12.7%) of the respondents have ever donated blood in their life (Ingale.L, *et al*.,2015).Study participants who ever donated blood before with good knowledge about voluntary blood donation was significantly lower than study participants who ever donated blood before with low knowledge about voluntary blood donation, in contrast to this other study conducted in Ethiopia indicated respondent who were knowledgeable was more likely to donate blood than non knowledgeable(Ingale.L, *et al*.,2015).This could be that those study subjects with overall good knowledge have no positive attitude to give their blood voluntarily. The proportion of study participants who ever donated blood with positive attitude about voluntary blood donation was significantly lower than the study participants who ever donated blood with negative attitude towards voluntary blood donation. Unlike other study, individuals who had history of blood donation showed higher attitude towards blood donation compared to those who did not have such history(Alfouzan.N,2014).The reason might be study subjects with positive attitude miss the opportunity to donate blood as the campaign is mostly done at institution level.

5. Limitation

It would be stronger to use analytical approaches to assess the level of community knowledge, attitude, and practice towards voluntary blood donation and complementing the study with a qualitative data collection approach. The design is cross section this may distort our result by virtue of its nature.

6. Conclusion and Recommendation

This study showed that there is a good (43.55%) over all community knowledge and only (32.9%) participant had positive attitude towards blood donation and about 77.4% had never practiced blood donation. The current community knowledge and attitude did not influence people to donate blood voluntarily. Age and gender were significantly associated with comprehensive knowledge of participant about voluntary blood donation. Educational status was significantly associated with attitude and comprehensive knowledge towards voluntary blood donation. Therefore, health bureau would be better to take initiative so as to increase the awareness and practices of

voluntary blood donation in the community through different strategies; including, Promote through mass media, community health worker/health extension workers together with Health Education and Communication package. Administrative also needs promotion starting at early child-hood through different mini Medias, School, Youth Centers regarding the benefits and need of blood donation and people could internalize about voluntary blood donation.

This may promote knowledge, awareness and practice; hence, keep the topic of blood donation alive in the minds of the general community. Health service facilities or blood bank should implement strategies to improve donor retention and should aim to provide an enjoyable donation experience.

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8. Author contributions

KU designed the study, participated in data collection, analysis, and drafted the manuscript. NH participated in study design, analysis, write-up, and critically revised the manuscript. All authors read and approved the final manuscript. KU is the guarantor of the paper.

9. Disclosure

The authors report no conflicts of interest in this work.

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8. Psychotropic Drug Non Adherence and Associated Factors Among Adult Patients with Major Psychiatric Disorders Attending at Psychiatry Clinics of Hiwot Fana Specialized University Hospital and Dire Dawa Dill Chora Hospital, Eastern Ethiopia

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Abstract: Psychiatric disorders are significant contributor to the global burden of disease. Today 450 million people are suffering from psychiatric disorders. Psychotropic drugs are effective in the treatment of psychiatric disorders, but non adherence to psychotropic drugs is a challenging problem in the management of patients with psychiatric disorders. Despite high magnitude of the problem, there is no sufficient information regarding magnitude and factors responsible for frequent drug non adherence among patients with major psychiatric disorders in Ethiopia. The aim of this study was to assess the prevalence and the associated factors of psychotropic drug non adherence among adult patients with major psychiatric disorders attending at psychiatry clinics of Hiwot Fana specialized University Hospital and Dire Dawa Dilchora Hospital, Eastern Ethiopia from May 10- June, 30/2015.Hospital based quantitative cross sectional study. Systematic sampling was used to get 613 study participants in outpatient departments of both hospitals. The data was collected using standardized questionnaire. Drug non adherence was assessed using the 8 item version of self-reporting questionnaire of Morisky medication adherence rating scale. The Morisky medication adherence rating scale score range from zero to eight and scoring 3 negative answers or more will considered as non adherent. Patient attitude towards treatment was assessed by 10 item drug inventory attitude Score. Data was collected using interviewer administered, pre tested and questionnaire and checked, cleaned and analyzed using SPSS version 20

The prevalence of psychotropic drug non adherence among patients with major psychiatric disorder was found to be 375(61.2%). Multiple logistic regression models of psychotropic drug non adherence revealed that being female [AOR =2.3, 95% CI: 1.38, 3.82] , taking low potency typical antipsychotic with antidepressants concomitantly [AOR=2.65,95 CI :1.00,6.99], being on treatment from 6 months to 24 months and more

than 24 months [AOR=2.33; 95 CI :1.44,3.78; AOR=2.51; 95 CI: 1.54,4.11], respectively. substance use [AOR=2.64 :95% CI;1.72,4.03],perceived stigma [AOR=2.15： 95 CI:1.48,3.12], patient attitude toward the medication [AOR=3.00: 95% CI :1.75,5.14].having poor social support [AOR=1.83; 95% CI :1.25, 2.69] were statistically associated with the antidepressant drugs non adherence.

The prevalence of psychotropic drug non adherence among patients with major psychiatric disorders was found to be high in this study. Sex, class of antipsychotics taken with anti depressants, experienced side effect, anti cholinergic side effect, sleep related side effect, duration being on treatment, substance abuse, cigarette smoking, attitude towards the medication and perceived stigma were covariates which affect the psychotropic drug non adherence among major psychiatric disorders.

Keywords: Psychotropic drugs; Major psychiatric disorders; Non adherence

1. Introduction

About 14 % 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, 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. Mental illness is common, with approximately 450 million people affected globallylly[WHO,2008].

Schizophrenia is one of the chronic and serious mental health problem characterized by clinical syndrome of variable, but profoundly disruptive, psychopathology that involves cognition, emotion, perception, and other aspects of behavior. The classic course of schizophrenia is one of exacerbations and remissions and patient usually relapse [Kaplan,HI.,and Sadock, BJ, 2010] Antipsychotic medications are the mainstay of the treatment for schizophrenia and have reduced the number of recurrent psychotic episodes among persons with schizophrenia [Stephen M,2000]. Globally, schizophrenia affects about 1% of adult population. As a chronic condition, prolonged medication treatment is needed, mainly with antipsychotic drugs [Nicolino PS.,etal.,2011]. Depression is a significant contributor to the global burden of disease and affects people in all communities across the world. The 2012 world mental health federation report indicated that as depression affects 350 million people in the world. 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 and will move into the first place by 2030 [World Fwdration of Mental Health,2012].

Medication adherence rates reported for populations with psychiatric illness ranges from 24 to 90 percent for patients with schizophrenia and treated with antipsychotic medication and 40 to 90 percent for patients with major depressive disorder who treated

with antidepressants worldwide. About 30% of all patients with psychiatric disorders discontinue their medication in the first month [Cramer JA and Rosenheck R,1998]. Patients' poor adherence to their medication is a complex problem for health care services, especially in the care of chronic illness, for which the correct, effective treatment is essential for a patient's quality of life and survival rate. Failure to take the appropriate drug regimen as recommended may lead to poor therapeutic outcomes, wasted health care resources and inappropriate changes to treatment by prescribers [Al-Qasem, A., Smith, F., and Clifford, S., 2011].

Advancements in the treatment of psychiatric disorders are limited by non adherence, which steal power from even the most beneficial medications [Taj F., etal, 2008]. Therefore, information regarding the non adherence in patients with psychiatric disorders is essential for designing and implementing strategies for improving medication adherence and for functional restoration**.** There is paucity of data regarding the drug non-adherence among psychiatric patient in developing countries including Ethiopia. To the knowledge of the present researchers although certain study was done on non adherence of chronic medical illness, but we do not found study done on this regard in Ethiopia. Therefore, this study attempts to fill this information gap and come up with recommendation on possible interventions and therapeutic techniques for enhancing adherence behavior among patients with psychiatric disorders. The overall purpose of the study was to assess the prevalence and the associated factors of Psychotropic drug non adherence among patients with major psychiatric disorders attending at psychiatry clinics of Hiwot Fana specialized University Hospital and Dire Dawa Dill Chora Hospital, Eastern Ethiopia from May 10- June , 30/2015.

2. Method and Materials

2.1. Study Area and Period

The study was conducted in psychiatric clinics of Hiwot Fana Specialized University Hospital and DilChora Hospital, Eastern Ethiopia from May 10- June 30/2015. Dire Dawa was founded in 1902 when the railroad from Djibouti reached the area. Dire Dawa is center of Dire Dawa city administration and the second large city in Ethiopia (42).

2.2. Study Design

Hospital based cross sectional study using quantitative method was employed to assess psychotropic drug non adherence and associated factors among patients with major psychiatric disorders.

2.3. Source Population

All adult patients who were diagnosed as major psychiatric disorders and on psychotropic drug treatment follow up attending psychiatry clinics of Hiwot Fana University hospital and Dire Dawa Dill Chora hospitals.

2.4. Study Population

Adult Patients with major psychiatric disorders who were on psychotropic drug treatment follow up during the study period and those have made more than one visit psychiatry clinics of Hiwot Fana specialized University and Dire Dawa Dill Chora hospitals were included in the sample.

2.5. Sample Size Determination and Sampling Procedures

Sample size determination

The sample size was determined using single population proportion formula by considering assumptions of the proportion of population living with psychiatric disorders and were non adherent with psychotropic medication of 50% with the marginal error of 4% at 95% confidence level. Then sample size was the following based on the formula.

$$n = \frac{Z^2 * p(1-p)}{d^2}$$

Where p: - is the patients with major psychiatric disorder population proportions who will be non-adherent to antidepressant/antipsychotic drug.

D: - is the margin of error (0.04),

Z: - refers to the cut off value of the normal distribution and is based on 95%

Confidence level (= 1.96)

$$\frac{1.96*1.96*0.5(1-0.5)}{0.04*0.04} = 600$$

Adding 10% (60 patients) of non respondent on total study population gave the total sample size 660.

2.6. Sampling Procedure

Systematic sampling was used to select study participants. The total sample size was proportionally allocated to the two hospitals based on the patient load. Number of patients taken from Hiwot Fana specialized university hospital was 432. Number of patients taken from Dire Dawa Dilchora Hospital was 181.Every other patient was selected with the sampling interval (k) of 2. The first patient was selected randomly among other study participants.

2.7. Inclusion and Exclusion Criteria

Patients with major psychiatric disorders and who were on treatment, have more than one visit, and whose age 18 years and above were included in the study. Patients who were acutely agitated or severely retarded, and did not communicate with data collectors were excluded from study

2.8. Study Variables

2.8.1. Dependent variable

Psychotropic drug non adherence

2.8.2. Independent variables

1. Socio-demographic variables: Age, Sex, Marital status, Ethnicity, Religion, Monthly income, Educational status and Occupation, place of residence
2. Treatment/ drug related variables: class of drugs, frequency of drug, drug side effect, drug regimen and duration of treatment.
3. Patient related factors: Feeling stigmatized substance use, perceived social support and Attitude towards treatment.
4. Health care related factors: Health information about the drug as well as about the disease, the duration of treatment, drug side effect.
5. Illness and co morbid related factors:Co morbid illnesses, type of major psychiatric disorders

2.9. Data Collection Procedures

Data collection instrument

The data was collected using both structured and standard questionnaire. The questionnaire contains variables related to major psychiatric disorders, the class of drug/s, presence of co-morbid illnesses was filled from patient record who were included in the study. Drug non adherence was measured using the 8 item version of self-reporting questionnaire of Morisky medication adherence rating scale (MMARS). Each item on the MMARS measures a specific medication-taking behavior. Each of the items was presented in a "yes or "no" format. Answers were scored as 0 or 1, with score 1 corresponding to negative answers. The MMAS scores range from zero to eight and scoring 3 negative answers or more were considered as non adherent. Patient attitude towards treatment was assessed by 10-item drug inventory attitude (DIA) Score. DAI score less than six was considered negative attitude towards treatment. Social support was assessed using the Oslo 3 item social support scale; the sum score scale ranging from 3–14, which was then operational zed into "poor support" 3–8", and "good support"9–14. Perceived stigma was measured using the 3 item perceived stigma measuring scale which comprised of dichotomous questions in which a negative response is indicative of felt or perceived stigma with an overall possible score ranging from 0 (no perceived stigma) to 3 (maximally perceived stigma)

2.10. Data Quality Control Issues

Data quality control issues were insured by conducting the pre test nearby health facility (Jugal hospital) prior to data collection. The questionnaire was translated to Amharic and Afan Oromo language to avoide language barrier. Training was given to the data collectors on the data collection tool and sampling techniques. Supervision was held

regularly during data collection period. The collected data was checked on daily basis for incompleteness and inconsistency. Manual editing and computerized data cleaning was done before data analysis.

2.11. Data Processing and Analysis

The coded Data was checked, cleaned and entered into Statistical Package for the Social Sciences (SPSS) window version 20 for analysis. Bi variate analysis was done for COR and multivariate analysis was employed to calculate AOR for variables which met p-value < 0.05 during bi variate analysis. P-value of < 0.05 was considered as statistically significant during multivariate logistic regression.

2.12. Ethical Considerations

Ethical clearance was obtained from institutional health research ethical review committee (IHRERC) of the collage of health and medical science**.** Permission and letter of cooperation was presented to the health institutions administrative bodies. Both Informed and written consent was obtained from study participants and they were informed that participation was on voluntary bases and have full right to withdraw at time of need during the interview process.

3. Results

From all study participants, 181 (29.5%) from Dire Dawa Dilchora Hospital and 432(70.4%) from Hiwot Fana University Hospital participated in the study with the response rate of 93%.

3.1. Socio-Demographic Characteristics

More than three forth (76.1%) of the respondents were males, and more than half 345(56.2%) of them predominantly resided in urban area.

Table1. Distribution of patients with major psychiatric disorder by socio demographic factors attending at DDH and HFUSH, May-June 30/2015(n=613).

Variables	Categories	Number	Percent
Site	Dilchora Hospital	181	29.5
	Hiwot Fana University Hospital	432	70.4
Sex	Male	446	76.1
	Female	147	23.9
Age (in years)	18-30	292	47.6
	31-45	198	32.3
	>45	123	20.1
Marital status	Single	254	41.4
	Married	293	47.7
	Divorced	52	8.5
	Widowed	14	2.5
Religion	Orthodox	195	31.8
	Protestant	42	6.8
	Muslim	370	60.3
	Others	3	0.4
Ethnicity	Amhara	185	30.1
	Oromo	307	50
	Harari	35	5.7
	Somali	23	3.7
	Tigray	24	3.9
	Guraghe	37	6
	Others	2	
Occupation	Gov't Employed	93	15.1
	Private business	86	14.1
	Daily laborer	47	7.7
	Jobless	131	21.3
	Student	44	7.2
	Farmer	149	24.3
	House wife	62	10.1
	Others(specify)	5	
Educational status	Unable to read and write	144	23.5
	Read and write	74	12.1
	Primary school	151	24.6
	Secondary school	140	22.8
	Diploma and above	103	16.8
Monthly income (in birr)	≤600	87	27
	601-1000	91	28.3
	1001-2000	85	26.4
	≥2000	59	18.3
Residence	Rural	268	43.6
	Urban	345	56.2

Clinical/Treatment related factors

Most of the respondents were patients with schizophrenia. From the total participants, 425 (69.2%), of them were petients with schizophrenia followed by major depressive disorder 132(21.5%) and Bipolar I disorder 56(9.1%).More than a third 216(35.3%) of the experienced side effects from the drugs they were taking and 356(58.1%) of them had history of skipping their medications due to different reasons. From these 228(64%) skipped due to forgetfulness, 81(22.8%) due to feeling of better, and 54(15.2%) skipped due to fear of the side effects of the medication (Table 4).

Table 2. Distribution of patients with major psychiatric disorder by clinical/illness and treatment related factors attending at DDH and HFUSH, May-June 30/2015(n=613).

Variables	Categories	Number	Percent
Type of Major psychiatric disorder	Major depressive disorder	132	21.5
	Schizophrenia	425	69.2
	Bipolar I disorder	56	9.1
Class of Anti depressant taken	TCAs	65	43
	SSRIs	86	57
Type of antipsychotic taken with antidepressants	Typical low potent	39	39
	Typical high potent	49	49
	Atypical	12	12
antipsychotic drug(s) is/are the patient currently taking	Typical low potent	320	71.7
	Typical high potent	82	18.4
	Atypical	44	9.9
Mood stabilizer drug	Sodium valproate	37	58.7
	Carbamazepine	26	41.3
Any Co morbidity	Yes	34	5.5
	No	579	94.5
Experienced side effect	Yes	216	35.3
	No	397	64.7
Duration of being on treatment	≤6months	146	24
	7-24 months	231	38
	>24 months	231	38
Experiencing skipping of drug	Yes	356	58.1
	No	257	49.9

More than two third, 149(69%) of them experienced autonomic ant cholinergic side effect like dryness of mouth, blurring of vision, constipation while 54(25%) of them developed sleep related side effects like drowsiness and sedation where as 31(14.4%) had developed extra pyramidal symptoms like tremor, body rigidity, dystonia and tardive dyskinesia.

3.2. Health Care and Patient Related Factors

More than half of the respondents 330-245 (54.8-56.3%) reported that they did not get health information regarding their illness and the medication they were taking About

357(58.3%) of them abused substance since initiation of treatment, nearly one fifth 119(19.4%) of them had negative attitude toward their medication, more than half of them 307(50.1%) and 328(53.7%) had poor social support and perceived stigma by being patient with major psychiatric disorder (Table 5).

Table 5. Distribution of patients with major patients with major psychiatric disorder by health care and patient related factors attending at DDH and HFUSH; May-June 30/2015(n= 613).

Variables	Categories	Number	Percent
Health information about the illness	Yes	277	45.2
	No	330	54.8
Health information about the medication	Yes	268	43.7
	No	345	56.3
How do you get your treatment	Freely	121	19.7
	With payment	492	80.3
Substance use	Yes	357	58.3
	No	256	41.7
Attitude towards drug	Positive	494	80.6
	Negative	119	19.4
Social support	Good	306	49.9
	Poor	307	50.1
Perceived stigma	Yes	328	53.7
	No	283	46.3

Table 4. Substance used by patients with major psychiatric disorder major attending at DDH and HFUSH, May-June 30/2015.

Substance used by the patient	Number	Percent
Khat	341	95.5
Cigarettes	176	49.3
Alcohol	24	6.7
Others	6	1.7

Note: percentages do not add up to 100 because of multiple responses.

3.3. Prevalence of Psychotropic Medication Non Adherence

As measured by MMARS, the prevalence of psychotropic medication non adherence among patients with major psychiatric disorder was found to be 375(61.2%) fig. 1). The prevalence among specific patients with major psychiatric disorder was found to be 259(69.3%), 83(62.9%) and 33(58.9%) among patients with schizophrenia, major depressive disorder and bipolar I disorder respectively.

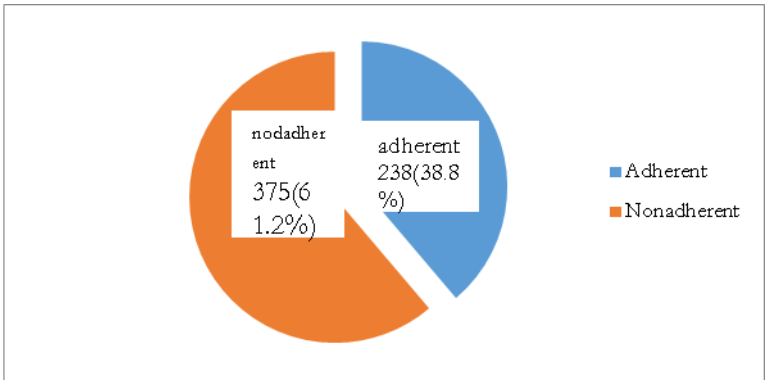

Figure 1. The prevalence of psychotropic medication non adherence among patients with major psychiatric disorder attending at DDH and HFUSH, May-June 30/2015(n= 613).

Table 5. Major psychiatric disorders and psychotropic medication non adherence among patients with major psychiatric disorder major attending at DDH and HFUSH, May-June 30/2015

	Adherent status		Total
Type major psychiatric disorder	Adherent (number, %)	Non adherent (number, %)	
Major depressive disorder	49(37.1%)	83(62.9%)	132
Schizophrenia	166(39.1%)	259(60.9%)	425
Bipolar I disorder	23(41.1%)	33(58.9%)	56

3.4. Factors Associated with Drug Non Adherence

3.4.1. Bi variate analysis

On bi variate analysis sex, residence, antipsychotic drug taken with antidepressants, experiencing side effect, way of getting treatment, duration of illness, history of substance abuse, attitude towards the medications, social support status and perceived stigma were explanatory variables which found to be significant and entered into multivariate analysis for further analysis.

3.4.2. Multivariate analysis

During the multivariate analysis of psychotropic medication non adherence in relation to all independent variables sex,class of antipsychotics taken with anti depressants, experienced side effect **(**anti cholinergic side effect and sleep related side effects),duration being on treatment for longer than 6 months,substance use, attitude towards the medication and perceived stigmas were found to be statistically significant.

Table 6. Factors associated with psychotropic medication non adherence among patients with Major psychiatric disorder attending at DDH and HFUSH, May-June 30/2015(n= 613).

Explanatory Variables	Drug Non Adherence		COR (95% CI)	AOR (95% CI)	P value
	Yes	No			
Sex					
Male	272(58.4%)	194(41.6%)	1	1	
Female	103(70.1%)	44(29.9%)	1.67(1.21,2.49)	2.3(1.38,3.82)	0.001**
Residence			1	1	
Rural	150(56%)	118(44%)		1.5(1.00,2.197)	0.033
Urban	225(65.2%)	120(34.8%)	1.5(1.06,2.05)	0.81(0.26,2.47)	0.79
Class of antipsychotics taken with anti depressants					
Typical	30(76.9%)	9(23.1%)	2.48(1.01,6.1)	2.65(1.00,6.99)	0.049**
Atypical	35(57.4%)	26(42.6%)	1	1	
Experienced side effect					
Yes	161(74.5%)	55(25.5%)	2.5(1.74,3.6)	2.30(1.52,3.43)	0.00**
No	214(53.9%)	183(46.1%)	1	1	
Ant cholinergic side effect					
Yes	113(75.8%)	36(24.2%)	2.42(1.59,3.67)	2.16(1.40,3.39)	0.001**
No	262(56.5%)	202(43.5%)	1	1	
Sleep related side effect					
Yes	46(85.2%)	8(14.8%)	4(1.86,8.68)	2.40(1.06,5.44)	0.036**
No	329(59.8%)	230(41.2%)	1	1	
Duration on Treatment					
≤6months	67(45.9%)	79(54.1%)	1	1	
7-24months	150(64.9%)	81(35.1%)	2.18(1.43,3.33)	2.33(1.44,3.78)	0.001**
≥25months	155(67.1%)	76(32.9%)	2.41(1.57,3.68)	2.51(1.54,4.11)	0.000**
How do you get your					

treatment?					
Freely	85(70.2%)	36(39.8%)	1.65(1.07,2.53)	0.81(0.48,1.35)	0.415
With payment	290(58.9%)	202(41.1%)	1	1	
Substance use					
Yes	244(68.3%)	113(31.7%)	2.06(1.48,2.87)	2.64(1.72,4.03)	0.00**
No	131(51.2%)	125(48.8%)	1	1	
Khat use					
Yes	232(68%)	109(32%)	1.92(1.38,2.67)	1.45(0.99,2.12)	0.053
No	143(52.6%)	129(47.4%)	1	1	
Cigarette smoking					
Yes	133(75.6%)	43(24.4%)	2.50(1.70,3.70)	1.87(1.20,2.93)	0.007**
No	242(55.4%)	195(46.6%)	1	1	
Alcohol drinking					
Yes	21(87.5%)	3(12.5%)	4.65(1.37,15.75)	2.52(0.7,8.94)	0.152
No	354(60.1%)	235(39.9%)	1	1	
Attitudes towards the drug					
Negative	96(80.7%)	23(19.3%)	3.216(1.98,5.24)	3.00(1.75,5.14)	0.00**
Positive	279(56.5%)	215(43.5%)			
Social support					
Poor	212(69.1%)	95(30.9%)	2.00(1.40,2.27)	1.83(1.25,2.69)	0.00**
Good	163(53.3%)	143(46.7%)	1	1	
Perceived stigma					
Yes	240(73.2%)	88(26.8%)	3.10(2.20,4.31)	2.15(1.48,3.12)	0.00**
No	133(47%)	150(53%)	1	1	

*Key: - **statistically significant.*

4. Discussion

The study showed that 375(61.2%) of the respondents were non adherent for psychotropic drugs using the 8- item MMARS. The non adherence rates with specific major psychiatric disorder was 259(69.3%), 83(62.9%) and 33(58.9%) among patients with schizophrenia, major depressive disorder and bipolar I disorder respectively. Sex, class of antipsychotics taken with anti depressants, experienced side effect **(**anti cholinergic side effect and sleep related side effect) duration being on treatment for longer than 6 months**,** substance use, cigarette smoking, attitude towards the medication and perceived stigma were factors which affect the psychotropic drug non adherence. Previously studies reported that Medication adherence rates reported for populations with psychiatric illness range from 24 to 90 percent for patients treated with antipsychotic medication and 40 to 90 percent for patients treated with antidepressants [Cramer JA and Rosenheck R,19986] this was consistent with the current study.

This is greater than studies done in Pakistan 41.2 %(Taj, F.,*etal*., 2008) ,India 35%(Sharma S, 2012), Nigeria 40.3 %(Adegoke, O., Timothy, O., Olukayode, A.,2011), Kenya 55%(Okonji, M., and Dhadphale, M.,2005), south Africa 35.8%(Kazadi, NGB.,Moosa, MYH., Jeenah, FY..,2008), and Denmark 33.6%(Hansen,DG.,Vach, W., Søndergaard, J., Gram LF, Kragstrup J. ,2004).The possible reason for the difference might be the difference in the study design used and sample size, the difference in the measurement of drug non adherence, difference in population enrolled in the study, difference in the socio demographic characteristics as well as difference in the psychotropic medications taken by the respondents.

The possible reason for the difference in the magnitude of prevalence can be due to the socio cultural difference in the study population and clinical related factors. Most patients who were taking antipsychotics (90.1 %) of study participants in the current study area were taking typical antipsychotics which were 30% in Nigeria (Adegoke, O., Timothy, O., Olukayode, A.,2011). These drugs have higher side effects than atypical antipsychotic which can affect patients' attitude towards treatment negatively and making patient non adherent to their drugs. The other possible factors that cause higher non adherence in this study area might be the higher substance uses 58.3% which was 49% in India (Sharma S.,etal,2012).Besides of those factors certain studies had used different inclusion criteria; in India participants were those who were on treatment for six months only ((Sharma S.,etal,2012),the methodological difference which were non probability sampling method used in Pakistan(Taj, F.,etal, 2008).

But the prevalence in this study is less than studies done in Thailand 77 %(Prukkanone, B., *et al*., 2010), India Kolkata 66.9% (Banerjee, S.,2012) and Sudan 64% (Sudanese Association of Psychiatrist,2010).The difference might be difference in the socio demographic characteristics, study design used and measurement used to asses drug non adherence and presence co morbid illnesses in Kolkata study.

The difference from the Thailand study might be the difference in the study design, populations enrolled in the study, and method they used to measure the non adherence; which were retrospective study using electronic pharmacy data, all patients with depressive episode were enrolled in the study and the method they used was medication

possession ratio (Prukkanone, B., *etal*., 2010). Regarding the Indian Kolkata study even though the study design and method used to measure the non adherence was the same, in Indian study most of the study participants were living in rural areas, 18% of the study participants had co morbid medical conditions and might be due to difference in other socio demographic characteristics of the population in the current study (Banerjee, S., 2012).

Sex, class of antipsychotics taken with anti depressants, presence of side effect **(**anti cholinergic side effect and sleep related side effect), duration being on treatment for longer than 6 months**,** substance use, negative attitude towards the drug, poor social support and presence of perceived stigma were covariates which were found to be statistically significant contributors for psychotropic drug non adherence in this study.

Being female was twice as high as non adherent for psychotropic medication as male in this study. This is in line with Kolkata study, but different with other studies. This divergence in reported findings may be due to socio cultural differences. The multiple roles assumed by woman include that of home makers, professionals, spouse, mothers, and care providers may contribute to their inability to adhere to prescribed regimen. Since women are reported to suffer from major psychiatric disorders and seek treatment, educating them about the potential problems related to abrupt suspension of therapy is crucial. Education about this widespread yet disregarded clinical phenomenon will help to prevent relapses and ensure better outcomes.

From the study participants who were taking antidepressants with typical antipsychotics concomitantly, the odds of being non adherent was three times as compared to those patients who were taking antidepressants with atypical antipsychotics[AOR=2.65,95 CI :1.00,6.99].

This might be due to the side effect that the patients encountered during the treatment more than fifty percent of the study participants 356(58.1%) had skipped their drug at least once during their treatment. They have different reasons for skipping. Among the reported reasons, 54(15.2%) of them skipped due to the side effect they experienced. The fact that TCAs and typical antipsychotics have some similar side effect, taking both drugs concomitantly aggravates the side effect. In the current study, More than two third 149(69%) developed autonomic ant cholinergic side effect like dryness of mouth, blurring of vision, constipation and 4(25%) sleep related side effects like drowsiness and difficulty staying awake during day or sleeping too much drowsiness and sedation.So, taking both drugs at the same time potentiate the side effect thereby the patient might be more likely to be non adherent when compared with those respondents who were taking antidepressants atypical antipsychotics.

Regarding the duration of the treatment, for those patients who were on treatment from 6 months to 24 months and more than 24 months were two to two and half times more likely to be non adherent than those who were on treatment for less than six months[AOR=2.33; 95 CI :1.44,3.78; AOR=2.51; 95 CI: 1.54,4.11], respectively. The median treatment duration of the study participants was 18 months which was the treatment duration of middle fifty (50%) of the study population who were patients with major psychiatric disorder. For example, treatment guidelines showed for the treatment

duration of patients with major depressive disorder require acute treatment with antidepressants for six to twelve weeks to achieve remission, followed by a minimum of an additional six months after remission to reduce risk of relapse (National Institute for Health and Clinical Excellence,2009), and can be up to two years maintenance treatment if the patient has chronic depression, severe functional impairment, or is at risk of severe consequences such as suicide (National Institute for Health and Clinical Excellence,2009).But more than third 38 % of these study participants had treatment duration of more than 24 months which were two and half times to be non adherent than who were below 6 months treatment duration. As illustrated in the multivariate analysis as treatment duration increases, the respondents were more likely to be non adherent. This could be due to boringness as well as forgetfulness to follow the treatment for long period of time by patients and also as the treatment duration increases the patients might felt better and were more likely to be non adherent to their treatment given.

Concerning substance use, those who were using cigarettes were nearly three times more likely to be non adherent than the non users[AOR=2.64 :95% CI;1.72,4.03]. Substance use was independently and significantly associated with non adherence. This finding coincides with study done in France which reported non adherence was associated in patients with substance use.(Misdrahi D, Petit M, Blanc O, Bayle F, Llorca PM.,2012) Possible reason includes the specified substance use can have negative impacts on a person's internal state causing increased cognitive anomalies and unpleasant withdrawal symptoms. In addition to the physical consequences, there are number of long term social and clinical consequences associated with substance use. Other consequences of those substance is increased risk of social exclusion and ultimately, homelessness or lack of family support which can end up with medication non-adherence and failure to attend appointments which were true in current finding in which patient who had poor social support were about two fold to be non adherent as compared patient having good social support.

For those patients who had perceived stigma, the odds of being non adherent was two times as compared to those who didn't perceive the stigma[AOR=2.15: 95 CI:1.48,3.12].This is in line with the Canadian study(Gabriel, A., and Violato, C.,2010).The possible reason might be the stigma associated with medication use may be difficult for patients to tolerate (Wing, R., Phelan, S., and Tate, D., 2002).The other explanation could be largely due to the negative nature of the illness that makes patients shameful and secretive and prevent them from taking proper treatment.

For patients who had negative attitude towards the drugs they take, the odds of being non adherent to medication were three times higher than those who had positive attitude towards their drug[AOR=3.00: 95% CI :1.75,5.14].This might be due to the side effects the patients encountered. That means when patients developed the side effects they might feels as the disease condition was worsened, which might lead to discontinuing the treatment they were taking. On top of this, the patients might not have information about the treatment condition particularly the side effects of the drug.

Patients who had poor social support were about two times to be non adherent than patients who had good social support [AOR=1.83; 95% CI: 1.25, 2.69].This is in line with the studies done in Nigeria(Adegoke, O., Timothy, O., Olukayode, A., 2011)

Limitations and Strengths of the Study

- In this study non adherence was measured using self-report questionnaire it might tends to underestimate non adherence due to recall bias.
- Attitudes towards the drugs, social support and perceived stigma were assessed using standardized tools.

5. Conclusion and Recommendations

The prevalence of psychotropic drug non adherence among patients with major psychiatric disorders was found to be high in this study. Sex, class of antipsychotics taken with anti depressants, side effect**,** duration being on treatment for longer than six months and above**,** substance use, negative attitude towards the drug and having perceived stigma were covariates which affect the psychotropic drug non adherence among major psychiatric disorders. Based on the findings and the conclusions, the following recommendations were forwarded for respective bodies.

The Ministry of Health:

- Should arrange a system for continuous professional development trainings for the health care providers of the hospitals about major psychiatric disorders and their treatment.
- Should design and implement programs that address substance use, stigma and poor social support in order to improve adherence among patients with major psychiatric disorders.
- Should consider the accessibility of drugs having lower side effects.
- Should emphasis on designing and implementing continue care for those who have no family or social support.

Dire Dawa Dil Chora Hospital and HFUSH:

- Should develop standard protocols for management of patients with major psychiatric disorders and manuals which describe strategies of drug selection, dosing, frequency of use, duration of treatment, side effects and their management.

The Healthcare Providers:

- Should select the appropriate classes of drugs for the major psychiatric disorders and should treat patients with the intended duration of treatment.

- Should give time to provide the appropriate health information about the major psychiatric disorders and their management with the intended duration of treatment

The researchers:

- Should undertake further study with other study design to provide stronger evidence regarding the prevalence and predictors of psychotropic drug non adherence among patients with major psychiatric disorders.
- Should study the treatment durations and its predictors in the treatment of major psychiatric disorders.

6. Competing Interest

All authors declare that they have no competing interest.

7. Authors' Contribution

MN and AS had made a substantial contribution to conception design, acquisition and interpretation of data.MN and AS revised the paper critically for the valuable contents and read and approved the final manuscript.

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9. Factors Affecting Implementation of Community Led Total Sanitation and Hygiene in Diretiyara District, Harari Regional Satte, Eastern Ethiopia

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Abstract: In Ethiopia, most population does not have access to safe and adequate water supplies and improved sanitation facilities. An estimated 60 to 80 percent of health problems are due to communicable diseases, which are the major causes of child morbidity and mortality, attributable to unsafe and inadequate water supply and unhygienic and unsanitary waste management (FMOH, 2003/04). The objective of this study is to assess factors affect implementation of community led total sanitation and hygiene in Diretiyara district in Harari Region, Eastern Ethiopia.

A cross-sectional study design was conducted in June, 2013 involving 420 out of the 7225 households found in Diretiyara district. Both Quantitative and qualitative data were collected by data collectors and supervisors respectively. Both bivariate and multivariate analyses were employed to examine the relationships between outcomes and explanatory variables, and adjust for possible confounders respectively.

In this study, 66% of the respondents have knowledge about CLTS and 89% of the respondents have latrine of which 21% of the respondents have latrine before the introduction of CLTS and 78% constructed after triggering. In present study, 11% of the respondents practice open defecation and 15% of the respondents report diarrheal cases in the last two weeks during the study period. The occurrence of diarrhea also significantly associated with the extent of latrine ownership (AOR [95%CI] = 2.48 [1.00, 6.12]. Attitude and perception parameters are significantly associated with consistent latrine utilization, Respondents who agree, "Open defecation is preferred due to the unpleasant smell and heat from the latrine" (COR [95%CI] = 0.58 [0.34, 0.99] were 58% less likely to use the latrine consistently.

This study showed that, CLTS increased the extent of latrine ownership and cleanliness. Poor consistent latrine use and intermittent good hygienic practice and misconception about CLTS were reported. Health extension workers and local authorities should give emphasis to sustainable behavioral change towards improved sanitation and good hygiene practices not only latrine ownership. Efficient use of model

families and health development army is crucial to internalized and own the approach by the community.

Keywords: CLTSH implementation; sustainable behavioral change; sanitation & hygiene; Diarrhea disease

1. Introduction

Globally, magnitude of the sanitation related deaths are striking 2.2 million people estimated to die each year from diarrheas and related diseases. Of these, the great majorities are children. The strong links between these figures and defecation in open spaces, lack of access to, or use of safe disposal of human excreta, lack of hygienic practices and contaminated water are not in dispute and more than 7 out of 10 are without improved sanitation in rural inhabitants (Robert, 2009).

Based on Sustainable Development Goals (SDG) (Goal 6) by 2030, nations are expected to achieve access to adequate and equitable sanitation and hygiene for all and end open defecation paying special attention to the needs of women and girls and those in vulnerable situations (David and Macharia, 2015). Poor sanitation and hygiene conditions are among the major causes of public health problems in Ethiopia, where children are the most vulnerable. Health statistics indicate that most of the burden of disease is preventable and a considerable proportion is directly related to unsafe water and inadequate sanitation. The average Ethiopian child suffers 5 to 12 diarrhea episodes a year basically resulted from poor environmental sanitation and between 50, 000 to 112,000 under five children die annually (Nucleus Research P.L.C, 2011).

CLTS is a community driven approach that focuses on eradicating open defecation by generating change in sanitation behavior at a community-wide level and stimulating demand for latrines without any external hardware support. It concentrates on the whole community and enables the communities to conduct their own sanitation profile through appraisal, observation and analysis of their practices of open defecation and its effects. The heart of this approach lies a paradigm shift to collective behavior change in creating open defecation-free environments. Although CLTS has been implemented in over 50 countries including Ethiopia (Saha and Negussie, 2009),data on factors affect implementation of CLTSH and the magnitude of those factors are scanty and there is a lack of rigorous and objective data specifically in the study area and generallyin Ethiopia.

2. Method and Materials

2.1. Study Area and Population

Based on health and health related indicator data, Harari region had a total population of 220,000, of which 111,048 were male and 108,952 were females. 55% of the population lives in urban inhabitants. The annual growth rate was 2.6%. The potential health service coverage was 100%. Latrine coverage of the region was 81% (while 84% for the nation) (FMOH, 2012/13). According to 2012 health and health related indicator data, access to

safe drinking water supply of the region was 75.8%, of which 87% was rural inhabitants and 97% was urban. The under five mortality rate is 94 per 1000 (FMOH, 2011/12).

The region has nine districts of which six (Amirnur, Abadir, Shenkor, Aboker, Janela and Hakim) are found in urban area while three (Errier, Diretiyara and Sofi) are in rural areas. The CLTS was implemented in three rural districts of which Diretiyara district was randomly selected. Diretiyara is 12km away from the Harar town in east direction. It is surrounded by Harar town in the east, Kombolcha on the west, Awoday in the south and Ijegina in the north. Diretiyara district has a total of 7,225 households (with a population of 31,071). It has one health center, six health posts, eight elementary and junior (1-8) schools (Harari Regional Health Bureau, 2011)

2.2. Study Design and Period

A cross-sectional study design was conducted in June, 2013 in all study areas. Observational method was also used by using an observational checklist.

2.3. Population of the Study

Source of population of this study were selected from the three districts (Errier, Diretiyara and Sofi) which are all found in rural areas and where the CLTS was implemented. All households found in Diretiyara district were considered as the study population.

2.4. Sample Population

A total of 422 households were sampled from the study area. All sampled household housewives or husbands or a household member age greater than 18 years old was eligible for an interview and was considered as a sample population.

2.5. Sample Size Determination

The sample size was determined by using a single population proportion formula:

$$\frac{Z^2_{1-\alpha/2} \, x \, p(1-p)}{d^2}$$

$$n = \frac{[(1.96)^2 x 0.5\,(1-0.5)]}{(0.05)^2} = 384 \text{HHs}$$

By considering the desired precision of (d^2) 5%, a 95% ($Z1-\propto/2$) confident level of 1.96 and P of 0.5, the final sample size was 422 HHs (including 10% non response). FGD was conducted with community leaders and health extension workers by supervisors until point of saturation.

2.6. Sampling Techniques

Systematic random sampling technique was used to select participants of this study. Every 17th (7225/422) household was considered as eligible for interview.

2.7. Study Variables

2.7.1. Dependent variable

Knowledge about CLTS, acceptance of CLTS, attitude towards CLTS, latrine availability, latrine consistent utility and practice of open defecation were taken as response variables.

2.7.2. Independent variable

Socio-demographic and economic variables (age, occupation, marital status, religion, educational level, and monthly income,), the practice of transient walk, feces mapping, feces calculation and feces mobility chart were considered as explanatory variables.

2.8. Data Collection Method and Instruments

For quantitative data, fourteen data collectors who completed 12th grade with previous experience in data collection were involved after two days training and for qualitative data. Two supervisors who had BSc in environmental health were also used. The questionnaire prepared in English and translated to Afan Oromowas used to generate the required data. FGD was conducted with eight discussants at a time by supervisors until the point of saturation. FGD was carried out after one day training was given to supervisors on how to administer FGD.

2.9. Data Quality Control

Data collectors were trained for two days. The questionnaire was pre-tested in other kebele to avoid any contamination of data.Supervision and checking of filled questionnaires was made on a daily basis in the field.

2.10. Data Analysis

Analysis of data was made by using SPSS Version16 statistical package. Bivariate and multivariate analyses were employed to examine the relationships between outcomes and explanatory variables and adjust for possible confounders respectively. The odds ratio was computed to assess strength of association between response and explanatory variables. Significance of statistical associations was assured using a 95% CI and P.value.

2.11. Ethical Considerations

Ethical clearance was secured from Institutional Research Ethics Review Committee of College of health Sciences. Formal letter of support was written to local officials. Information was collected from each participant after signing the written consent form. The information was re-coded anonymously and confidentiality was assured.

2.12. Operational Definition

Community-Led Total Sanitation (CLTS): is a community based approach that focuses on eradicating open defecation by generating change in sanitation behavior at a community-wide level and stimulating demand for latrines.

Knowledge about CLYSH steps: Respondents who state at least three steps of CLTSH (pre-triggering, triggering, post-triggering and, scaling up and going beyond for sanitation ladder)

Knowledge about CLTSH tools: Respondents who state at least the four major tools of CLTSH (transient walk, faces mapping, faces calculation, faces mobility chart and glass of water exercise).

3. Result

3.1. Socio-Demographic Characteristics of the Study Population

Four hundred twenty respondents were interviewed with the response rate was 99.5% from which the final analysis was computed. The age range of the respondents was from 18 to 61 years with the mean age of 37.25(±7.7) years (table 1)

Table 1. Socio-demographic characteristics of population under study, 2013.

Variables (n=420)	Frequency	Percent
Age (year)		
Less than 30	071	16.9
30 - 40	207	48.3
Greater than 40	142	33.8
Marital Status		
Single	038	9.0
Married	341	81.2
Divorced	024	5.7
Widowed	015	3.6
Separated	002	0.5
Family Size		
Less than or equal to 4	232	55.2
Greater than 4	188	44.8
Monthly Income		
Less than 700	104	24.8
700 - 1500	160	38.1
1500 - 2000	89	21.2
Greater than 2000	67	16.0
Educational Level		
Illiterate	141	33.6
Elementary (1-4)	123	29.3
Junior (5-8)	77	18.3
Secondary (9-10)	42	10.0

Preparatory (11-12)	08	1.9
Tertiary (12 +)	29	6.9
Occupational Status		
Farmer	257	61.2
Housewife	40	9.5
Merchant	55	13.1
Govt Employee	37	8.8
Daily Labor	31	7.4
Religion		
Orthodox	15	3.6
Muslim	401	95.5
Catholic	4	1.0

3.2. Factors Associated with the Implementation of CLTSH

From the total participants in this study, 279 66%) of the respondents had knowledge about CLTS and most of them, 371 (88.3%), got from health extension workers. However, 58 (14%) of them were not convinced that CLTS is an important tool to stop open defecation and still 218 (52%) of the respondents did not know the ignition participatory rural appraisal tools (transient walk, faces mapping, faces calculation and faces mobility chart). In this study only 22% of the respondents had latrine before the introduction of CLTS and 78% of them constructed after triggering.

On the other hand, 284 (68%) of the respondents perceived that the social mobilization techniques currently conducted in the study area brought a change in the attitude and practice of open defecation among the study population. Similarly, 51% of the respondents perceived that the formed committees were not effectively working to achieve open defecation free communities, even though the majority, 339 (81%), of the respondents trained about CLTS.

Based on the current study, both the poor families (359, 86%) and women (357, 85%) had proportionate and an active role in the implementation of CLTS activities. Nearly about 305 (73%) of the respondents felt that all communities benefited equally from CLTS intervention. The support for poor families in terms of money, skill and material to construct a latrine is minimal (46,11%,). On the other hand, the majority of the respondents (353, 84%,) believed that CLTS created social harmony. Regarding the continuous assessment of CLTS, 264 (63%) of the respondents perceived that there is a system of assessment by the community with regard to achieving the goals of CLTS.

Concerning the possession of latrines, 375 (89%) of the respondents had latrine of which about 298 (79.5%) of the latrines were cleanly maintained and during survey 62 (15%) of the respondents report diarrheal cases in the last two weeks among family members. Majority of the respondents construct the latrine after the introduction of the CLTS approach in the study area. Therefore, this approach enhanced latrine ownership in the study area and hence reduced diarrheal cases.

The majority of the respondents, 261 (62%), defecate at home surroundings and 130 (31%) of them defecate in open field before the implementation of CLTS tool and 388 (92%) of them experienced lack of freedom (92%, 388) in addition to vulnerability to different feco-oral diseases. Based on the current study, consistent use of latrine via all

family members seemed a problem, only 176 (47%) of the respondents reported consistent use of latrine among all family members. Only 99 (26.4%) of the respondents reported that they use proper hand wash with soap and water after use of latrine. Eighty eight percent of the respondents reported that there were no sanitary products like cement slabs, used for the construction of latrines and maintenance, though 353 (84%) of the respondents reported that there is a regular mobilization among the community to build a latrine, consistent use and promote good hygiene practices.

Table 2. Selected variables measured by knowledge of CLTS among study participants in Diretiyara administrative kebele, Harari region, Ethiopia, 2013.

Variable (n=420)	Knowledgeable			Odds Ratio (95 % CI)	
	Total	Yes	No	Crude	Adjusted
Age in year					
<30	71	55	16	0.50(0.26, 0.97)*	0.45(0.21,2.00)
30-40	207	134	73	0.94(0.60, 1.47)	1.23(0.71, 2.13)
≥40	142	90	52	1.00	1.00
Educational status					
Illiterate	141	115	26	1.96(0.55, 6.97)	3.61(0.84,15.57)
Elementary(1-4)	123	62	61	8.53(2.45, 29.65)*	18.99(4.48,80.54)*
Junior (5-8)	77	56	21	3.25(0.89, 11.88)	6.46(1.49,28.08)*
Secondary (9-10)	42	16	26	14.08(3.66,54.20)*	45.29(9.27,221.29)*
Preparatory (11-	8	4	4	8.67(1.39, 54.03)*	25.03(2.74,228.68)*
12)	29	26	3	1.00	1.00
Above 12					
Occupational					
status	48	33	15	1.34(0.54, 3.25)	1.44(0.47,4.41)
Housewife	42	30	12	1.17(0.46, 2.98)	1.23(0.38,3.95)
Merchant	37	16	21	3.83(1.52, 9.64)*	4.14(1.28,13.40)*
Gov't worker	246	165	81	1.43(0.71, 2.91)	1.81(0.75,4.36)
Farmer	47	35	12	1.00	1.00
Daily Labor					
Family size					
≤ 4	232	170	62	1.00	1.00
>4	188	109	79	1.99(1.32,2.99)*	1.76(1.05,2.95)*
Monthly income					
≤700	104	67	37	0.54(0.29, 1.00)	0.55(0.24,1.27)
700-1500	160	111	49	0.43(0.24, 0.77)	0.43(0.20,0.90)
1500-2000	89	68	21	0.30(0.15, 0.59)	0.27(0.12,0.60)
>2000	67	33	34	1.00	1.00
Accept CLTS					
Yes	362	256	106	1.00	1.00
No	58	23	35	3.68(2.07, 6.52)*	8.28(4.05,16.94)*

Note: = significantly associated p< 0.05.*

Table 3. Selected variables as measured by latrine ownership among study participants in Diretiyara administrative kebele, Harari region, Ethiopia, 2013.

Statement (n=420)	latrine ownership		Odds Ratio (95 % CI)	
	Yes	No	Crude	Adjusted
Accept the need of CLTS program				
• Yes	336		1.00	1.00
• No	26		6.30 (3.20, 12.40)*	3.23 (1.20, 8.67)*
	39			
	19			
Know the steps of CLTS.				
• Yes	197		1.00	1.00
• No	05		8.85(3.42, 22.93)*	3.15(1.08,9.24)*
	178			
	40			
practice of social mobilization				
• Yes	273	14	1.00	1.00
• No	102	31	5.93 (3.03, 11.59)*	2.39(1.04,5.49)*
Training of CLTS program				
• Yes	323	16	1.00	1.00
• No	52		11.26 (5.72,22.16)*	4.20(1.81,9.78)*
	29			
Two week diarrheal prevalence among family members				
• Yes	46		3.95 (1.99, 7.82)*	2.48(1.00,6.12)*
• No	16		1.00	1.00
	329	29		
System of reward and punishment to maintain the ODF status				
• Yes	135	02	1.00	1.00
• No	240	43	12.09 (2.88, 50.71)*	9.96(2.08,47.58)*
Promotion of latrine use and good hygiene practice.				
• Yes	325		1.00	1.00
• No	28		3.95(2.02,7.72)*	2.27(0.93,5.55)
	50			
	17			

Note: * = significantly associated p< 0.05.*\

Table 4. Attitude and perception towards CLTS as measured by consistent latrine use among study participants in Diretiyara administrative kebele, Harari region, Ethiopia, 2013.

Statement (n=375)	Consistent latrine use		Odds Ratio (95 % CI)	
	Yes	No	Crude	Adjusted
Preferred open defecation due to unpleasant smell and heat from the latrine.	151		0.58(0.34, 0.99)*	0.66(0.35,1.24)
• Agree	155		1.00	1.00
• Disagree	25			
	44			
Latrines are only intended for rich people.				
• Agree	97		0.60 (0.40, 0.90)*	0.61(0.36, 1.03)
• Disagree	84		1.00	1.00
	79			
	115			
Latrines require periodic maintenance.				
• Agree	160		1.00	1.00
• Disagree	193		0.31 (0.12,.81)*	0.29(0.10,0.87)*
	16			
	06			
Latrines built using local materials are affordable for low income people.				
• Agree	106		1.00	1.00
• Disagree	79		2.30 (1.52, 3.48)*	2.15 (1.25, 3.70)*
	70			
	120			
Open defecation is an ancestral practice passed down through generations	154		0.52 (0.30, 0.91)*	0.68 (0.35,1.32)
• Agree	156		1.00	1.00
• Disagree	22			
	43			
Cleanliness of the latrine.				
• Yes	167		1.00	1.00
• No	131		9.63(4.63,20.03)*	10.24(4.69, 22.39)*
	09			
	68			
Knowledge of CLTS.				
• Yes	139		1.00	1.00
• No	117		2.63(1.66,4.17)*	3.15(1.81, 5.49)*
	37			
	82			

Acceptance of CLTS.				
• Yes	160		1.00	1.00
• No	162		2.28(1.22,4.27)*	2.45(1.14,5.27)*
	16			
	37			
Time latrine was constructed.				
• Before CLTS	27	54	1.00	1.00
• After CLTS	149	145	0.49 (0.29, 0.82)*	0.53 (0.28,1.02)

Note:∗ = significantly associated p< 0.05.

4. Discussion

Diarrheal diseases are remaining the major cause of mortality and morbidity in low income countries like Ethiopia. In Ethiopia, literatures on CLTS showed that significant reduction in diarrheal incidences and nearly no acute watery diarrhea (AWD) incidence in the kebeles where CLTS was implemented (Saha and Negussie, 2009) and hence exploring the factors that influence the implementation of CLTS to achieve open defecation free (ODF) status is crucial.

In the current study, 11% of the respondents practice open defecation. This finding is promising compared to the study conducted by Plan International Ethiopiain collaboration with the Institute of Water at the University of North Carolina, where 37% of respondents practiced open defecation (Water Institute and Plan International Ethiopia, 2012).This could be an optimistic result from implementation of CLTS and scale up of the approach to another district in the region. The implementation of CLTS in the study area, not only boost latrine ownership and sanitation access, but also increase the cleanliness of the latrine and this is the pledged outcome of the approach in the reduction of the fecal-oral disease. This finding also supported by a study conducted in Mali by Alzua *et al.,* (Maria *et al*., 2015).

In this study, 15% of the respondents reported diarrheal cases in the last two weeks among family members during the study period. This is lower than the findings of the study conducted in the Jimma zone Kersa district that the overall two weeks period prevalence of diarrheal in the CLTS implemented area was 19% (Eshete *et al*., 2015). This indicates that there is a better implementation of CLTS among the current study population. In the current study, the knowledge of CLTS was significantly associated with being age less than 30, educational status, being government worker, family size and accept the importance of CLTS in the bivariate and multivariate analysis. Respondents, who not accept CLTS approach (AOR [95%CI] = 8.28 [4.05, 16.94] were eight times more likely not to have knowledge about CLTS compared to their counterparts respectively.

Weak follow up system to aggregate the data, track progress and assist people to move up the sanitation ladder (unimproved sanitation - shared systems - improved sanitation) and poor commitment of natural leaders to guide the implementation of CLTS, lack of effective social mobilization techniques, inadequate participation of women and support

of poor families, unavailability of sanitation technology to access a more advanced and safer form of sanitation, and lack of periodic training to in-depth understanding of the ignition participatory rural appraisal tools to achieve open defecation free status might be negatively influencing factors for the implementation of CLTS and its sustainability in the study area. Those factors also highlighted by discussant during focus group discussion.

In the present study, latrine ownership was significantly associated with acceptance of CLTS, knowledge of the steps of CLTS, the practice of social mobilization, training about CLTS, two week diarrhea prevalence, reward and punishment system, and promotion of latrine use and good hygiene practice in both bivariate and multivariate analysis. Inadequate promotion of latrine use and good hygiene practice (COR [95%CI] = 3.95 [2.02, 7.72] were three times more likely not to have latrine compared with their counterparts respectively. Moreover, the occurrence of diarrhea also significantly associated with the extent of latrine ownership in bivariate (COR [95%CI] = 3.95 [1.99, 7.82] and multivariate (AOR [95%CI] = 2.48 [1.00, 6.12] analysis. These might indicate that not only the availability of the latrine is important but also its consistent and proper use is vital. Hence, further need to done on behavioral change to sustain and strict implementation of CLTS in the study area.

Attitude and perception parameters are significantly associated with consistent latrine utilization. Respondents, who reported that, latrine is only intended for rich people (COR [95%CI] = 0.60 [0.40, 0.90] were 60% less likely to use the latrine consistently. Respondents who had unclean latrine (AOR [95%CI] = 10.24 [4.69, 22.39] were 10 times less likely to use the latrine consistently. Eighty two percent of the respondents reported agree, "Open defecation is preferred due to the unpleasant smell and heat from the latrine". This indicates that, the cleanliness of the latrine should be maintained, effective follows up system and boost up by the community to the upper sanitation ladder is crucial. Furthermore, the respondents who agree, "Open defecation is an ancestral practice passed down through generations" are 52% less likely to use the latrine consistently. This indicates that more need to be done on behavior of the respondent towards sanitation and hygiene to end open defecation in the current study population.

5. Conclusions and Recommendation

The main measure of CLTS achievement is generate open defecation frees villages through sustainable behavioral change towards their sanitation status and hygiene practices. All families gradually lifted up the steps in the sanitation ladder and committed to use sanitary latrines and develop hygienic behavior under their leadership. In this study, thirty four percent of the respondents' inadequate knowledge about CLTS and eleven percent of the respondents reported still practice open defecation. Poor continues follows up, lack of effective social mobilization and active participation of a significant portion of the society such as women, poor families and children were observed.

This study also showed that, CLTS increased the extent of latrine ownership, cleanliness and its utilization. On the other hand, lack of in-depth periodic training,

promotion of latrine use and hygienic practice were reported. This study indicated that 14% of the respondents did not still accept this approach as a means to end open defecation in their village. This could act as a bottleneck for the community to move up sanitation ladder. Moreover, this study also showed that there is a misconception about CLTS among a study population, which is a crucial factor for sustainable behavioral change towards thier sanitation and hygiene practice. Based on the finding of this study, the following recommendations are suggested in order to strict implementation of CLTS in the study area.

- Health extension workers and local authorities should give special attention to the full implementation of all steps and tools of CLTS for sustainability of the approach
- Health office should guarantee continuous follow up, enhance the active participation of all stakeholders, periodic training, enhance the availability of sanitation technology.
- Health offices and local authorities should ensure promotion of good hygiene practice, effective social mobilization; committed natural leaders to well understood CLTS steps, facilitation, monitoring, verification, and certification and recognized CLTS as a successful methodology to create ODF communities.
- Efficient use of model families and health development army is crucial to internalized and own the approach by the community.
- Rewarding or punishment system should be consistently implemented, and certification of the kebele should be based on the sustainable behavioral change towers their sanitation and good hygiene practice.

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10. Assessment of Level of Adherence and its Risk Factors to Anti-Tuberculosis Treatment among Tuberculosis Patients in Selected Public Health Facilities, Harar Town, Eastern Ethiopia

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Abstract: Tuberculosis (TB) is a highly infectious disease that continues to be identified as a major health concern worldwide. However, the highest rates of TB are found in developing countries. The magnitude of TB is high among the poor, displaced, homeless, drug addicts, elderly, malnourished, and women. Non-adherence to anti tuberculosis (TB) treatment can result in severe complications of patients, multidrug resistance, prolonged infectiousness, relapse, death and patients may transmit the disease to other people. Treatment interruption thus poses a serious risk both for the individual and the community. Treatment default also poses a public health threat, because individuals who do not complete therapy are more likely to remain infectious. Patient-related factors including socio-demographic factors, knowledge, beliefs and attitude about TB and its treatment play a great role to poor treatment adherence. The objective of this study was to assess the level of adherence and its risk factors to anti-tuberculosis treatment and defaulters among tuberculosis patients in selected health facilitiesA health facility based cross-sectional study was conducted to TB patients taking anti-TB treatment to interview using structured questionnaire. In addition, record review of TB patients was done to assess treatment outcomes. A total of 447 TB patients aged 18 years and older were participated in the study. Two hundred forty seven (55.3%) of the respondents were male. The median age of the respondents was 30 years (IQR: 23, 40). The proportion of patients with non-adherence was 90 (20.1%). in the adjusted multivariate analysis, being male (AOR: 2.270, 95%CI: 1.315, 3.917), age of ≥55 years (AOR: 2.972, 95%CI: 1.292, 6.837), educational status of illiterate (AOR: 4.429, 95%CI: 1.992, 9.847) and able to read and write, without formal education, (AOR: 2.687, 95%CI: 1.200, 6.019), living in rural area (AOR: 2.020, 95%CI: 1.112, 4.669), and being HIV positive (AOR: 3.058, 95%CI: 1.709, 5.473) were independently identified as predictors of non-adherence among TB patients. Non-adherence increases the risk of treatment failure and

relapse, and is considered to be the most important cause of drug-resistant TB. In particular, multidrug-resistant (MDR) and extensively drug-resistant (XDR) TB constitute serious threats to public health. Improving the treatment service process, maintaining close relationship between providers and patients, reducing waiting time in reception room will have a positive outcome on reducing poor adherence to TB treatment.

1. Introduction

The highest rates of TB are found in countries where poverty, crowding and insufficient health care programs is prevalent (Farmer, 2005). According to the WHO 2009 report, Ethiopia ranks seventh among the TB HBCs, with an estimated incidence of TB of all forms 378 and smear positive PTB 163 per 100,000 populations. The prevalence and mortality of TB of all forms in the same year is estimated to be 579 and 92 per 100,000 populations respectively (WHO, 2009). According to the Federal Ministry of Health (FMOH) 2009/10 annual routine report, a total of 149,508 forms of TB cases were detected among which 46,634 were new smear positive TB cases. The case detection rate (CDR) for smear positive and all forms of TB was 36% and 50%, respectively. The treatment success rate was 84% which is approaching to the WHO treatment success rate of 85% but the CDR is below the WHO standard CDR of 70%. According to the FMOH hospital statistics data, TB is the leading cause of morbidity, the third cause of hospital admission (next to delivery and malaria), and the second cause of death in Ethiopia next to malaria (FMOH, 2008). In 2006, the WHO launched the *Stop TB* Strategyas the internationally-recommended approach to reducingthe burden of TB in line with global targets set for 2015. The Millennium Development Goals (MDG) also set a target for TB control: the MDG 6 Target 6C is to halt and reverse incidence by 2015 (WHO, 2008). Two additional target impacts have been set by the Stop TB Partnership, which are to half prevalence and death rates by 2015 as compared to 1990 (WHO, 2008).

Without the implementation of proper control measures, WHO estimates that between 2000 and 2020, nearly one billion people wasnewly affected, 200 million will get sick and 35 million will die from TB (WHO, 2008). TB affects mainly the economically productive age group with 75% of cases occurring in the age group 15-54. It also causes unprecedented levels of infection and deaths among women and girls. This makes TB the leading cause of death among women of reproductive age group (FMOH, 2008).

The internationally recommended control strategy for TB is Directly Observed Treatment Short-course (DOTS). This strategy includes the delivery of a standard short course of drugs and treatment regimens have an intensive phase and a continuation phase. The anti-TB therapy consists of fixed dose combination of drugs. The delivery includes the direct observation of treatment (DOT) taking either by a health worker or by someone nominated by the health worker and the patients for this purpose. The DOTS strategy contains elements that empower patients to adhere to the anti TB treatment (WHO, 2003). Ethiopia adopted the WHO recommended DOTS strategy in 1995, since then TB control efforts have been decentralized to public health facilities

(hospitals, health centers and health stations) which are responsible for the diagnosis and treatment of TB as a result DOTS are implemented in public health facilities in hospitals and health centers (FMOH, 2008; WHO, 2010).According to hospital statistics data, TB is the leading cause of morbidity, the third cause of hospital admission and the second cause of death in Ethiopia (FMOH, 2008). There is a high rate of HIV among patients with TB in Ethiopia. The WHO Global Report 2008 estimated that 40% of patients treated for TB are HIV positive (FMOH, 2008).

In TB treatment programme adherence is a central issue, since non-adherence can result in prolonged infectiousness, drug resistance, relapse, or death. Non-adherence is the patient's inability or refusal to take TB drugs as prescribed by the health providers. When treatments are lasts for longer period as in the treatment for TB, patients often do not take their medication as instructed. This behavior is one of the biggest problems in TB control and can lead to serious consequences (CDC, 1999). Non-adherence can therefore have consequences for the individual, their family, the wider community in large, and can set back TB control efforts even though medications are widely available (WHO, 2003).

Patient adherence to the advice and directives of health care providers has received increasing attention over the past several years. This is largely due to a growing realization that the promise of efficacious, new therapies to treat long-term and chronic disease conditions cannot be realized unless patients consistently adhere to therapy (Charles, 2005).

Adherence can influence the emergence of new disease strains, individual health outcomes, and the overall cost of health care. Multidrug resistant TB emerged largely because of widespread no adherence to treatment for TB disease. A 12 month course of treatment for latent TB infection (LTBI) was found to be 93% effective among adherent patients, as compared to 75% effective among the overall population prescribed the treatment (Comstock, 1999).

Non-adherence to treatment may result in prolonged infectiousness, drug resistance, relapse, and death. Treatment interruption thus poses a serious risk both for the individual and the community (Garner *et al.*, 2007). Treatment default also poses a public health threat, because individuals who do not complete therapy are more likely to remain infectious. The consequences of default from drug-resistant TB treatment may be particularly grave, because effective therapy for drugs to which the strain has in vitro susceptibility. Thus, treatment default may lead to the transmission of TB that is more difficult to cure with existing drugs (Franke*et a*l**.,** 2008).

Non-adherence to treatment is a major challenge to the global TB control. The extent of non-adherence to TB treatment is difficult to assess, but it is estimated that up to one-fourth of TB patients fail to complete the 6-months treatment course (Sumartojo, 1993). Non-adherence increases the risk of treatment failure and relapse, and is considered to be the most important cause of drug-resistant TB (WHO,2008). In particular, multidrug-resistant (MDR) and extensively drug-resistant (XDR) TB constitute serious threats to public health. According to recent estimates of the World Health Organization (WHO), almost half a million people were diagnosed with MDR TB in 2008 (WHO, 2010). However, the status of anti-TB treatment adherence of

patients and factors affecting adherence has not been studied in the region. Therefore, the objective of this cross sectional study was to assess the magnitude of anti-TB adherence and factors that influence adherence among patients on anti TB in the Region.

TB control remains difficult despite of having effective treatment. To control, prevent TB and reducing drug resistance development in response to non – adherence to anti TB treatment; researchers recommended designing a need based strategy to standardize treatment for resource-limiting countries, for promoting adherence to anti TB. To solve the problem it needs understanding of factors affecting the patients' adherence to treatment.

Therefore, a study that assesses the factors affecting of patients adherence to anti TB treatment and identify its related factors has great importance to access information on the challenges and obstacles faced by patients. It is important that the awareness of these challenges and obstacles faced by Patients can assist individualizing management approaches and design culturally sound intervention strategies that would help for improvement of adherence promoting interventions can be developed. In addition, this study used as base line information for the Harari Region health bureau for monitoring and evaluation of treatment adherence behaviors to TB treatment, develop strategies that enable patients to adhere the treatment regimen, help to improve treatment adherence, reduce defaulters' rate and can help as a base line data for further studies in that area. The overall objective of this study is to assess the level and associated factors to anti-tuberculosis treatment of adherence and treatment outcome among adult tuberculosis patients in selected health facilities, Harar town, Eastern Ethiopia from April to May, 2014.

2. Methods and Materials

2.1. Study Area and Period

The study was conducted in Harar town two randomly selected hospitals and two randomly selected health centers. Harari Regional State located 525 kms from Addis Ababa, eastern Ethiopia. Harar is one of the most popular historical towns in the eastern part of Ethiopia. The town has a projected total population of 203,438 (M: F=102,369:101,069) in 2010. Harar town is divided in to 19 kebeles and can be divided in to two ethnic zones; Harari dominated and mixed zone. The health service coverage is estimated to be above 100%. There are four governmental hospitals, two private hospitals and four health centers in the town (Harari, 2010). This study was conducted in four randomly selected public health facilities from April to May, 2014.

2.2. Study Design

A health facility-based cross-sectional quantitative study was used for the assessment of TB treatment adherence.

2.3. Population

Source population

Source populations for the adherence study were all adult TB patients who were on anti-TB treatment during the study period on the selected health facilities.

Study population

For the drug adherence part of the study, the study participants were all adult TB patients who were on anti-TB for at least one month in the specified study period and met the inclusion criteria.

2.4. Sample Size Determination

The sample size was determined to estimate level of adherence to anti-TB treatment with reasonable degree of accuracy (i.e. margin of error was taken as 5% with 95% confidence) assuming 50% for the level of adherence of the patient to anti- TB treatment. Based on the above assumption, the following formula was used to estimate the required sample size: $n=\left(\frac{Z_{\alpha/2}}{\Delta}\right)^2 p(1-p)$ and the resulting sample size was 384 and 10% non-respondents (38). The final sample size was 422.

Where*;*

n: is the required minimum sample size,

Z: is the critical value from standard Normal distribution considering 95% confidence in the estimate of the prevalence of adherence,

P: is the expected proportion of adherence to anti-TB treatment of study participants and

Δ: is assumed margin of error in the prevalence of adherence to anti-TB treatment.

2.5. Sampling Procedure/Technique

Four health facilities of the DOTS centers were randomly selected by simple random sampling method from Harar town public health facilities and all patients attending the DOTs service within the study period were included in the study. The participants were interviewed about adherence behavior and factors that influence TB treatment using questionnaire. The number of study participants from each health facilities were allocated based on the probability proportional allocation. Computer Microsoft Office Exel generated random numbers was used after identification number was given to each active adult TB patient who had at least half month anti-TB treatment in each facility. To see the non-adherence day of the patients, we checked the TB patient's registration book. The patient's records which didn't fulfill the inclusion criteria or missing was substituted with the next patient on the list.

2.6. Data Collection Methods

Structured questionnaire was used to collect information on the level of adherence to anti-TB treatment. The questionnaire was prepared in English and translated to Amharic and Afan Oromo, and participants were interviewed by their own local language. Data collection sheet was prepared and used for the retrospective data collection or record

review. All record reviews were made by the investigators. One day of training on the objectives of the study, the questionnaire and techniques of interviewing was given to 10 data collectors with diploma in Nursing; and 3 supervisors with BSc degree either in Nursing or Health Officer**.** Face-to-face interviews with trained nurses, who had diploma in nursing, were carried out during the data collection period among patients on DOTS therapy.

All study participants were asked their permission to participate in the study before they meet the data collectors by the health workers actually work in the health facilities to keep the confidentiality of TB patients. Then, each study participant was interviewed after signing the consent form. The interview was conducted at the health facilities providing DOTS service.

2.7. Variables

Outcome variables

- Adherence to anti-TB treatment
- Treatment outcomes in the last five years

Independent variables

- Socio-demographic characters- (Age, sex, marital status, ethnicity, religion, monthly income, educational status and occupation).
- Knowledge of TB patients under treatment to anti-TB
- Social environment- factors related to health service, social care and support.
- Health status - side effects of anti TB treatment, improvement perception.

2.8. Data Quality Control

The questionnaire was pre-tested to check for its acceptability and reliability in health facilities providing DOTS that was not included in the actual study. The aim of pre- test was to secure the validity, reliability, and cultural accessibility of the instruments. . Identified anomalies were corrected before the final data collection and training was given for data collectors. Formats were prepared for the data collectors during data collection. The questionnaire was checked for completeness, accuracy, clarity and consistency by the investigators and necessary corrections and changes were made. The data collection format of each data collectors was checked daily for completeness, missed or other relevant information on meeting and supervision during data collection as well as by recollecting sub sample of study population by the principal investigator.

2.9. Methods of Data Analysis

Data was computerized and analyzed using SPSS version 16.0 software packages. Patients who missed 5% or more of the total prescribed dose of TB drugs were deemed as non-adherent. Odds ratio with 95% CI generated using logistic regression was employed to describe the strength of association between the selected study variables before and after controlling for possible confounders. Variables which were significantly associated with the likelihood of treatment completion in the bivariate analysis were included in a multiple logistic regression model to determine their relative contributions

in predicting the likelihood of treatment adherence while simultaneously adjusting for each of their effects. Results were reported as statistically significant whenever p-value was less than 0.05.

2.10. Ethical Considerations

Ethical approval was sought from Institutional Health Research Ethics Review Committee (IHRIRC) of Haramaya University, College of Health and Medical Sciences. Permission was obtained from each health facilities managers before the questionnaire was administered to the patients. Written consent of the patients were sought before administering questionnaires.

Personal identity was kept confidentially and the information that any patient provide was used solely for the purpose of the study. The name didn't use on the interview format or anywhere else and was never used in connection with any of the information that the participant that was given to any of data collectors.

3. Results

3.1. Socio-Demographic Characteristics of the Participants

A total of 447 TB patients aged 18 years and older were participated in the study. Two hundred forty seven (55.3%) of the respondents were male. The median age of the respondents was 30 years (IQR: 23, 40). Two hundred ten (47.0%) of the respondents were married, while 161 (36.0%) were single. Three hundred thirty eight (75.6%) of the respondents were residing in urban area. More than half, 257 (57.5%) and 266 (59.5%) of the participants had family income of <1000ETB per month and family size of 3-5, respectively. One hundred ninety eight (44.3%) of the respondents attended at least their secondary education; while 79 (17.7%) of them were illiterate (not able to read and write). Almost one fifth, 83 (18.6%) and 81 (18.1%) of the respondents were private and governmental employed, respectively (Table 1).

Table 1. Socio-demographic characteristics of Assessment of Level of Adherence and Its Risk Factors to Anti-Tuberculosis Treatment among Tuberculosis Patients in Selected Health Facilities, Harar Town, Eastern Ethiopia.

Characteristics	Total, n (%)	Adherent, n (%)	Non-Adherent, n (%)
Sex			
Male	247 (55.3)	186 (52.1)	61 (67.8)
Female	200 (44.7)	171 (47.9)	29(32.2)
Age in years			
18-34	288 (64.4)	236 (66.1)	52 (57.8)
35-54	120 (26.8)	97 (27.2)	23 (25.6)
≥55	39 (8.7)	24 (6.7)	15 (16.7)
Religion			
Orthodox	197 (44.1)	160 (44.8)	37 (41.1)
Muslim	210 (47.0)	165 (46.2)	45 (50.0)
Protestant	35 (7.8)	27 (7.6)	8 (8.9)
Other	5 (1.1)	5 (1.4)	-

Educational Status			
No education	79 (17.7)	51 (14.3)	28 (31.1)
Able to Read and write	73 (16.3)	53 (14.7)	20 (22,2)
Primary Education	97 (21.7)	78 (21.8)	19 (21.1)
Secondary Education and Above	198 (44.3)	175 (49.0)	23 (25.6)
Marital Status			
Single	161 (36.0)	128 (35.9)	33 (36.7)
Married	210 (47.0)	167 (46.8)	43 (47.8)
Divorced/Separated/Widowed	76 (17.0)	62 (17.4)	14 (15.6)
Occupational Status			
Gov. employed	81 (18.1)	69 (19.3)	12 (13.3)
Private employed	83 (18.6)	66 (18.8)	17 (18.9)
Unemployed	15 (3.4)	10 (2.8)	5 (5.6)
Student	44 (9.8)	36 (10.1)	8 (8.9)
Merchant	76 (17.0)	64 (17.9)	12 (13.3)
Daily Laborer	38 (8.5)	27 (7.6)	11 (12.2)
House wife	51 (11.4)	39 (10.9)	12 (13.3)
NGO employed	10 (2.2)	9 (2.5)	1 (1.1)
Ethnicity			
Oromo	188 (42.1)	146 (40.9)	42 (46.7)
Amhara	149 (33.3)	117 (32.8)	32 (35.6)
Harari	38 (8.5)	31 (8.7)	7 (7.8)
Tigrie	17 (3.8)	14 (3.9)	3 (3.3)
Gurage	49 (11.0)	43 (12.0)	6 (3.3)
Others	6 (1.3)	6 (1.7)	-
Residence Area			
Urban	338 (75.60	279 (78.2)	59 (65.6)
Rural	109 (24.4)	78 (21.8)	31 (34.4)
Family Size			
≤2	144 (32.2)	117 (32.8)	27 (30.0)
3-5	266 (59.5)	211 (59.1)	55 (61.1)
>5	37 (8.3)	29 (8.1)	8 (8.9)

3.2. Health Care System and Other Related Characteristics

Two hundred seventy six (61.7%) of TB patients walked to and from the health facilities, while 169 (37.2%) used vehicle (pubic transports). Additionally, 382 (85.5%) participants reported that their home were ≤4km away from the health facility. More than three fourth (82.1 %) of the study participants attended their health care from nearby hospital. Almost one third, 136 (30.4) study participants were on intensive phase of anti-TB treatment. One fourth (110, 24.6%) of the participants were living with HIV/AIDS; while 88.2% (n=314) and 39.6% (n=177) were newly treated and sputum negative pulmonary TB (SNPTB) patients, respectively (Table 2).

Table 2. Health care system and other related characteristics of Assessment of Level of Adherence and Its Risk Factors to Anti-Tuberculosis Treatment among Tuberculosis Patients in Selected Health Facilities, Harar Town, Eastern Ethiopia.

Characteristics	Total, n (%)	Adherent, n (%)	Non-Adherent, n (%)
Type of transport			
Vehicle	169 (37.2)	135 (37.8)	34 (37.8)
On foot	276 (61.7)	221 (61.9)	55 (61.1)
Other	2 (0.4)	1 (0.3)	1 (1.1)
Distance from HF			
≤4km	382 (85.5)	302 (84.6)	80 (88.9)
>4km	65 (14.5)	55 (15.4)	10 (11.1)
Duration of Treatment (in dys)			
15-30	136 (30.4)	107 (30.0)	29 (32.2)
31-60	73 (16.3)	59 (16.5)	14 (15.6)
61-90	21 (4.7)	16 (4.5)	5 (5.6)
91-120	23 (5.1)	17 (4.8)	6 (6.7)
>120	194 (43.4)	158 (44.3)	36 (40.0)
Type of HF			
Hospital	367 (82.1)	298 (83.5)	69 (76.7)
Health Center	80 (17.9)	59 (16.5)	21 (23.3)
Phase of treatment			
Intensive	136 (30.4)	107 (30.0)	29 (32.2)
Continuous	311 (69.6)	250 (70.0)	61 (67.8)
Type of patient			
New	394 (88.2)	314 (88.0)	80 (88.9)
Re-treatment	51 (11.4)	41 (11.4)	10 (11.1)
Defaulter	2 (0.4)	2 (0.6)	-
Type of Tb			
SPPTB	161 (36.2)	128 (35.9)	34 (37.8)
SNPTB	177 (39.6)	140 (39.2)	37 (41.1)
EPTB	108 (24.2)	89 (24.9)	19 (21.1)
HIV Status			
Positive	110 (24.6)	81 (22.7)	29 (32.2)
Negative	337 (75.4)	276 (77.3)	61 (67.8)

The overall Patient satisfaction

Greater than the third-fourth (n=321, 71.8%) of the participants received counseling every day during their follow-up. Three hundred sixty seven (82.1%), 350 (78.3%) and 370 (82.8%) study participants had transparent communication, privacy during counseling, and received necessary information from the health facilities respectively. Additionally, 364 (81.4%) and 388 (86.8%) participants reported that they complete their follow-up service ≤1 hour and satisfied with the service rendered by the health facilities (Table 3)

Table 3. Patient satisfaction on Assessment of Level of Adherence and Its Risk Factors to Anti-Tuberculosis Treatment among Tuberculosis Patients in Selected Health Facilities, Harar Town, Eastern Ethiopia.

Characteristics	Total, n (%)	Adherent, n (%)	Non-Adherent, n (%)
How frequent did you consulted in HF	91 (20.4)	63 (17.6)	28 (31.1)
Only first time I go there	321 (71.8)	267 (74.8)	54 (60.0)
Every day of follow-up	25 (5.6)	20 (5.6)	5 (5.6)
Once a while	10 (2.2)	7 (2.0)	3 (3.3)
No consultation at all			
Do satisfy with service rendered by HF	388 (86.8)	311(87.1)	77 (85.6)
Yes	25 (5.6)	18 (5.0)	7 (7.8)
No	17 (3.8)	14 (3.9)	3 (3.3)
Don't know	17 (3.8)	14 (3.9)	3 (3.3)
No Response			
Transparent communication with HF	367 (82.1)	295 (82.6)	72 (80.0)
Yes	24 (5.4)	19 (5.3)	5 (5.6)
No	38 (8.5)	32 (9.0)	6 (6.7)
Don't know	18 (4.0)	11 (3.1)	7 (7.8)
No Response			
Privacy during having service			
Yes	350 (78.3)	287 (80.4)	63 (70.0)
No	42 (9.4)	331 (9.2)	9 (10.0)
Don't know	31 (6.9)	22 (6.2)	9 (10.0)
No Response	24 (5.4)	15 (4.2)	9 (10.0)
How frequent do you come to collect your treatment			
Daily	300 (69.0)	244 (68.3)	58 (62.2)
Weekly	93 (20.8)	71 (19.9)	22 (24.4)
Monthly	42 (9.4)	35 (9.8)	7 (7.8))
When I finish the treatment	12 (2.7)	7 (2.0)	5 (5.6)
Do you receive necessary information when you come to HF	370 (82.8)	298 (83.5)	72 (80.0)
Yes	27 (6.0)	21 (5.9)	6 (6.7)
No	31 (6.9)	27 (7.6)	4 (4.4)
Don't know	19 (4.3)	11 (3.1)	8 (8.9)
No Response			
Duration to complete your service in HF	364 (81.4)	292 (81.8)	72 (80.0)
≤ 1 hr	83 (18.6)	65 (18.2)	18 (20.0)
>1 hr			

Knowledge and Perceptions about Tuberculosis

Eighty percent (n=360) of the study participants heard for the first time about TB before illness. About one third (n=160, 35.9%) and almost all (n=414, 91.6) were correct

about the cause of TB and its being transmittable, respectively. Mode of transmission of TB and its curability were correctly answered by 87.9% (n=364) and 97.3% (n=435) of the respondents, respectively (Table 3). Fifty nine (13.2%) study participants were taking medications other than the prescribed anti-TB treatment. Among these patients, 31 (52.3%) and 20 (33.9%) were taking other medications due to religious and feeling of '*didn't recover'* reasons, respectively (Table 4).

Table 4. Knowledge and Perceptions about Tuberculosis on Assessment of Level of Adherence and Its Risk Factors to Anti-Tuberculosis Treatment among Tuberculosis Patients in Selected Health Facilities, Harar Town, Eastern Ethiopia.

Characteristics	Total, n (%)	Adherent, n (%)	Non-Adherent, n (%)
Cause of Tb			
Correct	160 (35.9)	143 (40.1)	17 (18.9)
Incorrect	222 (49.6)	168 (47.1)	54 (60.0)
I don't know	65 (14.5)	46 (12.8)	19 (21.1)
TB is transmittable			
Correct	414 (91.6)	334 (93.6)	80 (88.9)
Incorrect	3 (0.7)	3 (0.8)	-
I don't know	30 (6.7)	20 (5.6)	10 (11.9)
Mode of transmission			
(n=414)	364 (87.9)	297 (88.9)	67 (83.8)
Correct	50 (12.1)	37 (11.1)	13 (16.2)
Incorrect			
Ways to stop transmission			
(n=414)	314 (75.8)	254 (76.0)	60 (75.0)
Correct	100 (24.2)	80 (24.0)	20 (25.0)
Incorrect			
Tb is Curable			
Correct	435 (97.3)	348 (97.5)	87 (96.7)
Incorrect	2 (0.4)	1 (0.3)	1 (1.1)
I don't know	10 (2.2)	8 (2.2)	2 (2.2)
Treatment to cure			
(n=435)	431 (99.0)	345 (99.1)	86 (98.9)
Correct	2 (0.5)	1 (0.3)	1 (1.1)
Incorrect	2 (0.5)	2 (0.6))	-
I don't know			
Duration to cure Tb			
(n=435)			
Correct	385 (88.5)	309 (88.8)	76 (87.4)
Incorrect	33 (7.6)	27 (7.8)	6 (6.9)
I don't know	17 (3.9)	12 (3.4)	5 (5.7)

3.3. Level of Non- Adherence to Medication

The proportion of patients with non- adherence was 90 (20.1%). Of the 90 non-adherence patients, about half (50%) and 20 (22.2%) of them reported that forgetting

and being far away from home as main reasons for not being adhered to anti-TB treatment. Only 1 (0.2%) patient reported that fear of side effects as a main reason for not compliance with treatment (Figure 1). Three hundred five (68.2%) study participants understood the risk of non-adherence, and almost three fourth (n=334) believed that taking of substances, like *khat*, tobacco, and alcohol, have negative effect on adherence (Table 5).

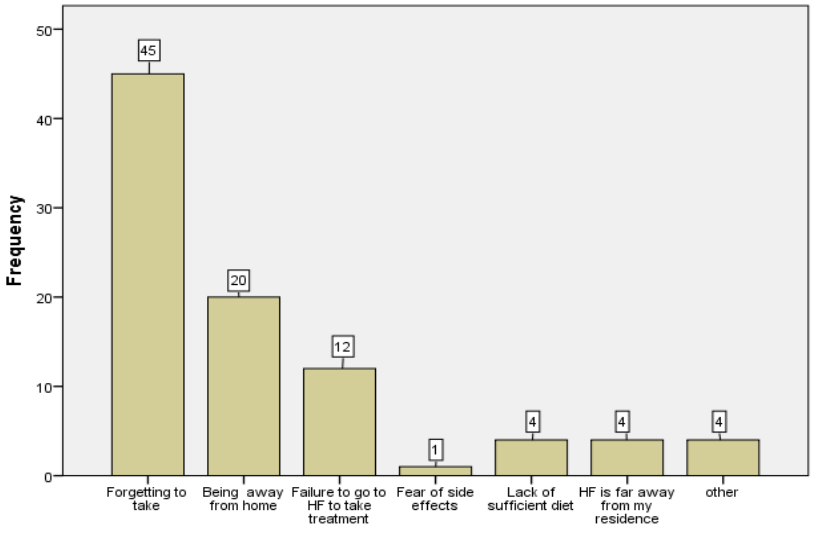

Figure 1. Reasons for non-adherence on Assessment of Level of Adherence and Its Risk Factors to Anti-Tuberculosis Treatment among Tuberculosis Patients in Selected Health Facilities, Harar Town, Eastern Ethiopia.

Table 5.Adherence related issues on Assessment of Level of Adherence and Its Risk Factors to Anti-Tuberculosis Treatment among Tuberculosis Patients in Selected Health Facilities, Harar Town, Eastern Ethiopia.

Characteristics	Total, n (%)	Adherent, n (%)	Non-Adherent, n (%)
When did you hear about TB			
Before illness	360 (80.5)	295 (82.6)	65(72.2)
During illness	87 (19.5)	62 (17.4)	25 (27.8)
Taking of Medication other than prescribed for TB			
Yes	59 (13.2)	46 (12.9)	13 (14.4)
No	388 (86.8)	311 (87.1)	77 (85.6)
The reason of taking other medication (n=59)			
I didn't recover from TB	20 (33.9)	17 (30.0)	3 (23.1)
Religious reason	31 (52.3)	23 (50.0)	8 (61.5)
Distant HF	2 (1.7)	1 (2.2)	1 (7.7)
Lack of appropriate service by	1 (1.7)	1 (2.2)	-
HF	5 (8.5)	4 (8.7)	1 (7.7)
Other			

Understand risk of non-adherence	305 (68.2)	247 (69.2)	58 (64.4)
Correct	142 (31.8)	110 (30.8)	32 (35.6)
Incorrect			
Use of substances			
Yes	149 (33.3)	113 (31.7)	36 (40.0)
No	298 (66.7)	244 (68.3)	54 (60.0)
Use of Substances have negative effect on adherence			
Yes	334 (74.7)	273 (76.5)	61 (67.8)
No	113 (25.3)	84 (23.5)	29 (32.2)

3.4. Predictors of Non-Adherence to TB Treatment

In the bivariate analysis, being male (COR: 1.912, 95%CI: 1.123, 3.117), age of ≥55 years (COR: 2.837, 95%CI: 1.392, 5.778), Educational status of illiterate (COR: 4.177, 95%CI: 2.217, 7.872) and able to read and write, without formal education, (COR: 2.871, 95%CI: 1.464, 5.630), being single (COR: 2.034, 95%CI: 2.399, 6.334), living in rural area (COR: 1.879, 95%CI: 1.138, 3.105), being HIV positive (COR: 1.793, 95%CI: 1.092, 3.945), and <1000ETB of monthly family income (COR: 2.234, 95%CI: 1.347, 3.706) were significantly associated with non-adherence of anti-TB treatment (Table 6)

Table 6. Bivariate logistic regression shows predictors of non-adherence to anti-TB treatment on Assessment of Level of Adherence and Its Risk Factors to Anti-Tuberculosis Treatment among Tuberculosis Patients in Selected Health Facilities, Harar Town, Eastern Ethiopia.

Characteristics	Total, n (%)	COR	p-value	95%CI
Sex				
Male	247 (55.3)	1.912	0.009	1.123-3.117
Female	200 (44.7)	1		
Age in years				
18-34	288 (64.4)	1		
35-54	120 (26.8)	1.078	0.792	0.624-1.855
≥55	39 (8.7)	2.837	0.004	1.392-5.778
Educational Status				
Illiterate	79 (17.7)	4.177	<0.001	2.217-7.872
Able to Read and write	73 (16.3)	2.871	0.002	1.464-5.630
Primary Education	97 (21.7)	1.853	0.068	0.954-3.500
Secondary Education and Above	198 (44.3)	1		
Marital Status				
Married	210 (47.0)	1		
Single	161 (36.0)	2.034	0.021	2.399-6.334
Divorced/Separated/Widowed	76 (17.0)	0.470	0.043	0.155-0.931
Residence Area				
Urban	338 (75.60	1		
Rural	109 (24.4)	1.879	0.014	1.138-3.105

Family Size				
≤2	144 (32.2)	1	0.873	
3-5	266 (59.5)	1.130	0.642	0.676-1.887
>5	37 (8.3)	1.195	0.693	0.492-2.904
Type of TB				
SPPTB	161 (36.2)	1.244	0.492	0.667-2.320
SNPTB	177 (39.6)	1.238	0.495	0.670-2.287
EPTB	108 (24.2)	1	0.752	
HIV Status				
Positive	110 (24.6)	1.793	0.021	1.092-3.945
Negative	337 (75.4)	1		
Family Income				
<1000ETB	257 (57.5)	2.234	0.002	1.347-3.706
≥100ETB	190 (42.5)	1		
Distance from HF				
≤4km	382 (85.50)	1		
>4km	65 (0.596)	0.686	0.304	0.335-1.406
Phase of Treatment				
Intensive	136 (30.4)	1		
Continuous	311 (69.6)	0.900	0.678	0.548-1.406
Current use of Substances				
Yes	149 (33.3)	1.440	0.883	0.893-2.320
No	298 (66.7)	1		
Type of HF				
Hospital	367 (82.1)	1.537	0.134	0.876-2.698
Health Center	80 (17.9)	1		

However, in the adjusted multivariate analysis, being male (AOR: 2.270, 95%CI: 1.315, 3.917), age of ≥55 years (AOR: 2.972, 95%CI: 1.292, 6.837), educational status of illiterate (AOR: 4.429, 95%CI: 1.992, 9.847) and able to read and write, without formal education, (AOR: 2.687, 95%CI: 1.200, 6.019), living in rural area (AOR: 2.020, 95%CI: 1.112, 4.669), and being HIV positive (AOR: 3.058, 95%CI: 1.709, 5.473) were independently identified as predictors of non-adherence among TB patients (Table 7).

Table 7. Multivariate logistic regression shows predictors of non-adherence to anti-TB treatment on Assessment of Level of Adherence and Its Risk Factors to Anti-Tuberculosis Treatment among Tuberculosis Patients in Selected Health Facilities, Harar Town, Eastern Ethiopia.

Characteristics	Total, n (%)	AOR	p-value	95%CI
Sex				
Male	247 (55.3)	2.270	0.003	1.315-3.917
Female	200 (44.7)	1		
Age in years				
18-34	288 (64.4)	1		
35-54	120 (26.8)	1.022	0.946	0.548-1.904
≥55	39 (8.7)	2.972	0.010	1.292-6.837
Educational Status				
Illiterate	79 (17.7)	4.429	<0.001	1.992-9.847

Able to Read and write	73 (16.3)	2.687	0.016	1.200-6.019
Primary Education	97 (21.7)	1.760	0.119	0.865-3.583
Secondary Education and Above	198 (44.3)	1		
Marital Status				
Married	210 (47.0)	1.526	0.278	0.711-3.276
Single	161 (36.0)	2.652	0.125	0.132-4.213
Divorced/Separated/ Widowed	76 (17.0)	1		
Residence Area				
Urban	338 (75.60	1		
Rural	109 (24.4)	2.020	0.021	1.112-4.669
HIV Status				
Positive	110 (24.6)	3.058	<0.001	1.709-5.473
Negative	337 (75.4)	1		
Family Income				
<1000ETB	257 (57.5)	1.367	0.334	0.725-2.578
≥100ETB	190 (42.5)	1		

4. Discussion

Early detection of patients and providing effective treatment are the main interventions to prevent the spread of TB. However, current long-term anti-tuberculosis therapy could easily lead to patient non-adherence, which presents an important barrier for TB control programs. Patients' adherence to their medication regimens was reported to be influenced by the interaction of number of factors. These various factors may be grouped as: health-system factors, social and family factors, and personal factors. The factors that influencepatient adherence to TB treatment vary in different populations (Xu *et al.*, 2009). There are a number of factors that influence adherence to anti TB drugs. A cross sectional study conducted in eastern Ghana showed that economic status of patients and family support wasfactors contributing to high non adherence rate of TB patients (Boateng *et al.,* 2010).

Non-adherence to treatment may result in prolonged infectiousness, drug resistance, relapse, and death. Treatment interruption thus poses a serious risk both for the individual and the community (Garner *et al.*, 2007). Treatment default also poses a public health threat, because individuals who do not complete therapy are more likely to remain infectious. The consequences of default from drug-resistant TB treatment may be particularly grave, because effective therapy for drugs to which the strain has in vitro susceptibility. Thus, treatment default may lead to the transmission of TB that is more difficult to cure with existing drugs (Franke*et a*l**.,** 2008).

This study attempted to investigate the level of non-adherence to TB treatment and associated factors among TB patients on intensive and continuation phase of treatment. The overall non-adherence level of the study participant were 20.1% which is close to other studies done in Spain (Caylà *et al.*, 2009) and India (Pandit and Choudhary, 2006; Bagchi *et al.*, 2010). Studies conducted in south west Ethiopia (Kebede and Wabe, 2012) and northern Ethiopia (Getachew *et al.*, 2015) reported almost similar non-adherence level, 20.8% and 18.5%, respectively.

This finding is almost twice that of reported from china (Xu *et al*., 2009) and North West Ethiopia (Adane *et al*., 2013) which were 12.2% and 10%, respectively. However, very different report was observed in Nepal (Bam *et al., 2005*) in which 44% of TB patients were non-adherence. The variation is probably due to different population with different socio-economic and systems in health care services. Generally, the main reason to non-adherence to TB treatment is the difference towards limited social and economic resources that TB patients endure. The study participants also differs in accessible transport and infra-structure that they may found it difficult to get to the clinic because their places of dwelling and the clinic were not in close proximity to each other.

Almost similar result was observed in Zambia which showed that 22% of the patients were non-adherent. The main reason for not taking the treatment was that the respondents felt better (Mulenga *et al*., 2010), which is very different from our findings in which the main reason for not to taking treatment was forgetting. In south India, on risk factors for non-adherence to DOT, documented high rate (33%) of non-adhere to DOT and the risk factors that associated with non-adherence were being illiterate (Gopi *et al*., 2007; Bam *et al*., 2005; Pandit and Choudhary, 2006). Being illiterate and able to read and write (without formal education) were also risk factors in our study.

Even though our study did not reveal, in India and Siberia, substance abuse, smoking and alcohol use were highly related to non-adherence to TB treatment (Gelmanova *et al*., 2007; Bagchi *et al*., 2010). Unlike our findings in which being single was indicated as a risk factor in bivariate analysis. Report in South Africa indicates that patients who were divorced/ widowed were more likely to be non-adherent (Naidoo *et al*., 2013).

The proportion of HIV co-infection among TB patients was 24.6%. This finding is close to the report on North West Ethiopia which is 23.4% (Adane *et al*,). HIV co-infection was one of the independent predictor in our study to be non-adherence, which was supported by similar findings from South Africa (Naidoo *et al*., 2013) and Uzbekistan (Hasker *et al.,* 2008).

5. Conclusions and Recommendations

Non-adherence to treatment is a major challenge to the global TB control. The extent of non-adherence to TB treatment is difficult to assess. Non-adherence increases the risk of treatment failure and relapse, and is considered to be the most important cause of drug-resistant TB. In particular, multidrug-resistant (MDR) and extensively drug-resistant (XDR) TB constitute serious threats to public health.

Based on our study result, special attention and adherence counseling should be given for individual who are in high risk: male patients, elders, illiterate and those who didn't attend formal education, those who are living in rural areas, and those who are co-infected with HIV.

Additionally, improving the treatment service process, maintaining close relationship between providers and patients, reducing waiting time in reception room will have a positive outcome on reducing poor adherence to TB treatment.

Further research is also recommended since the issue of adherence is dynamic. Promotion of universal knowledge of TB in the community and continuous health education to tuberculosis patients are also recommended.

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11. Intensified Tuberculosis Case Finding, Implementation of Isoniazid Preventive Therapy and Associated Factors among People Living With HIV at Public Health Facilities of Harari Region, Eastern Ethiopia: A Cross Sectional Study

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Abstract: The dramatic spread of HIV in the past few decades, particularly in sub-Saharan Africa, has been accompanied by major increase in the number of new cases of tuberculosis. In high HIV prevalence population, especially in sub-Saharan Africa, TB is a leading cause of morbidity and mortality. In response to the dual burden of HIV and TB, a number of collaborative TB/HIV activities were recommended which include intensified case-finding, Isoniazid preventive therapy and infection control in health-care and congregate settings. But information about the status of collaborative TB/HIV care services which decreases the burden of TB among PLHIV in Ethiopia is limited. Therefore, the main aim of this study was to assess intensified TB case finding, implementation of IPT and associated factors among PLHIV.A facility based quantitative cross sectional study design was employed. 419 PLHIV from six randomly selected public health facilities of Harari region were collected from ART and Pre-ART register by systematic sampling method. Randomly selected PLHIV were interviewed to collect quantitative data. Data was entered into Epi-Data and analyzed by SPSS statistical packages for windows. The presence of association between variables was measured using odds ratio with 95% confidence interval at P-value < 0.05. Multivariate logistic regression analysis was employed to control possible confounders. The proportion of PLHIV who were screened for TB during any one of their follow-up cares was 75.2%. Ninety four (22.4%) of the study participants were diagnosed for having TB during their HIV follow-up cares. Sex, educational status, residence area, ART utilization status and missing dose of ART were statistically associated with TB infection PLHIV who had never been diagnosed for TB before they knew their positive HIV status were nearly four times more likely to be diagnosed for TB during

follow-up cares than those diagnosed before (AOR [95% CI]: 3.78 [1.69-8.43]). Nearly a third (78.7 %) of all interviewed PLHIV self-reported that they had been treated with IPT. From this it can be concluded that ICF for TB and IPT among PLHIV in Harari Region need to be improved and the national and international guidelines to improve ICF and IPT among PLHIV should be implemented in the region.

Keywords: Tuberculosis; Intensified case finding; Isoniazid preventive therapy; PLHIV

1. Introduction

The dramatic spread of HIV in the past few decades, particularly in sub-Saharan Africa, has been accompanied by a major increase in the number of new cases of tuberculosis (TB) (GFATM 2012).TB is the most frequent life-threatening opportunistic infection in people living with HIV (PLHIV) in both industrialized and developing countries (Lawn SD 2008). About 11.5 million adults living with HIV/AIDS are estimated to be co-infected with tuberculosis, with 82% of those co-infected living in sub-Saharan Africa. In Ethiopia, routine data in the year 2005/2006 showed that 41% of TB patients are HIV positive (FMoH 2007). For this reasons regular screening of all PLHIV for active TB disease and provision of either treatment for active disease or preventive therapy are essential (WHO 2010).

HIV is the strongest risk factor for developing TB disease in those with latent or new mycobacterium tuberculosis infection. The risk of developing TB is between 20 and 37 times greater in PLHIV than among those who do not have HIV infection (Ayles H 2009). TB is responsible for more than a quarter of deaths among PLHIV (Cain KP 2010). The dual epidemics have a number of impacts on the health sector. It increases demand for care, deplete resources and worsen health care delivery system. In response to the dual epidemics, World Health Organization (WHO) has recommended a number of collaborative TB/HIV activities as part of core HIV and TB prevention, care and treatment services. These include interventions that reduce morbidity and mortality from TB in PLHIV, such as the provision of antiretroviral therapy (ART) and the three I's for HIV/TB: intensified case-finding of TB (ICF), Isoniazid preventive therapy (IPT) and infection control for TB including those on antiretroviral therapy (ART) (Chheng P 2008).

Intensified Tuberculosis Case Finding (ICF) and treatment of TB among PLHIV interrupts TB transmission and reduces morbidity and mortality. Active screening of TB offers the opportunity to provide isoniazid preventive therapy for those who do not have symptoms and signs of TB (Carbett EL 2007).All PLHIV should be regularly screened for TB using a clinical algorithm at every visit to a health facility and those who do not report any one of the symptoms of current cough, fever, weight loss or night sweats are unlikely to have active TB and should be offered IPT (WHO 2011).

Isoniazid Preventive Therapy is a key public health intervention for the prevention of TB among people living with HIV. It has been recommended since 1998 by WHO and the Joint United Nations Programme on HIV/AIDS (UNAIDS) as part of a comprehensive HIV and AIDS prevention strategy. However, its implementation has been very poor, particularly in the highest risk populations, and has been impeded by several barriers including lack of an accepted approach to exclude active TB disease and restricted access to Isoniazid for fear of developing drug resistance (UNAIDS 2013, Fred M. Gordin 1997).The advice given to patients by their health care professionals to cure or control disease is often misunderstood, carried out incorrectly, forgotten, or even completely ignored (Chheng P 2008). The World Health Organization (WHO) recommended regimen for TB preventive therapy in adolescents and adults living with HIV is Isoniazid (INH)] 300 mg daily for at least 6 months (WHO 2011). IPT can be safely given to PLHIV who have no TB, reducing the risk of developing TB by 33-67% for up to 48 months (WHO 2011).

TB Infection Control measures are essential to prevent the spread of *M. tuberculosis* to vulnerable patients, health care workers, the community and those living in congregate settings. In light of the crisis of drug resistant TB in countries with a high burden of HIV, establishing facilities that are safe from TB has become an emergency situation for health services, prisons and other congregate settings, in general, for HIV clients in particular (WHO 2011).

Despite the significant progress made in targeting people living with TB, the implementation of interventions to reduce the impact of TB among people living with HIV is far below the targets of Global Plan to Stop TB (WHO and UNAIDS 2008). Intensified case-finding or screening for TB among people living with HIV remains very low, only a tiny fraction of the global target of screening 11 million people living with HIV by 2015 received the service (FHAPCO 2008). Information about the status of TB/HIV collaborative activities in general and reducing the burden of TB among adult PLHIV in particular in Ethiopia is limited. This is due to absence of well standardized information flow at all levels and scarcity of research based evidences.Therefore, the main aim of this research was to assess Intensified Tuberculosis case finding, implementation of Isoniazid preventive therapy and its associated factors among adult people living with HIV at public health facilities of Harari Region.

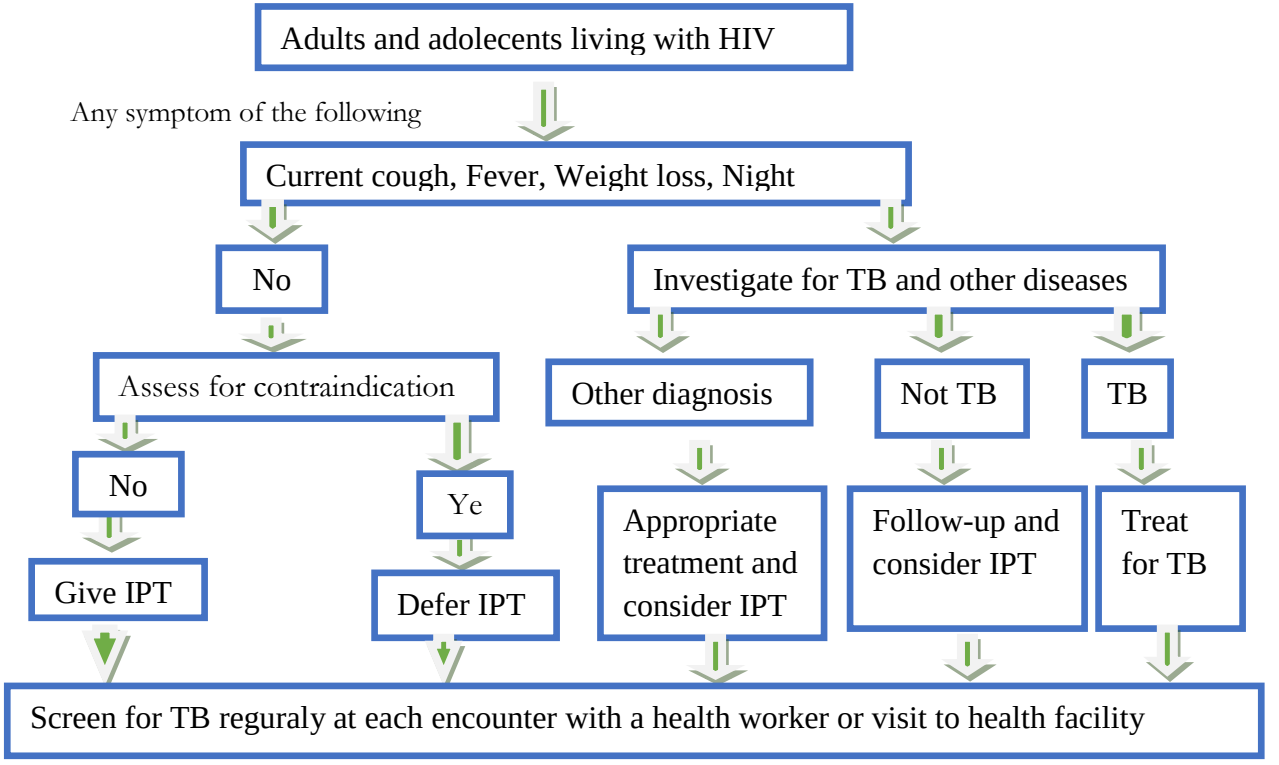

Figure 1. Algorism for TB screening in adults and adolescents living with HIV in high prevalence and resource constraint settings (Adapted from WHO guideline, 2011).

2. Methods and Materials

2.1. Study Design and Setting

A facility-based cross sectional study was conducted among 423 people living with HIV and following their HIV/AIDS care and support at health institutions in Harari region. Harari region is one of the nine regional states found in Ethiopia. Harar is the capital city of the region, and is found at 526km from Addis Ababa, the capital city of Ethiopia, to the east. The region has nine woreda administration structures. Three of the weredas are rural and six are urban. The urban woredas are sub- divided into nineteen kebeles, whereas the rural woredas are sub divided in to seventeen peasant associations. According to the population projection of 2007 census, the region has a total population of 205,000 of which 54.8% were urban dwellers (HRHB 2014). The study was conducted from January to March, 2015 among PLWHA attending their HIV/AIDS care and support at six public health facilities, two hospitals and four health centers found in the region.

2.2. Study Participants

The participants of this study include randomly selected adultpeople living with HIV and registered at selected public health facilities and attending HIV/AIDS care and support at randomly selected public health facilities. PLWHA with mental problem and seriously ill who cannot provide appropriate information were excluded from the study.Children under the age of 15 years were also excluded from the study.

2.3. Sample Size and Sampling Technique

To calculate the sample size a single population proportion formula, [$n = (Z\ \alpha/2)^2\ p\ (1-p)\ /\ d2$], was used.A study conducted in Addis Ababa city, Ethiopia; in 2011 reported that ICF was done for 92.8% PLWHA and 38.7% of the patients were given IPT (Amenu WDand Bethabile LD. 2014). In addition, 95% confidence level, 5% margin of error ($d = 0.05$) and 15% non response rate were considered. Therefore, sample size for ICF was found to be 103 and for IPT sample size was calculated to be 419. Therefore, the larger sample sizewas used to improve the validity of the study. Therefore, the total sample size in this study was 419.

Exit interview was conducted among randomly selected PLHIV attending HIV care clinics at the selected health facilities in their follow-up cares. To collect sample from each health facilities, proportional sample size allocation was used depending on HIV patient load in each health facilities. The cumulative patient load in each health facilities was obtained from HIV registration books (ART and Pre-ART registers). Then using systematic random sampling, samples were selected from log-books of PLHIV. The most next person on the registration book was interviewed if the selected person was died or defaulted. The samples obtained from the six health facilities were not similar as the commutative load of patients among different health facilities was dissimilar. Therefore, different number of participants was collected from each four of health centers and two hospitals.

2.4. Data Collection

A pre tested structured questionnaire was used to collect data via interviewer administered approach. The tool was adapted from standardized WHO guideline, prepared for monitoring and evaluation of TB/HIV activities (WHO 2011). The tool was then translated to local languages: *Amharic and Afaan Oromoo* for data collection. After completion of data collection the questionnaire was again translated back to English language for analysis. The questionnaires were developed after completion of a literature review and pretested on 5% of the sample size of PLWHA attending their HIV care and support at health facilities other than the selected health facilities. Feedback obtained from pretest was incorporated and the survey tools were finalized with some modifications. Six bachelor degree nurses (data collectors) and three public health professionals (supervisors) were recruited to facilitate data collection process. They were given training before commencement of data collection.

2.5. Data Analysis

Data were entered into Epi Data version 3.1 and exported to SPSS version 17 statistical packages for analysis. Descriptive statistics was used to summarize data and the results were presented using frequency tables and percentages. Inferential statistic was also used to determine presence of associations between explanatory variables and dependent (IPT, ICF) variables. A multivariate logistic regression analysis was employed to measure the role of confounders between variable based on the independent variables. Crude Odds ratio with 95% CI was used to determine presence of association between explanatory variables and intensified tuberculosis case finding and isoniazid preventive therapy. The degree of association between dependent and independent variables was measured using adjusted odds ratio with 95% confidence interval at significance level of ≤ 0.05.

Measurements

Dependent variables for this study aretuberculosis screening status for PLHIV and treatment status with isoniazid preventive therapy for PLHIV. Explanatory variables includesocio demographic variables such as age, sex, residence, monthly income, educational status, religion and ethnicity, length of stay with HIV, ART treatment, length of stay on ART, ART missed dose and hospitalization.

2.6. Data Quality Control

The questionnaire was pre-tested and feedback was used to make modifications to the questionnaires. Members of field staff (data collectors and supervisors) were selected based on their experience in the field of data collection and supervision. They were given extensive training before data collection was commenced. During training, the objective of the study, method of data collection and supervision were discussed. Furthermore, each question included in the questionnaire was discussed in detail. Field practice (pre-test) was undertaken on 5% of PLWHA those have follow up service at

health facility outside of the selected facilities to check the applicability of the questionnaire. Each day, collected data were checked for its completeness and consistence by supervisors and investigators. Data were also cleaned and rechecked after double data entry was performed.

2.7. Ethical Consideration

The study protocol was approved by Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University, College of Health and Medical Science (CHMS), Haramaya University. Official letter of cooperation was written to Harari Regional Health Bureau (HRHB) and each health facilities that were included in the study from College of Health and Medical Science (CHMS), Haramaya University. A letter explaining about the purpose, method and anticipated benefit and risk of the study was attached to each questionnaire. It was explained for the respondents that participation in this study was voluntary and private information would be protected. Written informed consent was obtained from each participant. In order to protect confidentiality, participants' names and ID numbers were not included in the questionnaire.

3. Results

3.1. Socio-Demographic Characteristics of the Respondents

A total of 419 PLWHA attending HIV chronic care follow-up at public health facilities in Harari region were participated in the study. Out of the total respondents 272(64.9%) were females. The mean age (± SD) of the study participants was 38 ±10 years. Three hundred thirty seven (80.4%) of the participants were in the age group 25-49 years. One hundred eighty four (43.9%) were Amhara by ethnicity and 201 (48.0%) were followers of Christian Orthodox by religion. From total participants 38.7% have no formal education while the remaining 61.3% attended some formal education of primary, secondary and tertiary education. Two hundred thirty seven (56.6%) of the respondents were currently married and living with their partners. Majority 344 (82.1%) of the participants were urban dwellers. Regarding the occupation of the respondents, 121(28.9%) were government employee while 111(26.5%) and 56 (13.4%) were nongovernmental employee and merchant respectively. The average household monthly income is 1402 Ethiopian birr. The participants' household family size ranges from 1 to 9 with mean/SD 3±1.6 (Table 1).

Table 1. Socio-demographic characteristics of the respondents (n=419) Harari Region, 2015.

Variables	Frequency (n)	Percent (%)
Sex of the respondents		
Male	147	35.1
Female	272	64.9
Age of the respondents		
Less than 25 years	19	4.5
25-49years	337	80.4
50years and above	63	15.1
Ethnicity of the respondents		
Oromo	157	37.5
Amhara	184	43.9
Tigre	27	6.4
Adare	21	5.0
Gurage	27	6.4
Others	3	.7
Religion of the respondents		
Orthodox	201	48.0
Musilim	171	40.8
Protestant	43	10.3
Others	4	1.0
Educational status of the respondents		
Have no formal education	162	38.7
Attended formal education	257	61.3
Occupation of the respondents		
Government employee	121	28.9
Nongovernmental employee	111	26.5
Farmer	16	3.8
Merchant	56	13.4
Others	115	27.4
Current marital status of the respondents		
Single	237	56.6
Married	182	43.4
Resident of the respondents		
Urban	344	82.1
Rural	75	17.9
Monthly income of the respondents		
1400 and less	273	65.2
More than 1400	146	34.8
Family size of the respondents		
Three and less	269	64.2
Greater than three	150	35.8

3.2. HIV related Health Services

Three hundred fifty nine (85.7%) of the study participants have already started HAART treatment while the remaining 14.3% were on pre ART care service. The CD4 level of the study participants ranges from 50 to 1242 with mean (± SD) 476.6 ± 214.6) cells/ml^3. The mean period (± SD) since diagnosed positive for HIV and length of stay

(± SD) on HAART is 6.5 ±3.2 and 5.6±2.6 years respectively. Thirty nine (9.3%) of those who started HAAR have missed at least a dose of their medications in the last four days of data collection period. One hundred seventy seven (42.2%) of the respondents were admitted to hospital at least once due to HIV related illness. Ninety five (22.7%) respondents hide their information of taking ART.

3.3. Prevalence of Tuberculosis Infection among PLWHA

The proportion of interviewed PLHIV who were beenscreened for TB (asked for at least one cardinal signs of TB: current cough, fever, night sweating and weight loss) during any one visit of their follow-upcares were 315 (75.2%). Ninety four (22.4%) of participants those screened for TB self reported that they were diagnosed for active TB during their HIV care follow-ups. In other words, 94 active TB patients were identified out of the total 419 PLHIV starting from their first contact to the healthcare provider for either of HIV testing, care and support or treatment services. Thirty six (38.3%) of these TB/HIV co-infected clients reported that they were diagnosed for TB before they knew that they were HIV positive (Table 2).

3.4. Isoniazid Preventive Therapy

Two hundred ninety one (69.5%) of the study participants have awareness about Isoniazid Preventive Therapy (IPT)of which 288 (68.7%) knew that people living with HIV/AIDS who do not have active TB should be accessed to IPT as part of the package of HIV/AIDS care and support. Among 221 (52.7%) eligible patients for IPT (negative result for TB screening) only 174(78.7%) were provided IPT service. From the study participants those who were provide IPT services 125(71.8%) participants received INH from HIV/AIDS care and support clinic while 43(24.7%) received the drug from TB clinic and the remaining were given the prescription and collected the drug from other health facilities (Table 2).

Table 2. Collaborative TB/HIV care service delivery among PLHIV in Harari Region, 2015.

Variables	Frequency (n)	Percent (%)
TB screening offered at HIV care clinic (n=419)		
Yes	315	75.2
No	104	24.8
Ever be diagnosed for TB (n=315)		
Yes	94	29.8
No	221	70.2
Timing of diagnose for TB (n=94)		
Before diagnosed for HIV	36	38.3
After diagnosed for HIV	58	61.7
Knowledge about IPT (=419)		
Know	291	69.5
Do not know	128	30.5

Knowledge for eligibility for IPT (n=419)		
Yes	288	68.7
No	48	11.5
Don't know	83	19.8
Ever been treated with IPT (n=221)		
Yes	174	78.7
No	47	21.3
From where INH was collect(n=174)		
HIV care clinic	125	71.8
TB clinic	43	24.7
Others health facility	6	3.5

3.5. Factors associated with TB infectionamong *PLWHA*

Multivariate logistic regression analysis showed that sex, educational status, ART status, duration of stay with HIV, CD4 level and missing dose of ART medications were some of the factors that were significantly associated with Tuberculosis infection among PLWHAafter possible confounders were controlled. Female clients were 2.5 times more likely to be positive for TB than males [AOR 2.51; 95%CI (1.52, 6.14)] and those who attended formal education were less likely to have TB infection than those had never attended formal education[AOR 0.52; 95%CI (0.21, 0.83)]. It was observed that being on ART treatment is safe as those clients on ART were less likely to have TB infection than those on pre ART [AOR 0.50; 95%CI (0.35, 0.88)]. HIV clients those stayed with HIV for six yearsand more were 2.23 times more likely to acquire TB infection as compared with those stayed with HIV for less than six years [AOR 2.23; 95%CI (1.33, 6.52)]. HIV/AIDS patients whose CD4 count is greater than 350 cells/dl[3] were 38% less likely to be infected with TB than those for which CD 4 count is 350cells/dl[3] and less[AOR 0.62; 95%CI(0.22,0.82)]. Study participants who missed their ART dose at least once were 2.57 more likely to acquire TB infection than those who didn't miss dose [AOR 2.57; 95%CI (1.21, 5.32)] (Table 3).

Table 3. Factors association with tuberculosis infection among people living with HIV (n=315) in Harari Region, eastern Ethiopia, 2015.

Characteristics	Result of TB screening		COR(95%CI)	AOR(95%CI)
	Positive	Negative		
Age of the respondents	N (%)	N (%)		
Less than 25 years	2	11	1.00	1.00
25-49years	76	181	0.43	0.21
50years and above	16	29	0.34	0.44
Sex of the respondents				
Male	37	76	1.00	1.00
Female	57	145	1.24(1.11,3.84)	2.51(1.52,6.14)
Current marital status				
Single	58	95	1.00	1.00
Married	38	124	2.02(1.25,6.12)	1.51(0.95,4.31)

Educational status				
Have no formal	34	81	1.00	1.00
Attended formal	60	140	0.97(0.14,0.99)	0.52(0.21,0.83)
Resident of the respondents				
Urban	77	189	1.00	1.00
Rural	17	32	0.76(0.23,0.87)	0.48(0.14,3.92)
Monthly income				
1400 and less	59	142	1.00	1.00
More than 1400	35	79	0.94(0.25,3.41)	0.62(0.25,2.81)
History of ART				
Pre ART	11	37	1.00	1.00
On ART	83	184	0.65(0.15,0.92)	0.50(0.35,0.88)
Length of stay with HIV				
Less than six years	39	80	1.00	1.00
Six and more years	55	141	1.30(1.13,4.92)	2.23(1.33,6.52)
Length of stay on HAART				
Five years and less	28	87	1.00	1.00
Greater than five years	66	134	0.65(0.11,0.98)	0.47(0.21,1.73)
CD4 level				
350 and less	60	165	1.00	1.00
Greater than 350	34	56	0.59(0.12,0.83)	0.62(0.22,0.82)
Missed any one of ART dose				
Yes	12	21	1.00	1.00
No	82	200	1.39(1.22,2.12)	2.57(1.21,5.32)
Hospitalized at least once				
Yes	50	94	1.00	1.00
No	44	127	1.53(0.48,3.4)	2.21(0.12,6.22)
Knowledge about INH				
Yes	62	166	1.00	1.00
No	32	55	0.64(0.14,3.53)	0.97(0.53, 8.32)

4. Discussion

HIV is the strongest risk factor for developing tuberculosis disease. The risk of developing TB is between 20 and 37 times greater in people living with HIV than among those who do not have HIV infection. In response to the dual epidemics of HIV and TB, the World Health Organization (WHO) has recommended a number of collaborative TB/HIV activities as part of core HIV and TB prevention among which intensified case-finding of TB (ICF), Isoniazid Preventive Therapy (IPT) and Infection Control for TB are the main one (WHO 2012).

In this study 315 (75.2%) of the respondents reported that they had been screened for common signs and symptoms for TB by their healthcare providers (current cough, fever, night sweats and weight loss). This result is slightly lower than that of an earlier study conducted in Addis Ababa by Wesen and Mitike that reported 89.7% (Wesan A and Mitike G 2009). This finding is also lower than the study result conducted in Addis

Ababa, in which 92.8% of the study participants reported that they were screened for TB (Amenu WDand Bethabile LD. 2014). This might indicate that TB/HIV care service in peripheral part of the country still requires special attention regarding TB screening among PLWHA. The finding of this research is higher than findings from previous studies in other parts of African countries. For instance, a study on integration of TB and HIV services in Sub-Saharan Africa in 2010 showed that, only 64% of newly enrolled persons with HIV infection or AIDS were screened for TB (WHO 2010).

The result of this study showed that 94 (22.4%) of PLHIV developed active TB during HIV follow-up cares. This finding is higher than the finding from a similar study conducted in Addis Ababa in 2008 in which prevalence of TB among PLHIV was reported to be 15.6% (Wesan A and Mitike G 2009). Another study conducted in Addis Ababa in 2011 also reported lower number of TB cases among PLHIV in which only 10.4% of study participants self-reported that they were diagnosed for active TB disease during their HIV care follow-ups (Amenu WDand Bethabile LD. 2014). Another study conducted in Addis Ababa also indicated lower, in which 32 (7%) HIV-positive clients were diagnosed with confirmed TB disease (Shah S 2009). The result indicated a huge gap when compared with the case of developed countries. A study conducted in German on cohort of 11,693 patients indicated that 233 were diagnosed with TB (N = 62) at enrollment and (N = 171) during follow-up respectively (Basel K 2014).

However, the finding of this study reported lower prevalence of TB among PLHIV when compared with the study findings of Hong Kong in 2005 where prevalence of TB was reported to be 39% (Chan CK 2010) and Pakistan in 2007 where the prevalence of TB among HIV patients was 30.2% (Memon AR 2007). A study in Georgia in 2008 showed same prevalence of TB among PLHIV with this study where 22% of HIV positive peoples have active TB (Gabunia P 2008).

Isoniazid Preventive Therapy (IPT) is one of the key interventions recommended by WHO to reduce the burden of TB in PLHIV (WHO 2012). IPT can reduce the risk of developing TB by 33-67% if it is safely given to PLHIV without active TB disease (Basel K 2014). The result of a meta-analysis showed that the provision of IPT to persons with HIV infection reduced the incidence of TB by 33% (Corbett EL 2007). The finding of our study indicated that among 221 eligible patients for IPT (negative result for TB screening), only 174 (78.7%) (41.5% among total participants) were provided with IPT service during their HIV chronic follow-up cares. The finding of this study is higher than previous study findings conducted in Addis Ababa where 28.7% were provided with IPT (Amenu W.D. and Bethabile L.D. 2014). Despite its importance, implementation of IPT in HIV care and treatment programs in resource limited countries was unacceptably low which indicates missed opportunities in the prevention of TB among PLHIV (Haileyesus G 2010). However, the finding of this study is higher than previous findings from other countries and even in Ethiopia. For instance, according to the 2011 global TB report, sampled data for Bangladesh revealed IPT coverage of only 5.4%, for Ethiopia 15.1%, for Myanmar 8.0%, and only 3% for Nigeria [16].

In this study sex, educational status, *ART* initiation status, duration of stay with HIV, CD4 level and missing dose of ART medications were some of the factors that were significantly associated with Tuberculosis infection among PLWHA.The same factors werereported from the study conducted in Addis Ababa wherelength of stay with HIV, length of stay on HAARTand diagnosed for TB before HIV were found to be factors affecting TB infection among PLHIV (WHO 2011).

5. Limitation of the Study

This study used only quantitative data and did not include exploratory qualitative data and as a result might be affected with recall bias as findings are dependent on patients' self-report. The study suffered from the usual limitation of a cross sectional nature of the design. Limited numbers of similar studies were conducted in the study area to compare our findings with.

6. Conclusion and recommendation

It can be concluded that screening for TB among PLHIV in Harari Region is lower when compared to other studies conducted in different parts of the country. However, prevalence of TB among PLHIV seems to be higher compared to previous findings both in Ethiopia and in other countries. In addition, provision of IPT is still low, though better than previous studies. ICF for TB and IPT among PLHIV in Harari Region need to be strengthened by adopting the available national and international guidelines. In addition, continuous support of healthcare providers through on-going trainings and experience sharing should be used as a tool for improving the implementation of ICF and IPT.

7. Abbreviations

AIDS	Acquired Immune Deficiency Virus
ART	Anti Retroviral Therapy
FMoH	Federal Ministry of Health
GFATM	Global Fund to Fight AIDS, TB and Malaria
HIV	Human Immunodeficiency Virus
IC	Infection Control
ICF	Intensified Case Finding
INH	Isoniazid
IPT	Isoniazid Preventive Therapy
PLHIV	People Living With HIV
SPSS	Statistical Package for Social Science
TB	Tuberculosis
UNAIDS	United Nations Programme on HIV/AIDS
WHO	World Health Organization
IHRERC	Institutional Health Research Ethics Review Committee

CHMS College Health and Medical Science

HRHB Harari Regional Health Burea

8. Competing Interests

The authors confirm that there were no competing interests.

9. Authors' Contributions

AG made substantial contributions from inception of the research idea to proposal development, data collection, analysis and interpretation of data and preparation of the manuscript. DA participated in conception of research idea, proposal development, data collection, analysis of data, and preparation of the manuscript for publication. GE has participated proposal development, data collection, analysis of data and preparation of the manuscript for publication. All the authors read and approved the final version of the manuscript.

10. Authors' Information

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12. Opportunities and Challenges to Integrate Micro and Small Scale Enterprises in Solid Waste Management for Common Residential buildings (Condominiums) in Harar and Dire Dawa Cities, Eastern Ethiopia

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Abstract: Different approaches are used by different countries to manage solid waste. In Ethiopia, solid waste management (SWM) services were majorly responsibilities of the municipalities, which resulted in inadequate service provision. For developing countries, micro and small enterprises (MSEs) can be one of the methods which can play a vital role in achieving the active participation of the population as a solution for problems associated with solid waste.

The aim of the study was to assess SWM practice and willingness to pay among residents of common residential buildings in cities of eastern Ethiopia; with a view of determination of MSEs integration opportunities and challenges.

A cross sectional study was conducted in Harar and Dire Dawa cities, the two main cities in Eastern Ethiopia where common residential buildings are expanding rapidly. The study was carried out from January 01 to February 28. 2015. The data were collected by observational checklist and interview guide. In addition, a plastic bag and balance were used for determination of waste characterization and generation rate. The sample size was 634 households which were selected proportionally. The collected data were entered by using Epi Data software and analyzed by using STATA statistical software accordingly.About 293 (53.86%) of the residents dispose their solid waste to the nearby receptacle. Majority (95.22%) of the residents had temporary storage bin. Most (83.46%) of the households did not sort and store solid waste. About 84.16% of the residents indicated serious problem with SWM service. About 278 (58.77%) and 92 (19.45%) were willing to pay 11 to 20 and 21 to 30 Ethiopian birr to the SWM service by MSEs, respectively. About 86.21% perceived that MSEs should provide the SWM service. Metallic wastes, organics, beverage containers, plastics and papers were among the major

recyclable components identified by the waste characterization. The average generation rate was 0.365 kg/c/day. Educational status, number of usual members, average monthly income and floor level were the predictor factors that showed a statistically significant association from the multiple linear regression analysis. The city government showed its full support.The existing SWM system was of a poor status. The residents preferred to obtain the SWM from MSEs and they were willing to pay optimum amount for it. In general, many opportunities and few challenges were identified in the integration of MSEs in SWM service. The city government, therefore, should involve the MSEs in the SWM of common residential buildings and residents of the cities, to be successful in optimal management of solid wastes, by critically considering the identified opportunities and challenges.

1. Introduction

There is high migration of people from rural areas to cities for various opportunities. Consequently, cities are forced to expand not only horizontally, but also vertically to accommodate the whole population (Ahsan and Zaman, 2014). This increasing population in cities produces an ever increasing amount of solid waste every day. Waste management is one of the most challenging services that municipalities around the globe offer to their citizen. When it comes to high raise apartments and common residential buildings the problem is severe (UN-HABITAT, 2014; Ramachandra and Bachamanda, 2007).

Different approaches are used by countries to manage solid waste. In Ethiopia, solid waste management (SWM) services are mainly the responsibilities of the municipalities, which resulted in inadequate service provision. This forced the society to take the informal waste collectors as an option. Collection of waste by the informal waste collectors is carried out in accordance with the needs of households without any fixed schedule. There is no concern or even awareness from the side of the users about where and how the collected waste is disposed of; the decision is up to the waste collectors (Scheinberg, 2011).

It is known fact that the informal private economy is crucial in almost all cities in the developing world, playing a significant role in solid waste management. But it needs integration into the formal sector with legal basis. Ethiopian solid waste proclamation No.513/2007 which is formulated at federal level in 2007 allows the private sectors including micro and small enterprises (MSEs) to participate in solid waste management service (SWM proclamation of Ethiopia, 2007)

For developing countries, micro and small enterprises (MSEs) can be one of the methods which can play a vital role in achieving the active participation of the population as a solution for problems associated with solid waste (Chuen-Khee and Othman 2010; Scheinberg, 2001).

As cities rapidly grow, so does the amount of waste they generate. To accommodate the fast growing population, cities build common residential buildings and high rise

apartments. Thus, urban growth has now begun vertically through high-rise developments (UN-Habitat ed., 2010).

The change in human living style and consumption patterns with the changing structure of economic activity leads to generation of various types of waste. In low-income countries, in particular, rapid urban growth is putting extraordinary pressure on limited urban resources for the provision of essential basic services, further straining capacity in urban management (Hoornweg and Tata, 2012; Khatib, 2011).

Solid waste management problems in developing countries are associated with; administration problems, insufficient funding, inequity service provision, more reliance on imported equipment, illegal dumping and a lack of people's awareness in integrated solid waste management (IWMS) (Coffey and Coad 2010).

Currently in Ethiopia, solid waste management is growing beyond the capacity of the municipalities. Households are the primary producers of solid and also the ones who suffer and are directly affected by uncollected solid waste. These challenges are reflected in most cities of the country. The problem is recognizable in common residential building where living pattern is densely populated. Higher standards of living and increasing population rate have resulted in an increase in the quantity and variety of waste generated. It has been obvious that if waste generation and its uncontrolled disposal continue in the recent pattern then it would very soon be beyond the capacity of municipalities to control the adverse impacts in a short period (PPIAF, 2011; Edmealem, 2013).

At present, information and existing management of different types of solid waste generated by residents of the common residential buildings are not stringently monitored. Solid waste management in common residential buildings in Ethiopia is hampered by the inaccessibility of temporary storage containers. There is to lack of sufficient place for container placement, odor problems and road issues. Thus, door to door collection by informal waste collectors is the only option. These informal activities take place outside the legal framework and are often driven by the struggle for survival. Thus, there is a need to have organized sector such as micro and small enterprises (MSEs) who can support the municipalities (Pieter, 2013; Edmealem, 2013).

Harar and Dire Dawa as two of the major cities of Ethiopia are in the same situation as other Ethiopia cities. Thus, this study primarily focuses on exploring the existing waste management systems in common residential building in the two cities. Key challenges and opportunities will be identified in the study. Hence Ethiopia has started to organize and participate micro and small enterprises (MSEs) in different sectors the intention of the cities' municipalities to organize MSEs in solid waste management will be assessed.

The role of informal solid waste collectors is undeniable in filling in the gap, in waste collection, between the households and the municipality but always driven by illegal struggle and survival. Nevertheless there is no or small organized MSEs which takes part in solid waste management in Harar and Dire Dawa cities. This study will contribute to a better understanding of the characteristics of the current solid waste management system in common residential buildings and the opportunities and challenges to organize

MSEs in the sector. Therefore, the community will be benefited from the findings of this study in putting forward options for better management of solid wastes. In addition, this study will provide information regarding available job related with solid waste management, with its opportunities and challenge, for the community and as well for the municipality. Moreover, it can be as input for researchers in the area for further and related investigations, and for policy makers to design better solid waste management strategies which encompasses the community at large. The general aim of this study was to assess SWM practice and willingness to pay among residents of common residential buildings in cities of eastern Ethiopia; with a view of determination of MSEs integration opportunities and challenges.

2. Methods

2.1. Study Design

A quantitative cross-sectional study supplemented with qualitative inquiry was employed.

2.2. Study Setting

This study was conducted in Harar and Dire Dawa cities, the two main cities in Eastern Ethiopia where common residential buildings are expanding rapidly, from January 01 to February 28, 2015. In these cities, there are different sectors providing solid waste management services including town municipality and urban beautification agencies. There are also many common residential buildings. For the quantitative study, data were collected by a questionnaire and observational checklist. In addition, a plastic bag and balance was used to determine the solid waste generation rate and its characterization. To support the quantitative study, in-depth interviews were conducted using semi-structured open-ended questions (interview guide) with the two cities municipality and beautification agency officials.

2.3. Study Participants

All heads of common residential area households (Condominiums) in Harar and Dire Dawa town were the source of population for this study. All common residential areas households (Condominiums) were included in the study. Households that were used for storage purpose at the time of data collection were excluded from the study. For the quantitative study, a multi-stage sampling technique was employed to select a fair representative sample of common residential households. From each town a total of three common residential household sites were selected by using simple random sampling technique. First the sample size was allocated proportionally based on the number of households to the four common residential household sites. Then from each site, households were selected by simple random sampling from the households available there (Figure 1). For the qualitative study, professionals and officials in the city municipality and beautification agency were involved.

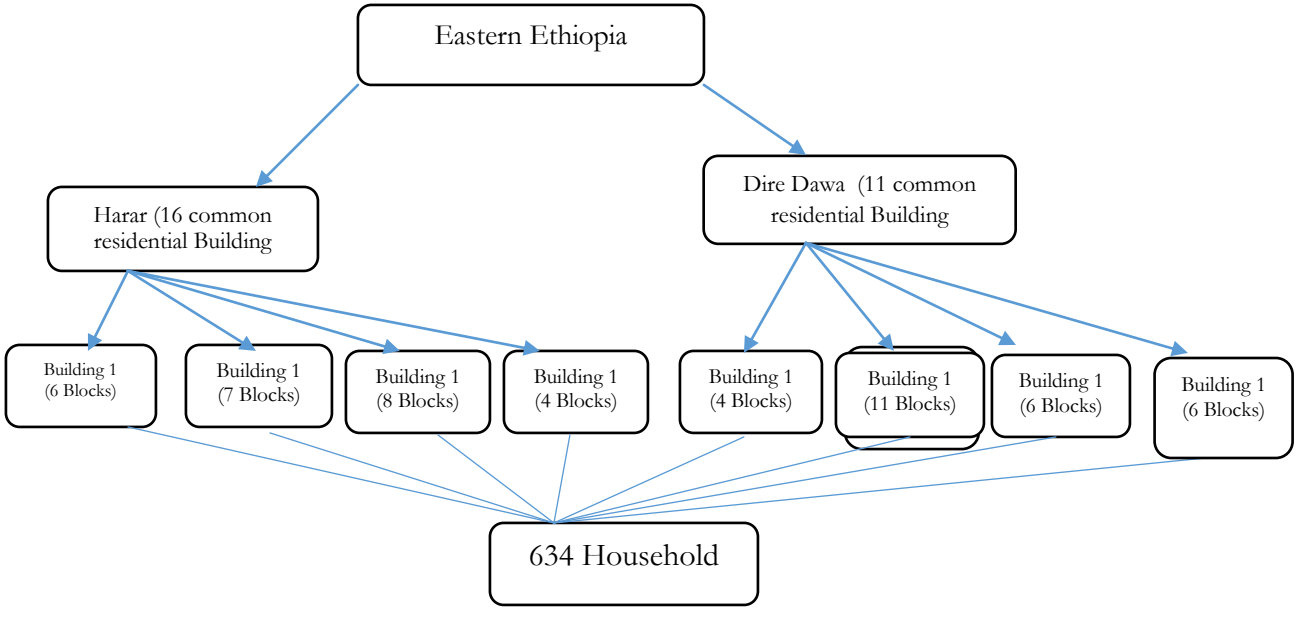

Figure 1: Schematic representation of sampling procedure.

2.4. Study variables

Generation rate is the outcome variable and common collection space, waste sorting, collection cost, waste recycling, waste collection system, waste disposal, willingness to pay for solid waste management, residents' perception about MSEs, readiness of city administration to integrate MSEs, socio-demographic factors (gender, income, age, profession, flat's ownership, floor number, andduration of living), and policy support were the idependent variables.

2.5. Data Sources/Measurement

For the purpose of data collection, questionnaire and observational checklist were developed by reviewing important documents and literatures. A plastic bag and balance was made ready for determining the solid waste generation rate and its characterization. An interview guide was prepared for the data to be collected from the town municipality and beautification agencies.

Data regarding all the variables were collected through an interview by questionnaire and interview guide, observational checklist, plastic and balance. For the quantitative data, the investigators were responsible for coordinating the assessment and identify sampled households (household heads) who were involved in completing the instrument. The data collectors were responsible for conducting the interviews, determining the solid waste generation rate and its characterization by using their professional experience. The aim of the study was cleared to the subjects.

For the qualitative data, trained data collectors conducted the in-depth interviews. Moreover, one assistant interviewer was assigned to handle tape recording and note-taking activities during each interview. After each interview, the investigators and moderators transcribed the recorded data.

Bias

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.

2.6. Sample Size

For the quantitative study, to determine the number of residential households to be included in the study, the single population formula was used. A proportion of 50% was used, since there was no study done previously to assess the solid waste management system in common residential buildings. This study had assumed 50 % proportion to

obtain the maximum sample size at 95% certainty and a maximum discrepancy of ± 5% 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 sample size was calculated using OPEN EPI Epidemiologic calculator (Open source Epidemiologic Statistics for Public Health) computer software version 2.3 and the overall sample size was found to be 634.For the qualitative study, head and responsible professionals of municipality and beautification agency were interviewed.

2.7. Quantitative Variables

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 11 for further analysis.

2.8. Statistical Methods

The frequency distribution of dependent and independent variables were computed. To ascertain the association between dependent and independent variables, bivariate analysis were 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 linear regression model analysis was fitted to identify predictor factors of solid waste generation rate.

The qualitative data, from the in-depth interviews were tape recorded and transcribed under selected themes based on the question guide. It was transcribed and summarized manually and by using Open Code computer software.

2.9. 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

3.1 Personal and Demographic Data

A total of 544 households were included in this study with an 85.8% response rate. Majority of the respondents were head (42.83%) and spouse of head (50%) of households. Most of the residents age range between 25 to 34 years (45.96%) and married (83.09%). About 84.55% and 89.53% of the households had heads and most educated household members above 9 to 12 grade completion and above, respectively. About 3 and 4 usual members were found in 28.13% and 29.04% of the households, respectively. Government employees took the majority (47.43%) among the occupation of the residents. About 57.72% of the residents had an average monthly income ranges from 3000 to 6999 Ethiopian Birr. About 316 (58.09%) of the residents lived in a rented house. Regarding duration of living, about 94.27% of the residents lived for six and lesser years. About 86.72% of the residents lived at second and lower floor level (Table 1).

Table 1. Characteristics of residents of common residential buildings in Eastern Ethiopia, 2015

Characteristics	Number (un-weighted)	% (Weighted)
City		
Dire Dawa	290	53.31
Harar	254	46.69
Position of Respondent		
Head of household	233	42.83
Spouse of head of household	272	50.00
Children	20	3.68
House maid	13	2.39
Others	6	1.10
Sex of household head		
Male	285	52.39
Female	259	47.61
Age Group		
18 – 24	46	8.46
25 – 34	250	45.96
35 – 44	167	30.70
45 – 54	48	8.82
55 – 64	21	3.86
65 – 74	6	1.10
75 – 84	6	1.10
Marital Status		
Married	452	83.09
Divorced	24	4.41
Never Married	47	8.64
Widowed	21	3.86
Education level of household head		

No formal education	22	4.04
1-4 grade complete	15	2.76
5-8 grade complete	47	8.64
9-12 grade complete	131	24.08
Certificate diploma	98	18.01
First degree	176	32.35
Second degree and above	55	10.11
Education level of most educated household member		
No formal education	3	0.55
1-4 grade complete	15	2.76
5-8 grade complete	39	7.17
9-12 grade complete	148	27.21
Certificate diploma	81	14.89
First degree	173	31.80
Second degree and above	85	15.63
Number of usual members		
1	20	3.68
2	95	17.46
3	153	28.13
4	158	29.04
5	62	11.40
6	39	7.17
7	10	1.84
8	5	0.92
9+	2	0.37
Occupation of the principal income earner of the household		
Self-employed as laborer	19	3.49
Self-employed as trader	127	23.35
Self-employed as professional	15	2.76
Employee of a private company	78	14.34
Employee of government	258	47.43
Retired	11	2.02
Others	36	6.62
Average monthly income of the household (Ethiopian birr)	-	
<1000	10	1.84
1000 – 1999	28	5.15
2000 – 2999	45	8.27
3000 – 3999	59	10.85
4000 – 4999	86	15.81
5000 – 5999	92	16.91
6000 – 6999	77	14.15
7000 – 7999	44	8.09
8000 – 8999	30	5.51
9000 – 9999	9	1.65

10000+	64	11.76
Flat ownership		
Private house	228	41.91
Rented house	316	58.09
Floor level		
Ground	133	24.45
First	169	31.07
Second	170	31.25
Third	47	8.64
Fourth	25	4.60
Duration of living in the flat (in years)		
1 – 2	256	47.06
3 – 4	192	35.29
5 – 6	65	11.95
7 – 8	18	3.31
9 – 10	13	2.39

3.2. Existing Situation Regarding Solid Waste

Concerning cleaning pattern, about 298 (54.78%) of the residents clean twice per day. About 293 (53.86%) of the residents dispose their solid waste to the nearby receptacle. Majority (95.22%) of the residents had temporary storage bin and of which 41.30% exclusively used sack as storage bin. About 296 (54.41%) had a designated storage place. Most (83.46%) of the households did not sort and store solid waste. In line with this, 416 (76.67%) did not reuse, recycle or recover their solid waste, and of the rest 96 (75%) showed to recover plastics (Table 2).

Table 2. Solid waste cleaning, storage, reuse, collection and disposal practices among residents' of common residential buildings in Eastern Ethiopia, 2015

Variables	Number (un-weighted)	% (Weighted)
Cleaning pattern		
Once per day	215	39.52
Twice per day	298	54.78
Within 2 days interval	11	2.02
Within 3 days interval	1	0.18
Within 1 week interval	1	0.18
Others	18	3.31
Solid waste disposal options		
Nearby receptacle	293	53.86
Bury or burn it	7	1.29
Open disposal to street	105	19.30
Open disposal to river	6	1.10
Disposed by MSE collectors	133	24.45

Availability of temporary storage pin			
Yes		518	95.22
No		26	4.78
Almost exclusively used storage bin			
Plastic bin		112	22.67
Plastic bag		165	33.40
Sack		204	41.30
Metal bin		4	0.81
Bamboo basket		6	1.21
Cartoon		3	0.61
Availability of designated place for waste Storage			
Yes		296	54.41
No		248	45.59
Sort and store separately			
Yes	Minimal	54	9.93
	Moderate	29	5.33
	Significant	6	1.10
	Optimal	1	0.18
No		454	83.46
Reuse, recycle or recover of material			
Yes	Minimal	86	15.81
	Moderate	37	6.80
	Significant	3	0.55
	Optimal	2	0.37
No		416	76.47
Mainly reused, recycled or recovered Material			
Bottles		31	24.22
Plastics		96	75.00
Others		1	0.78

Around 346 (63.6%) of the households received a collection service, and of which 82.66% was by MSEs. The service providers emptied the storage container twice a week for 54.91% of the residents. About 52.21% and 43.38% of the residents reported that it was emptied to a communal container and placed at less than 30 meters one way distance, respectively (Table 3).

Table 3. Solid waste collection and emptying practices among residents' of common residential buildings in Eastern Ethiopia, 2015.

Variables	Number (un-weighted)	% (Weighted)
Receive solid waste collection service		
Yes	346	63.60
No	198	36.40
Service Provider		
MSEs	286	82.66
Informal collectors	60	17.34
Storage container emptying frequency by service provider		
Several time each day	3	0.87
Daily	20	6.65
3 times a week	42	12.14
Twice a week	190	54.91
Once a week	87	25.14
Less frequently	4	1.16
If no service provider, container emptied by		
Head of household	12	6.06
Spouse of head	48	24.24
Any male adult	8	4.04
Any female adult	59	29.80
Any child aged 13-18 years	31	15.66
Any child aged 6-12 years	17	8.59
Others	23	11.62
Container emptied option		
Larger container	42	7.72
Communal container	284	52.21
Open pile of waste	112	20.59
Final disposal site	14	2.57
Don't know	92	16.91
One way distance to empty container (in meter)		
<30	236	43.38
31 – 60	81	14.89
61 – 90	12	2.21
91 – 120	45	8.27
121 – 150	26	4.78
151 – 180	7	1.29
181 – 210	63	11.58
211+	74	13.60

About 289 (53.13%) of the residents don't know about the communal larger container emptying pattern and 245 (45.04%) responded that it was emptied by city municipality. Regarding the collection service, 241 (44.3%) was unsatisfied and of those 47.72% reported too long collection interval as a reason for dissatisfaction. About 441 (81.07%) of the residents did not know about the final disposal site (Table 4).

Table 4. Solid waste collection and emptying services among residents' of common residential buildings in Eastern Ethiopia, 2015.

Variables	Number (un-weighted)	% (Weighted)
Pattern of emptying communal larger container		
Daily	2	0.37
Three times a week	20	3.68
Twice a week	77	14.15
Once a week	76	13.97
Less than once a week	7	1.29
Less than once in 2 weeks	20	3.68
Less than once in 3 weeks	35	6.43
Less than once a month	18	3.31
Don't know	289	53.13
Communal larger container emptied by		
City Municipality	245	45.04
Informal waste collectors	30	5.51
MSEs	104	19.12
Don't know	165	30.33
Perception about the collection service		
Very satisfied	94	17.28
Reasonably satisfied	146	26.84
Not satisfied at all	241	44.30
Don't know	63	11.58
Reason for non-satisfaction about the Service		
Too long collection interval	115	47.72
Unsatisfactory container location	25	10.37
Unsanitary container condition	11	4.56
Impolite behavior of workers	24	9.96
Unsanitary neighborhood appearance	10	4.15
Unreliable service	37	15.35
Others	19	7.88
Knowledge regarding final disposal site		
Yes	103	18.93
No	441	81.07

3.4. Major Concerns about Solid Waste Management

Among list of five possible problems that a house might be faced, 38.79% of the residents selected access and quality to water as the most serious problem (Figure 2). In addition, about 36.03% selected unreliable electric supply as the second most serious problem (Figure 3).

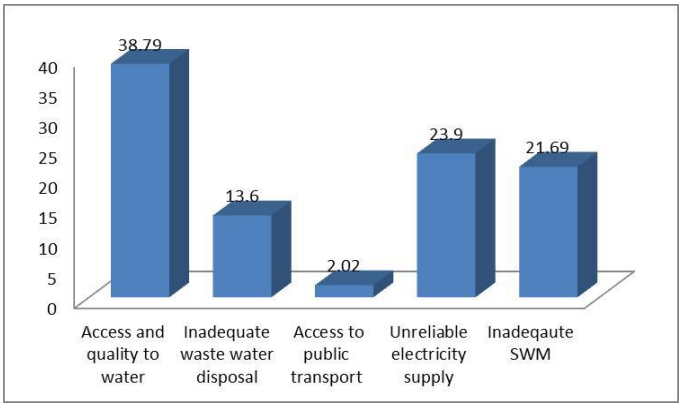

Figure 2. Most serious problem among a list of possible problems that a household might be faced among residents' of common residential buildings in Eastern Ethiopia, 2015.

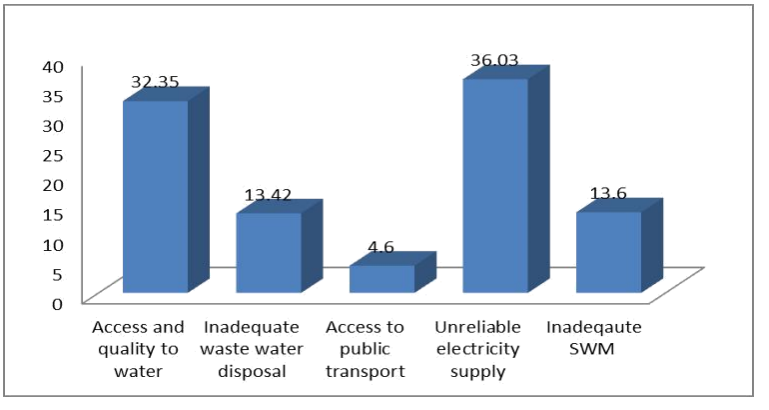

Figure 3. Second most serious problem among a list of possible problems that a household might be faced among residents' of common residential buildings in Eastern Ethiopia, 2015.

However, without the possible problems being listed, about 42.46% and 41.73% of the residents indicated problem with solid waste management service as very serious and somewhat serious, respectively (Figure 4). In addition, 47.43% responded problem with nuisance from solid waste disposal or dumping as very serious (Figure 5).

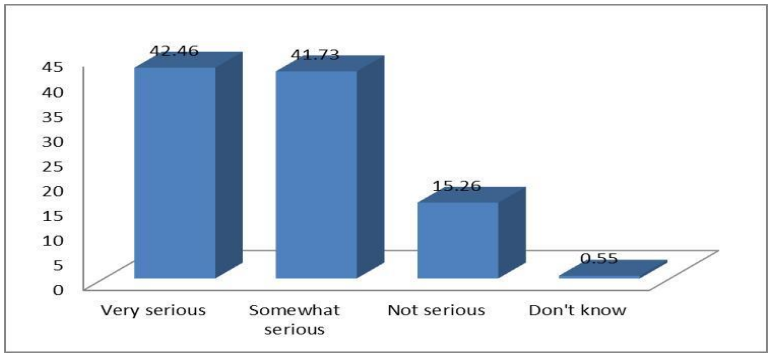

Figure 4. Seriousness of the problem with solid waste management service among residents' of common residential buildings in Eastern Ethiopia, 2015.

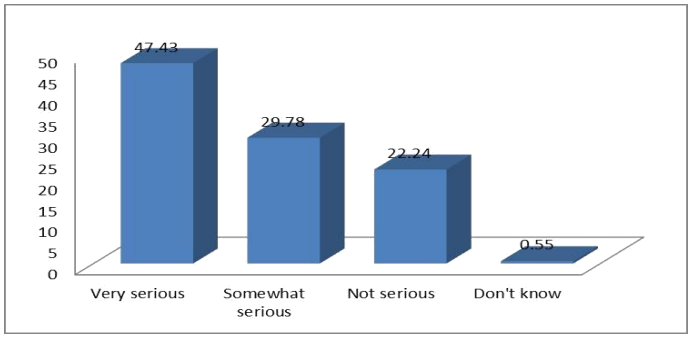

Figure 5. Seriousness of the problem with nuisance from solid waste disposal or dumping among residents' of common residential buildings in Eastern Ethiopia, 2015.

About 53% of the residents perceive that the city's rapid expansion did not outstrip solid waste management (Figure 6).

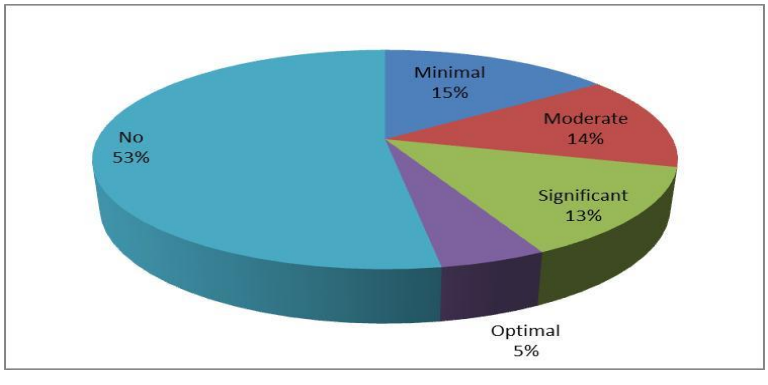

Figure 6:.Perception that the city's rapid expansion outstrips solid waste management among residents' of common residential buildings in Eastern Ethiopia, 2015

3.5. Demand assessment and willingness to pay for solid waste collection service

Among the proposed method of solid waste collection (refer the Annex), 68 (12.50%), 469 (86.21%), 7 (1.29%) preferred collection option one, collection option two and both, respectively.

Among those preferred collection option one, 39.13% were willing to walk a distance of 91 to 120 meters to walk to a large communal container and 56% were unwilling to have a communal container within 20 meters distance. Odor and nuisance problem was among the major (95.24%) reasons for the unwillingness about the communal container location. Additionally, about 66 (88%) of the residents were willing to pay 1 to 20 Ethiopian Birr (Table 5).

Table 5. Perception and willingness regarding "collection option one" among residents' of common residential buildings in Eastern Ethiopia, 2015.

Variables	Number (un-weighted)	% (Weighted)
Distance willing to walk to large communal container (in meters)		
<30	15	21.74
31 – 60	14	20.29
61 – 90	2	2.90
91 – 120	27	39.13
120+	11	15.94
Willingness to have communal container within 20 meters		
Yes	33	44.00
No	42	56.00
Reason for saying "NO" to container location		
Health and odor problem	2	4.76
Odor and nuisance problem	40	95.24
Willingness to pay per month for collection option one		
1 – 10	33	44.00
11 – 20	33	44.00
21 – 30	5	6.67
31 – 40	2	2.67
41 – 50	2	2.67

Among the residents preferred "collection option two", 300 (55.15%) and 97 (17.83%) indicated that early morning before 9 a.m. and anytime in the morning as the most convenient times of the day to meet the collectors, respectively. Almost half (43.93%) of the residents were willing to have communal container within 20 meters distance, and the rest indicated odor and nuisance problem as a major reason for their unwillingness

about the location. About 278 (58.77%) and 92 (19.45%) were willing to pay 11 to 20 and 21 to 30 Ethiopian birr, respectively (Table 6).

Table 6. Perception and willingness regarding "collection option two" among residents' of common residential buildings in Eastern Ethiopia, 2015.

Variables	Number (un-weighted)	% (Weighted)
Willingness to have communal container within 20 meters		
Yes	239	43.93
No	236	43.38
Don't know	69	12.68
Reason for saying "NO" or "Not sure" to container location		
Health and odor problem	12	3.93
Odor and nuisance problem	293	96.07
Willingness to pay per month for collection option one		
1 – 10	33	6.98
11 – 20	278	58.77
21 – 30	92	19.45
31 – 40	28	5.92
41 – 50	28	5.92
51+	14	2.96
Reason for unwillingness to pay		
Cant's afford to pay	5	-
Unreliable service	1	-
Responsibility of government only	1	-
Others	2	-

Concerning payment regarding solid waste management service, government fee collector was the most (59.56%) preferred way of payment by the residents, and of those 238 (73.46%) selected to pay with water bill (Table 7).

Table 7. Solid waste management service fee collection options among residents' of common residential buildings in Eastern Ethiopia, 2015.

Variables	Number (un-weighted)	% (Weighted)
Preferred way of payment		
Government fee collector	324	59.56
MSEs fee collector	129	23.71
Neighborhood leader	33	6.07
All are equally suitable	53	9.74
Don't know	5	0.92
If government collector, how		
With water bill	238	73.46
With electric bill	13	4.01
On its own	70	21.60
Others	3	0.93

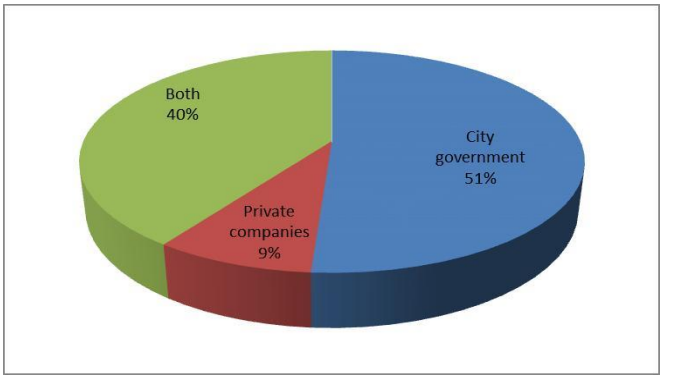

Figure 7. Perception regarding responsibility to manage solid waste among residents' of common residential buildings in Eastern Ethiopia, 2015.

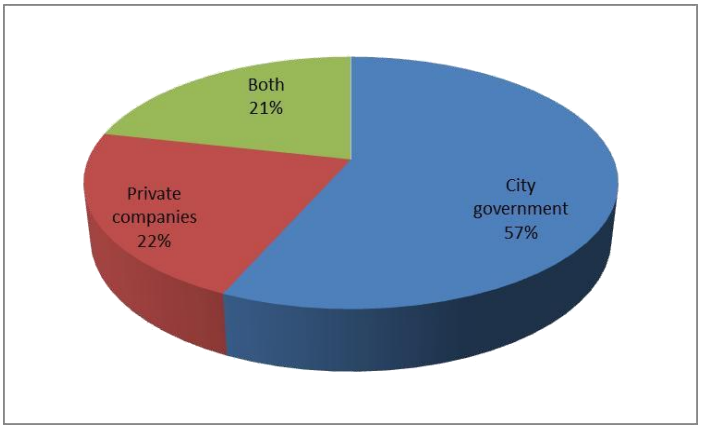

Figure 8. Perception regarding best institute to handle solid waste management among. residents' of common residential buildings in Eastern Ethiopia, 2015.

Perception regarding the existing waste collection and disposal service provided by the city government indicated that 333 (61.95%) of the residents are unsatisfied.

3.6. Solid Waste Characterization and Generation Rate

The characterization of solid waste was done by segregating into ten components. The average generation rate was 0.365 kg/c/day (Table 8).

Table 8. Solid waste characterization and generation rate (in kilogram/capita/day) among residents of common residential buildings in Eastern Ethiopia, 2015.

Waste Component	Mean	StandardError	95% Confidence Interval	
Paper	0.020	0.004	0.011	0.028
Construction and destruction Debris	0.022	0.014	-0.007	0.051
Inorganics	0.028	0.011	0.007	0.050
Glass	0.045	0.007	0.031	0.059
Metallic wastes	4.495	4.463	-4.312	13.30
Plastics	0.015	0.002	0.012	0.019
Textile	0.046	0.005	0.036	0.057
Organics	0.307	0.015	0.277	0.337
Household hazardous waste	0.112	0.015	0.083	0.140
Beverage containers	0.029	0.004	0.021	0.037
Total	0.344	0.011	0.323	0.365

3.7. Multiple Linear Regression Analysis

A multiple linear regression model analysis was performed to explore the relations between the predictor variables with the generation rate while simultaneously adjusting for all other variables included in the model.

The regression analysis showed, while keeping the other predictor variables constant, being 9 to 12 grade, certificate diploma, first degree, and second degree and above education level of household head results in 0.126, 0.139, 0.151, and 0.165 kg/c/day increase,respectively in solid waste generation rate when compared with having no formal education. While keeping the other predictor variables constant, having 2, 3, 4, 5, 6, 7, 8, and 9 and above usual members in the house results in 0.4, 0.429, 0.507, 0.601, 0.541, 0.532, 0.631, and 0.618 kg/c/day decrease, respectively in solid waste generation rate when compared with 1 usual member.

In keeping the other predictor variables in the model constant, having an average monthly income of Ethiopian Birr greater than 10, 000 results in a 0.043 kg/c/day decrease in solid waste generation rate when compared with those who have less than 5000 Ethiopian Birr, respectively. While keeping the other predictor variables in the model constant, living in 3rd and 4th floor of the building results in 0.108 and 0.116 kg/c/day increase, respectively in solid waste generation rate when compared with those who live in the ground floor, respectively (Table 3).

Table 9. Predictors of solid waste generation rate (in kilogram/capita/day) among residents' of common residential buildings in Eastern Ethiopia, 2015.

Waste Component	Coeffi cient	P-value	95% Confidence Interval	
Education level of household Head				
No formal education	1.000	-	-	-
1-4 grade complete	-0.011	0.875	-0.152	0.130
5-8 grade complete	0.023	0.680	-0.086	0.131
9-12 grade complete	0.116	0.019	0.019	0.213
Certificate diploma	0.139	0.007	0.039	0.239
First degree	0.151	0.002	0.054	0.248
Second degree and above	0.165	0.003	0.567	0.274
Number of usual members				
1	1.000	-	-	-
2	-0.400	<0.0001	-0.503	-0.298
3	-0.429	<0.0001	-0.529	-0.329
4	-0.507	<0.0001	-0.608	-0.408
5	-0.601	<0.0001	-0.709	-0.492
6	-0.541	<0.0001	-0.658	-0.425
7	-0.532	<0.0001	-0.698	-0.366
8	-0.631	<0.0001	-0.842	-0.421
9+	-0.618	<0.0001	-0.932	-0.305
Average monthly income of the household				
<5000	1.000	-	-	-
5001 – 10000	-0.046	0.025	-0.085	-0.006
10000+	-0.043	0.237	-0.115	0.029
Floor level				
Ground	1.000	-	-	-
First	0.007	0.769	-0.042	0.056
Second	0.262	0.289	-0.022	0.075
Third	0.108	0.003	0.037	0.179
Fourth	0.116	0.014	0.024	0.208

3.8. Findings of the Qualitative Study

A total of 6 officials and professionals were involved in the in-depth interview. The results of the in-depth interview was summarized and arranged as follows:

3.8.1. Current solid waste collection and transport service

Almost all participants responded that there are policies or laws with regard to solid waste management; however, some were not sure that it gave emphasis to proper collection and the 3 Rs. Half of the participants responded that the waste generated from the common residential buildings were collected by informal collectors. In addition, all responded that practices such as reuse and recycling activities were limited.

3.8.2. Enabling rules and regulations

All the participants responded that there is an institutional framework in the city to perform SWM with MSEs. They all added that the existing rules and regulations conducive for the work of MSEs. Some responded that they initiated MSEs in SWM, as some private companies requested for involvement. All agreed that the current solid waste collection delivered by the city government is insufficient, as the budget allocated for it is very limited.

3.8.3. Financial supports

The participants agreed that the government is willing and ready to support MSEs by paying the service charge on time and by facilitating access to credit. They all agreed that the fee collection should be done by the government fee collector, together with water and electric bill, which is believed to help that the users will pay the service charge on time.

3.8.4. Equipment and material support

The interviewees responded that the city government is willing to support the MSEs by equipment and materials necessary for the actual work and self-protection, even if there was a resource limitation. In addition, all agreed that waste containers available in the cities during the study period were insufficient.

3.8.5. Capacity building mechanisms and awareness raising programs

All participants agreed that the city government is willing and ready to provide training and support for the MSE managers and workers. In addition, all agreed that there will be a public awareness raising methods by using different mechanisms.

3.8.6. Supervision function and monitoring

The participants responded that in the future there will be a regular monitoring and control systems with regard to waste collection and transport service provided by MSEs.

They also described that there will be different ways for complaint launching and feedback mechanisms. Concerning theMSE's solid waste collection and transport services, the participants agreed for the regular undertaking of supervision. In addition, all participants believed that the involvement of MSEs will improve the service and it can address all inhabitants of common residential areas.

4. Discussions

Solid waste management practice and willingness to pay for among residents in common residential buildings were tried to be determined by both quantitative and qualitative design. The solid waste management practice and willingness to pay was assessed by interview and observation. In addition, the solid waste characterization and weighting were done by collecting solid waste generated for three consecutive days, characterizing and weighting per each day and taking the average.

The limitation for the quantitative data was that most of the data obtained were subjective and the generation rate didn't consider seasonal variation. However, the optimum sample size, cross questions, observation, and qualitative findings could provide reliable evidence in the assessment of solid waste management practice and willingness to pay. Having reliable evidence in this regard might be very indicative of the opportunities and challenges in integrating MSEs in solid waste management.

This study indicated that most of the residents cleaned their house regularly, had temporary storage bin and designated storage place; higher than a study done in Kersa, Ethiopia. The reason behind may be due to the majority rural residency of the Kersa study. However, the findings of this study may be considered as an opportunity which attracts the private sectors involvement in solid waste management, since the regular cleaning pattern, the storage bin and its designated place will ensure a regular job for the MSEs (Mengistie and Negga, 2010).

About one fifth of the residents use open dump for their waste, which was a bit lesser than that of the study done in Addis Ababa. This may be due to the rules and regulations of common residential buildings, which inhibits open dumping. In line with this, more than half of the residents dispose their solid waste to the nearby receptacle. This, however, doesn't mean proper waste management, as it needs to be transported and dumped at selected site. As this study further identified the collection by MSEs is the most preferred option for the residents, this will enhance keeping the safety of the environment in one hand and creates a big job opportunity for the MSEs on the other hand (CMA, 2009; Hoornweg and Tata, 2012; Mazhindu *et al.*, 2012).

More than half of the residents perceive that solid waste management is solely the responsibility of city government, which is similar with a study done in Sierra Leon. This may be due to the low level awareness and knowledge about solid waste management. This will affect the solid waste management in all aspects, even by creating a challenge for the integration of MSEs into the sector. However, optimal awareness creation activity is strongly recommended for the effective integration of the MSEs into the sector (Sankoh and Yan, 2013).

Most of the residents in this study did not sort, reuse, recycle or recover their solid waste, which goes in line with studies done in Ethiopia and Sierra Leon. This may be due to the low level awareness and perception regarding solid waste, as it has been supplemented with the qualitative study which stipulated that the city government has exerted lesser effort in awareness creation activities. However, the waste characterization indicated that most component of the household waste was reusable, recyclable and recoverable; as it has been supported by a review study done about developing countries. This can be taken as an opportunity for the MSEs to quickly engage in the service and utilize the wasted resources (UNEP, 2009; Mengistie and Negga, 2010; Sankoh and Yan, 2013; Guerrero *et.al*, 2013).

The solid waste generation rate determined by this study goes in line with that of a study in Addis Ababa. It was slightly higher than that of a study in Bahir Dar and Dessie cities of Ethiopia. This may be due to seasonal or sample size variation. The relatively higher generation rate may also be linked with this study findings indicated the low level of waste sorting, reuse, recycle or recover. Therefore, awareness creation of the public and integration of MSEs in solid waste management must be a prior intervention target (Guerrero *et.al*, 2013; Mekete *et.al*, 2009; Solomon, 2011)

Most of the residents were willing to pay about 11 to 20 Ethiopian Birr for the solid waste collection service by MSEs. The amount is slightly higher when compared with other study reports, which considered it as optimum. This might be due to the findings of this study which suggested that the residents considered solid as the most serious problem. Therefore, this can be considered as a very good opportunity to integrate MSEs in the solid waste management (Hagos *et al*, 2012; Tadesse and Hadgu, 2009; Solomon, 2011; Edmealem, 2013).

As the number of usual members of the household increases the solid waste generation rate tends to decrease, which goes in line with a study done in Sierra Leon. This may be due to the fact that whenever people tend to live alone, the tendency for cooking is very low which increases the consumption of canned and packed food and beverages. This in turn increase the solid waste generated. However, the recyclable components of such kind of recyclable wastes may attract private agencies to get involve in solid waste management (Sankoh and Yan, 2013).

Greater average monthly income tends to decrease the solid waste generation rate, which is in line with a review study done by Guerrero and colleagues (2013). Higher income might be related with consuming quality goods with a very low wasteable component, which in turn decreases the waste generation rate of the wealthiest residents. However, since most of the residents in the city have an average or lower monthly income, relatively increased generation rate of solid waste is expected. This in turn will create an opportunity for the MSEs in having a regular solid waste collection job with higher solid waste generation rate.

The qualitative study identified that the city government has a plan and mechanism to provide loan and material support for the MSEs. This was shown on a study done in Bahir Dar city of Ethiopia. This may indicate the perception of the city government that the solid waste management urgently requires a stakeholder involvement, such as MSEs,

as it was evidenced by the qualitative study again. This, in general, can be taken as an opportunity for the MSEs to get involved in the solid waste management (Lohri et.al, 2014).

The resource and capacity limitation with the city government in providing necessary equipment and materials was in line with other studies done in Ethiopia. This can indicate the challenge that the MSEs may face in their involvement in solid waste management of the common residential areas. Therefore, the government needs to improve its preparedness and support by providing the necessary equipment and materials in time with the required amount (Solomon, 2011; Hagos et al, 2012).

5. Conclusion

Based on both the quantitative and qualitative findings of this study, it can be concluded that the existing solid waste collection system was of a poor status. The residents preferred to obtain the solid waste management service from MSEs and they were willing to pay optimum amount for it. Slightly higher level solid waste generation rate and low recycling of solid wastes was identified. Metallic wastes, organics, beverage containers, plastics and papers were among the major recyclable components identified by the waste characterization. The city government was found to be ready and willing to support and integrate MSEs into SWM of the city.

In general, low awareness and perception of the residents were identified as the challenges to integrate MSEs into the solid waste management service. On the government side, low level of commitment and lack of resources were the identified challenges.

On the other hand, having the regular cleaning pattern, the storage bin and its designated place, positive perception of the community about MSEs involvement in solid waste management, recognized level of problem related with solid waste, recyclable and recoverable waste characteristics, willingness to pay, policy and regulation availability, government plan and mechanism to provide loan and material support were among the opportunities identified for the integration of MSEs in solid waste management of the cities.

The city government, therefore, should involve the MSEs and residents of the cities in the solid waste management of common residential buildings to be successful in optimal management of solid wastes, by critically considering the identified opportunities and challenges. In addition, the MSEs should consider all the opportunities and challenges identified before entering to the system.

6. Acknowledgments

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Annex

Collection Option one: A large communal container - probably of 5 to 8 cubic meters capacity *(interviewer should demonstrate the size)* would be placed in your neighborhood at a central location and each household and establishment would be expected to carry its container of refuse to empty it into the container. The container would have an organized MSEs attendant to sweep the area and keep it tidy. A vehicle would pick up the container and take it away to be emptied before it is completely full.

Collection Option two: As with the first service option, a large communal container would beplaced in your neighborhood. However, instead of you and your neighbors being required to carry their waste to the communal container, door-to-door collection would be arranged by MSEs for an added a fixed monthly fee. The door-to-door collection would be done by a worker using a push cart or donkey, depending on which would work better in your neighborhood.