OPEN ACCESS
Freely Available Online

JOURNAL OF PUBLIC HEALTH INTERNATIONAL
ISSN NO: 2641-4538

Research Article

DOI : 10.14302/issn.2641-4538.jphi-18-2470

Prevalence of Diarrhea and Associated Factors among Under Five Years Children in Harena Buluk Woreda Oromia Region, South East Ethiopia, 2018

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Abstract

Background: Acute diarrheal diseases are the leading cause of preventable childhood death, especially in developing countries. It is the second leading cause of death in under-five year children nest to pneumonia.

Objectives: The aim of this study was to determine the magnitude and associated factors of diarrhea in under-five in Harena Buluk district.

Methods: A community based Cross sectional study was conducted in February, 2018. A two stage stratified sampling method was done to select the eligible households. Data was collected by trained data collectors using pretested questionnaire list which was prepared based on EDHS and WHO core questionnaires related to diarrhea. Data was entered in to a computer using Epi data 3.1 and exported to SPSS V.20 for further analysis. Logistic regression was used to determine level of association with 95% CI. A p-value <0.05 in the final model were considered as significant.

Result: The two weeks period magnitude of diarrhea among under-five children was 28.4% with 95% CI (14.5-20.8) which was associated with households with one under five children [AOR: 0.268, 95% CI(.08,0.90)], living in the home with single room [(AOR = 6.01, 95% CI(1.01,36.01)], clean latrine/faces not seen around the pit or on the floor of latrine[AOR: 0.298, 95% CI(0.097,0.92)], long time take to fetch water from source [AOR: 0.046,95%CI(0.01,0.22)], home based water treatment [(AOR = 0.15, 95% CI: (0.04, 0.62)], living with animal in the same house[AOR: 8.31, 95% CI(2.46,28.06)], children who took gruel type of food[AOR: 0.24, 95% CI (0.07,0.81)], hand washing practice before cooking food [AOR: 0.195(0.066, 0.574)].

Conclusion: The two weeks period magnitude of acute under-five diarrhea was relatively high and number of under five children in the household, cleanness latrine, time taking from the source of water, home based water treatment, number of rooms in the home, live with animal in the same house, type of food child take, hand washing before food preparation had significant association with the occurrence of under-five diarrhea. Improve community about home and environmental sanitation and hand practices were recommended.

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Keywords: Acute diarrhea, Children, Diarrheal Disease, under five

Received: Nov 07, 2018 **Accepted:** Nov 22, 2018 **Published:** Dec 05, 2018

Editor: Masoud Mohammadnezhad, Associate Professor, Public Health (Health Promotion) School of Public Health & Primary Health Care Fiji National University

Introduction

Back Ground

Diarrhea is defined as a child with loose or watery stool for three or more times during a 24–hours period and caused by a host of bacterial, viral, protozoa and parasitic organisms. Rotavirus and Escherichia coli are the two most common etiological agents of moderate-to-severe diarrhea in low-income countries. It is more common when there is a shortage of adequate sanitation and hygiene and safe water for drinking, cooking and cleaning, improper feeding practices, and poor housing conditions [1]. Though most episodes of childhood diarrhea are mild, acute cases can lead to significant fluid loss and dehydration, which may result in death or other severe consequences [2].

Despite global success in the reduction of all cause and diarrhea specific mortality in the past 30 years, diarrhea remains the second leading cause of death due to infections among children under five years of age worldwide and account for 1,400 children death every day, around 1 in 10 child deaths worldwide due to diarrhea in 2015. It is more than the death of children due to AIDS, malaria, and measles combined [3]. It is estimated that diarrhea accounted for 9.9% of the 6.9 million deaths among children under 5 in 2011 [4]. Young children are especially vulnerable bearing 68% of the total burden of diarrhea disease. Among children less than five years, diarrhea accounts for 17% of all deaths [2].

While it is both preventable and treatable, each year around 526 000 deaths of under-five children and nearly 1.7 billion cases of childhood diarrheal disease every year. This rate varies between regions, Most deaths from diarrhea occur among children less than 2 years of age living in South Asia and sub-Saharan Africa many of those who survive suffer from malnutrition and lasting impairments to mental and physical development [2,5]. Diarrheal deaths are exceedingly prevalent in just a handful of countries and half of deaths due to diarrhea.

A large proportion of diarrheal disease in developing world is due to multiple risk factors are indicated, namely unsafe water supply, lack of water linked to inadequate hygiene, poor personal and domestic hygiene and agricultural practices, contact with unsafe water, inadequate sanitation and quality and quantity of water, availability of toilet facilities, housing conditions, level of education, household economic status, place of residence, feeding practices, and the general sanitary conditions around the house cause various disease outcomes, mainly diarrheal About 88% of diarrhea-associated deaths are attributable to unsafe water, inadequate sanitation, and insufficient hygiene. As simple as hand washing may seem, it is one of the most important factors in preventing the spread of germs and staying healthy. Unwashed hands can accelerate the spread of bacteria, parasites, and viruses that are transmitted from human and animal faeces or the environment [6]. Nowadays, globally diarrhea accounts for 9% of all deaths among children under the age of five [7].

The morbidity and mortality related to diarrheal diseases in under-5 children are still sizeable and persistent in low income countries, especially in sub-Saharan Africa, and pose a significant, long-standing public health concern. Diarrhea is one of the major contributors to deaths for under age 5 children in Ethiopia. Diarrhea contributes to more than one in every ten (13%) child deaths in Ethiopia. The percentage of children under age 5 who had diarrhea accounts 12% in 2016 [8].

Diarrheal diseases are among the leading causes of under-five deaths worldwide. Globally diarrhea accounts for 9% of all deaths among children under the age of five. Low income nations like India, Nigeria, the Democratic Republic of Congo, Pakistan, and Ethiopia are hit especially hard. In these countries, children are often exposed to pathogens because of poor environmental sanitation and water supplies [7]. Childhood mortality rate in general and infant mortality in particular, are often used as broad indicators of social development or as specific indicators of health status. Child mortality reduction by two-third is one target of Millennium Development Goal [9]. The majority of morbidity and mortality related to under-five diarrhea were in Africa and South Asia. Diarrhea can last several days, and can leave the body without the water and salts that are necessary for survival. Most people who die from diarrhea actually die from severe dehydration and fluid loss. It also predisposes children to malnutrition which makes children more susceptible to other

infections [5].

As compared with other regions of the world, the African region shows the smallest reductions in mortality rates and the most marked slowing down trend. The under-five mortality rate in the African region is seven times higher than that in the European region.

Though Ethiopia has recorded significant reduction in childhood mortality, still many children die from diarrhea before their 5th birth day. Over two-thirds of child deaths in Ethiopia are due to infectious diseases such as pneumonia, diarrhea, malaria, and measles; and problems of the newborn. Moreover diarrhea is the second cause for clinical presentation among under five-year child population next to pneumonia in Ethiopia .Nationally, diarrhea prevalence is 12% in 2016 and it is more abundant in rural than urban areas [8]. Even though improvement was made in reducing childhood mortality from 123 under five deaths per 1,000 live births in 2005 to 59 under five deaths per 1,000 live births in 2016, children in the country still suffer from diarrhea, respiratory problems and malnutrition [8].

Variations across communities in factors like accessible, safe and adequate water supply, environmental sanitation and person hygiene, availability and quality of MNCH services and facilities, maternal education level, place of residence (urban/rural) could play significant roles on diarrhea morbidity and mortality in a specific community. Thus this study was aimed to assess the magnitude and determinants of diarrhea morbidly in under-5 children at Harena Buluk wereda. Studies conducted that aimed to assess diarrhea morbidly in conjunction with its determinant factors among under-5 children at community level in Ethiopia particularly in the context of Bale zone, Harena Buluk wereda are limited. This suggests that many more studies are remaining to be done.

Even though there are different diarrhea prevention strategies and policies including the health extension program in the ground, diarrhea is still the leading cause of morbidity among children visiting under five years clinic in the study area. In addition to this the woreda has been affected by acute watery diarrhea (AWD) epidemic and a lot of children died in 2016/2017. Therefore this study was done to assess the magnitude and associated factors of diarrhea among under-five children in Harena Buluk woreda by the year of 2018.

Definitions of Key Terms

Diarrhea is defined as having three or more loose or watery stools per twenty four hours in two weeks period preceding the data collection, as reported by the mother/care taker of the child(WHO, 2010).

Prevalence of Diarrhea the number of diarrhea cases at the time of the interview divided by the total number of households included in the study.

Exclusive Breast Feeding A child who receives breast milk only and no other food, solid or liquid with the exception of vitamins, minerals and medicines [1].

Improved Water Source Water from protected springs and/or wells, from pipe and from distribution post unless considered as unimproved [1].

Improved Latrine pour flush to piped sewer system/ septic tank/pit latrine, VIP and pit latrine with slab otherwise considered as unimproved [1].

Care Giver Hygiene is personal hygiene of the caregivers like short finger nail cut or long fingernail which could be factors for the occurrence of diarrheal disease among children

Appropriate Hand Washing Practice is the way of child caregiver hand washing practice which shows clean hand palm, fingertip and between-fingers observed by data collectors to determine its relationship with the occurrence of diarrheal.

Hand Washing Facility refers to households having hand washing facilities like plastic or metal with water seated nearest to latrine for children to wash their hands after latrine utilization as observed by data collectors.

Hand Washing during Critical Time refers to caregivers' hand washing practice after utilization of latrine, before food preparation and child-feeding as identified by caregivers' oral report of their practice to identify its relationship with diarrheal occurrence

Index Child refers to a child that was included in the study from a household to have information on the demographic and health characteristics.

Methodology

Description of Study Area

The study was conducted in Harena Buluk woreda and data was collected in February, 2018. Harena Buluk is one of the pastoral woredas found in Bale zone of Oromiya region, Southeast Ethiopia. The study site is approximately 582 kilometers away from Addis Ababa and 152 kilometers from Bale Robe, the capital city of Bale zone. It is bounded by Goba, Madda Walabu, Delo Mena and Adaba woredas to the north, south, east and west direction respectively. The district is divided in to thirteen rural and one urban kebeles (the smallest administrative unit in Ethiopia), having a total population of 106, 987 residents. The total households of the district were 22899 and 17,587were children under five years of age. It had 52 primary and 3 secondary schools. The population is predominantly Muslim by religion. The main weather condition of the woreda is kola (low land) with some part of it having weyna-dega (mid land) weather condition which is accounts about 9 and 5 kebeles respectively. Agriculture and pasturing is the main sources of the district's livelihood. Health services in the district were provided by 5 health centers and 18 health posts. At the kebele level, health care is delivered by health extension workers who are assigned to render health services at the local level.

Study Design and Period

A community based cross-sectional study was done to assess the magnitude and associated factors of acute diarrheal disease among children under-five years of age in Harena Buluk woreda from February 1 to February 20, 2018.

Population

The source populations are all households with mothers/care takers who have under-five children in the district, Harena Buluk woreda. The study populations are all households with mothers/care takers who have under-five children in the in the selected kebeles, Harena Buluk woreda. And the study units are randomly selected household with at least one under five-child in selected kebeles. Those households under five years children and lived in the area for more than six months are included in the study; while mothers who are ill and cannot respond to the interview, children who are critically ill and with persistent diarrhea were excluded from the study.

Sample Size Determination

Using EPI INFO for window version 7, sample size was calculated for each specific objective and the highest sample size is taken. Using single population proportion formula by considering 23% of the under five-children had two-week prevalence of diarrhea from a study done in Kersa, Eastern Ethiopia by Bezatu Mengistie, Yemane Berhane, Alemayehu Worku, 2011 with 95% confidence level, 5% desired precision and taking design effect of 1.5, accounted for two stage sampling [10]. Adding 10% for none response rate, the total calculated sample size was 450 mothers with less than five years children.

Sampling Techniques

Multistage sampling was employed to select kebeles and households which have under-five children in the woreda. In the first stage all the kebeles stratified by place of residence as urban (only one small kebele) and rural. On the second stage the rural kebeles again stratified based on geographical and climate condition as low land/pastoral and mid land/agrarian kebeles because the residence area (urban and rural) and geographic/ climate condition by itself make a difference in socio economics among source population. From the total 13 rural kebeles 5 are mid land and 8 are low land. Then, from each stratum kebeles to be included in the study was allocated proportionally and selected randomly. Therefore, from rural strata 3 low land and 1 mid land kebeles as well as the only one kebele from urban strata taken as study population, from which the study unit was selected. As a result 5 kebeles were selected out of the total of 14 kebeles found in the district.

Similarly the number of households to be a study unit selected from each kebeles allocated proportionally. The systematic random sampling technique was used to take the mothers/caretaker-child pairs from each of the selected kebeles (small villages). Households with at least one under five years of age child was eligible for the study. One child- mother pair was selected at random to collect information on the child's demographic and health characteristics for

households with two or more under 5 years of age children. The first household was selected randomly and the subsequent households were selected systematically until the proportionately allocated sample size fulfilled. When the selected households had no under-five children, the next neighborhood household was selected. A brief illustration of the sampling procedure is displayed in the figure below.

Data Collection Instrument and Data Quality Control

The questionnaire was prepared based on EDHS and WHO core questionnaires related to diarrhea. The questionnaire was written in English, translated into Afan Oromo (local language), and then translated back into English to assure its accuracy. In order to ensure data quality data collectors and supervisors were trained on the data collection procedure. Data collection process was supervised by the principal investigators and supervisors. The filled questionnaire was checked for completeness and consistency on daily bases.

Data Collection Methods

Data was collected by interview using adapted standard questionnaire and administered by an interviewer. The respondents were primarily mothers of eligible children-under five years of age, but in the absence of the mother, the next primary caregiver will be interviewed. Five data collectors who were clinical nurses and Afan Oromo speakers were trained in questionnaire administration and data collection procedures. Pretest was done in 5% of the total sample size in another Kebele of the same study area. The result of the pretest was used to correct some unclear ideas and statements. The data collection was supervised by two supervisors (Health Officers) and the principal investigator at the center. Their role was to daily check the consistency, clarity and completeness of the collected questionnaires. The data collectors along with their supervisors took two days training about the questionnaire and data collection procedures.

Study Variables

The dependent variable is prevalence of diarrhea in under-five year children in the last two weeks period. The independent variables are socio-demographic factors such as place of residence, household size, parental education, maternal occupation, maternal age, number of children under-five years of age, family size and child's age and sex. Environmental factors were type of water source, distance to the water source, availability of latrine facility, availability of hand washing facility, number of rooms, livestock in house and refuse disposal method. Behavioral factors were feeding practices, hand washing practice, home based water treatment, duration of breast-feeding, breast feeding status, and time of introducing supplementary feeding.

Data Analysis

The data was coded and entered in to a computer using Epi-data 3.1 software and exported to SPSS V.20statistical software for cleaning and further analysis of the data. Descriptive statistics was done to describe the study populations using measures of frequency, disease occurrence, central tendency and dispersion that were displayed using tables and graph. The necessary assumption of logistic regression was checked using Hosmer and Lemeshow goodness-of-fit-test statistics. Due to the binary nature of the outcome variable, binary logistic regression analysis was used to determine the OR and 95% CI of the effect of the different independent variables on the outcome variable. To reduce excessive number of variables and instability of the model, only variables with P. value < 0.2 in the bivariate analysis will be considered for inclusion in the multivariate analysis to control for the effect of confounders. Variables with P-value < 0.05 in the multivariate analysis (final model) will be considered as independently associated with the outcome variable.

Ethical Consideration

Ethical approval and clearance was obtained from the research review committee of Madda Walabu University Goba Referral Hospital, Department of Public Health. Permission was obtained from concerned bodies of Harena Buluk district. Full verbal consent was obtained from the mothers/caretakers of the child after clear explanation given about the aim of the study. Confidentiality and privacy was maintained during data collection, analysis and reporting in which the information obtained from the respondents was not shared with anyone other than the data collectors and principal investigator. For Children with diarrhea and not get appropriate treatment during the data collection

time, the data collectors were provide ORS and advised their family to take them to the nearby health institution for better management.

Result

A total of 450 households were included in the study and a complete response (100%) was obtained from all respondents. The mean age of the respondents was 27.93+6.52SD years with the majority of them 247 (54.9%) were 25-35 years of age. The majority of the respondents 270(60%) were illiterate and 386(85.8%) were house wife by occupation. The majority of the Households 334(74.2%) had one or two under five children in their family and the mean family size of the Households was 6.55 persons. Almost all 403(89.6%) of the respondents were Muslim in religion. (Table 1).

Environmental Characteristics of the Households

Three hundred thirty four (74.2%) and 75 (22.5%) of the households had latrine and hand washing facility respectively. Majority of the latrine facility of the households were 304(91%) private and 330(98.8) of them were not improved type and 72 (21.3%) of the households had unclean latrine or feces seen around the hole of pit latrine. Most of the households 232(51.6%) disposes their waste material properly. 230(51.1%) of the households use improved type of water source and 118(26.2%) of the households take 30 minute or more to fetch water. 170(37.8%) of the households treat their drinking water at home (Table 2)

Behavioral Characteristics of the Respondents

Majority of the respondents give their child 410 (91%) other food in addition to BF. Most of the respondents 243(59.3%) were prepare gruel and 239 (58.3%) of the respondents feed their children using their hand. Most of the respondents 209 (46.4) wash their hand using water only (Table 3).

Demographic and Health Characteristics of the Indexed Children

Two hundred thirty one (51.3%) of the children were females with the majority of the children 161 (35.8%) were in the age group of 12-24 months. The mean age of the children was 24.55(±13.63 SD) months. 263(58.4%) and 285(73.5%) of the children receive Rota and measles virus vaccine respectively. In this study, 128(28.4%) of the children had experience diarrhea in the two weeks period preceding the study (Table 4).

Factors of Childhood Diarrhea

In the bivariate analysis number of under five children in the household, household family size, occupation of mother, education of the fathers, occupation of fathers, place of Residence, religion, average family monthly income were found to be significantly associated with under-five diarrhea. The odds of having diarrhea in household with tow and less number of under five children were 4.18 times less likely than the odds in household with more than two under five children [COR: 0.239, 95% CI (0.152-0.375)] children who live in the household of five or less family size were 1.83 times less likely prone to diarrhea when compared to those children live in the household greater than five family member [COR: 0.545, 95% CI (0.347-0.857)]. Children of fathers who completed primary education were less probable to have diarrhea compared to children of mothers who were illiterate [COR: 0.69, 95% CI(0.45-1.06)]. Likewise children of fathers who were secondary and above educational status were more than three times less likely to experience diarrhea compared to children of mothers who were illiterate [COR: 0.28, 95% CI(0.11-.71)]. Children from households of urban community were about 1.5 times less likely to have diarrhea compared to children of rural community households [COR: 0.67, 95% CI (0.37, 1.234)]. Children of house hold whose income more than one thousand were less likely to develop diarrhea compared to children of household whose income were one thousand and less birr per month [COR: 0.387, 95% CI(0.245,0.611)].Children of mothers whose occupation house wife were four times more likely to experience diarrhea as compared Children of mothers whose occupation were government employee. Children of mothers whose occupation were farmer three times more likely to have diarrhea compared to government employee Likewise children of mothers whose occupation were merchant two times more likely to have diarrhea compared to government employee. In this study Educational status of the mother, Age of mothers category, Occupation of fathers, Marital status, Ethnicity, Relation of respondents to child and Monthly income of family were not showed significant association with under five diarrhea (Table 5)

Table 1. Distribution of study subjects by demographic and socio-economic characteristics of the households in Harena Buluk, Oromia region, Ethiopia, 2018

Variables	**Responses**	**Frequency (n=450)**	**Percentage (%)**
Number of under five children in the household	Two and Less	334	74.2
	More than two	116	25.8
Household family size	Five and Less	162	36.0
	More than five	287	63.8
Educational status of the mother	Illiterate	270	60.0
	Primary school	149	33.1
	secondary and preparatory	26	5.8
	12+	5	1.1
Occupation of the mothers	Government employee	11	2.4
	Housewife	386	85.8
	Merchant	25	5.6
	Farmer	26	5.8
	Others	2	.4
Age of mothers category	15-24	142	31.6
	25-35	247	54.9
	35 and more	61	13.6
Education of the fathers	Illiterate	183	40.7
	Primary school	221	49.1
	Secondary and preparatory	29	6.4
	12+	17	3.8
Occupation of fathers	Government employee	23	5.1
	Merchant	29	6.4
	Farmer	385	85.6
	Daily labor	9	2.0
	Others	4	.9
Marital status	Married	428	95.1
	Divorced	10	2.2
	Single	6	1.3
	Widowed	6	1.3
Residence	Urban	72	16.0
	Rural	378	84.0
Religion	Muslim	403	89.6
	Christian	47	10.4
Ethnicity	Oromo	442	98.2
	Sidama	6	1.3
	Amara	2	.4
Relation of respondents to child	Mother	418	92.9
	Caretaker	32	7.1
Monthly income of family	≤1000	269	59.8
	>1000	**181**	**40.2**

Table 2. Distribution of study subjects by environmental characteristics of the households in Harena Buluk district, Oromia region, Ethiopia, 2018

Variables	Response	Frequency (n=450)	Percentage (%)
Number of rooms	One room	52	11.6
	Two rooms	289	64.2
	Three or more rooms	109	24.2
Animals live in same house	yes	135	30.0
	No	315	70.0
Latrine availability	Yes	334	74.2
	No	116	25.8
Type of latrine n=334	Improved	4	1.2
	Not improved	330	98.8
Latrine ownership n=334	Private	304	91
	Shared	30	9
Feces seen around the pit hole n=334	Yes	85	25.4
	No	250	74.6
Hand wash facility n=334	yes	75	22.5
	no	259	77.5
If no latrine where they use n=116	Open field	116	100
	Other	0	0
Refuse disposal method	proper	232	51.6
	improper	218	48.4
Water source	Improved	230	51.1
	Not improved	220	48.9
Time to water source	Thirty minute and less	332	73.8
	More than thirty minute and less	118	26.2
Home based water treatment	yes	170	37.8
	no	**280**	**62.2**

Table 3. Distribution of study subjects by behavioral characteristics of the respondents in Harena Buluk district, Oromia region, Ethiopia, 2018

Variables	Response	Frequency (n=450)	Percentage (%)
The child take other food than breast feed	Yes	410	91.1
	No	40	8.9
Type of food the child take mostly	Cow's milk	109	26.6
	Powder milk	4	1
	Gruel	243	59.3
	Adult food	54	13.1
Child feed method	Hand	239	58.3
	Cup and spoon	142	34.6
	Bottle	29	7.1
Hand washing method	Soap and water	167	37.1
	Ash and water	74	16.4
	Only water	**209**	**46.4**

Table 4. Distribution of demographic and health characteristics of the indexed children in Harena Buluk district, Oromia region, Ethiopia, 2018

Variables	Response	Frequency (n=450)	Percentage (%)
Sex	Male	231	51.3
	Female	219	48.7
Age category	Less than twelve month	116	25.8
	12-24 month	161	35.8
	25-35 month	45	10.0
	Greater than35 month	128	28.4
Current breast feeding status	Exclusive breast feeding	40	8.9
	Partial breast feeding	186	41.3
	Not breast feeding	224	49.8
Age at supplementary feeding n=410	Less than six month	10	2.4
	At six month	341	83.2
	Greater than six month	59	14.4
Duration of breast feeding	Less than one year	102	22.7
	One year and more	348	77.3
Measles virus vaccine n=388	Yes	285	73.5
	No	103	26.5
Rota virus vaccine	Yes	263	58.4
	No	187	41.6
Have diarrhea in the last two weeks	Yes	128	28.4
	No	**322**	**71.6**

Table 5. Bivariate analysis of Demographic and socio-economic determinants (P. value<0.2) of under-five diarrhea in Harena Buluk district, Oromia region, Ethiopia, 2018.

Variables	Responses	No diarrhea n (%)	Diarrhea n(%)	COR(95% C.I)
No of under five children in the HH	Two and Less	266(79.6)	68(20.4)	**0.239(0.152-0.375)**
	More than two	56(48.3)	60(51.7)	1
Household family size	Five and Less	128(79)	34(21)	**0.545(0.347-0.857)**
	More than five	193(67.2)	94(32.8)	1
Occupation of mother	Government employee	11(91.7)	1(8.3)	1
	House wife	267(69.7	116(30.3)	4.78(0.61-37.45)
	Merchant	26(81.2)	6(18.8)	2.54(0.27-23.64)
	Farmer	18(78.3)	5(21.7)	3.06(0.31-29.70)
Education of the fathers	Illiterate	120(65.6)	63(34.4)	1
	Primary school	162(73.3)	59(26.7)	0.69(0.45-1.06)
	Secondary and above	40(87)	6(13)	**0.28(0.11-0.71)**
Occupation of fathers	Government employee	21(91.3)	2(8.7)	1
	Merchant	24(82.8)	5(17.2)	2.18(0.38-12.47)
	Farmer	266(69.1)	119(30.9)	4.69(0.08-20.35)
	Daily labor	11(84.6)	2(15.4)	1.9(0.23-15.45)
Place of Residence	Urban	56(77.8)	16(22.2)	0.67(0.37,1.234)
	Rural	266(70.4)	112(29.6)	1
Religion	Muslim	284(70.5)	119(29.5)	1
	Christian	38(80.9)	91(9.1)	0.51(0.27,1.20)
Average family monthly income	≤1000 Birr	173(64.3)	96(35.7)	1
	>1000 Birr	149(82.3)	32(17.7)	**0.387(0.245,0.611)**

Environmental Determinants

Households' environmental variables and their relationship with under-five diarrhea were assessed on the bivariate analysis. But latrine availability, feces seen in the pit hole, hand washing facility, refuse disposal method, time to fetch water from source, home water treatment, number of rooms and animals live in same house were found to be significantly associated with under-five diarrheal morbidity.

Children from household who had no latrine were 3 times more likely to experience diarrhea compared to children from household who had latrine [COR: 2.91, 95% CI(1.86,4.54)]. Children from household who had clean latrine/ faces not seen around the pit or on the floor of latrine were 1.5 times less likely to experience diarrhea compared to children from household who had not clean latrine/ feces seen around the pit or on the floor of latrine [COR: 0.65, 95% CI (0.37,1.14)]. Children from households had no hand washing facilities were five times more likely prone for diarrhea compared to those children of households who had hand washing facilities[COR: 5.18, 95% CI (0.19,0.53)]. Children from households experience improper waste disposal were 2.2 times more likely to develop diarrhea compared to those children of household who dispose waste properly[COR: 2.22, 95% CI(1.46,3.38)]. Children from households who take below 30 minute to get water from source were four times less likely to develop diarrhea compared to those children of household get water after walking more than 30 minute [COR: 0.262, 95% CI(0.17,0.41)]. Children from households who treat water before using were less likely to develop diarrhea compared to those children from households who didn't treat water before using [COR: 0.52, 95% CI(0.33,0.82)]. Children of households use improved water source were three times less likely to experience diarrhea compared to children from households who use unimproved water source [COR: 0.32, 95% CI(0.19,0.53)]. Children of households had one room house were 3.5 times more likely to experience diarrhea compared to those children of house hold who had house of more than two rooms [COR: 3.6, 95% CI(1.74,7.41)]. likewise children of household had house of two rooms were 1.7 times more likely to develop diarrhea compared to those children of house hold who had house of more than two rooms [COR: 1.69, 95% CI(0.98,2.897)], and child of house hold live with animal in the same house were four times more likely to develop diarrhea compared to those children of house hold live in separated room from animal[COR: 3.9, 95% CI(2.52,6.04)] (Table 6).

Behavioral Determinants

In the bivariate analysis, current breast feeding status, type of food the child take (Powder milk and gruel), eating unwashed fruit, eating uncooked food, prepare child food separately, utensil washing methods, methods of child feeding, hand washing before food preparation, hand washing before food serving, hand washing after visiting latrine, and hand washing after cleaning of child bottom were the behavioral variables that showed significant association with under-five diarrheal morbidity.

Children who partially breast feeding were 4.5 times more likely to develop diarrhea when compared to children exclusively breast feed[COR: 4.5, 95% CI (1.53,13.21)]. Similarly children who didn't breast feeding were three times more likely to develop diarrhea when compared to children exclusively breast feed [COR: 3.44, 95% CI(1.18,10.08)]. Children usually taking gruel type of food were 1.5 times less likely compared to children eating other type of food [COR: 0.64, 95% CI(0.416,0.98)]. But child cow milk and adult type of food were not showed any significant association with under-five diarrheal morbidity. Children who didn't ate unwashed food were two times less likely to develop compared to those children who ate unwashed fruit [COR: 0.49, 95% CI(0.32,0.76)]. Children used to eat uncooked food were two times more likely to develop diarrhea compared to those children not used to eat uncooked food [COR: 2.02, 95% CI(1.2,3.39)]. Children of mothers who prepare their children food in separately were two times less likely to develop diarrhea compared to children of mothers prepare children food together with the family [COR: 0.42, 95% CI(0.27,0.65)]. Children of mother who used only water to wash utensil were 1.5 times more likely to develop diarrhea compared to children of mothers who used soap and water[COR: 1.58, 95% CI(1.01,2.48)]. Children of mother who wash their hand before food preparing were six times less likely to develop diarrhea compared to children of mothers who were not wash their hand

Table 6. Bivariate analysis of Environmental determinants (P. value<0.2) of under-five diarrhea in Harena Buluk district, Oromia, Ethiopia, 2018.

Variables	Responses	No diarrhea n (%)	Diarrhea n(%)	COR(95% C.I)
Latrine availability	Yes	259(77.5)	75(22.5)	1
	No	63(54.3)	53(45.7)	**2.91(1.86,4.54)**
Feces seen around the pit hole	Yes	61(71.8)	24(28.2)	1
	No	199(79.6)	51(20.4)	0.65(0.37,1.14)
Hand washing facility	Yes	70(93.3)	5(6.7)	1
	No	189(73)	70(27)	**5.18(2.01,13.37)**
Refuse disposal method	Proper	184(79.3)	48(20.7)	1
	Improper	138(63.3)	80(36.7)	**2.22(1.46,3.38)**
Time to water source	30 minute and less	263(79.2)	69(20.8)	0.262(0.17,0.41)
	More than 30 minute	59 (50)	59 (50)	1
Home water treatment	Yes	135(79.4	35(20.6)	**0.52(0.33,0.82)**
	No	187(66.8	93(33.2)	1
Number of rooms	One	28(53.8)	24(46.2)	**3.6(1.74,7.41)**
	Two	206(71.3	83(28.7)	1.69(0.98,2.897)
	More than two	71.60%	28.40%	1
Animals live in same house	Yes	69(51.1)	66(48.9)	**3.90(2.52,6.04)**
	No	253(80.3)	62(19.7)	1

before food preparing[COR: 0.158, 95% CI (0.098,0.254)]. Children of mother who wash their hand before food serving were two times less likely to develop diarrhea compared to children of mothers who were not wash their hand before food serving [COR: 0.49, 95% CI (0.32,0.76)]. Children of mother who wash their hand after visiting latrine were three times less likely to develop diarrhea compared to children of mothers who were not wash their hand after visiting latrine [COR: 0.29, 95% CI(0.19, 0.44)]. Children of mother who wash their hand after cleaning bottom of children were four times less likely to develop diarrhea compared to children of mothers who were not their hand after cleaning bottom of children [COR: 0.24, 95% CI (0.14,0.40)]. But hand washing before eating was not show significant association with under five children diarrhea. Children of mothers/care takers who wash their hand using water and soap/ash were 1.5 times less likely to develop diarrhea compared to those children of mothers/care takers who wash their hand with water only [COR: 0.69, 95% CI(0.46,1.04)]. Children who received Rota vaccine were two times less likely prone to diarrheal diseases compared to children not received rata vaccine[COR: 0.43, 95% CI(0.28,0.65)]. Similarly those children received measles vaccine were four times less likely prone to diarrheal diseases compared to children not received Rota vaccine[COR: 0.26, 95% CI (0.16,0.42)]. Length of breast feeding, age at supplementary food and method of children feeding were not show significant association with under five children diarrhea. (Table 7)

Factors for Under-five Diarrhea: Multivariate Analysis

In the bivariate analysis any possible confounders were not controlled and assessing the independent effects of the covariates was difficult. So, an enter method of binary logistic regression technique was used to assess the independent effects of explanatory variables on under five diarrhea. To avoid excessive number of variables and unstable estimate in the final model, only variables with P-value less than 0.2 in the bivariate analysis were taken in the multivariate analysis. Model fit was checked by Hosmer-Lemeshow goodness-of-fit test statistics.

The multivariate binary logistic regression analysis identified that number of under five children in the family, utilization of latrine, time from the source of water, home based water treatment, number of rooms in the home, animal live in the same house with the family, type of food child take, hand washing before food preparation, and mothers/care takers hand washing method had significant association with the occurrence of under-five diarrhea. The odds of having diarrhea in household with tow and less number of under five children were 3.7 times less likely than the odds in household with more than two under five children [AOR: 0.268, 95% CI(.08,0.90)].According to this study, children of household who had clean latrine/ faces not seen around the pit or on the floor of latrine was 3.4 times less likely to develop diarrhea compared to those clean latrine/faces seen around the pit or on the floor of latrine[AOR: 0.298, 95% CI(0.097,0.92)]. Time take less than 30 minuet to fetch water from source was 16.7 times less likely to develop diarrhea compared to time take more than 30 minutes to fetch water from source to home [AOR: 0.046, 95% CI (0.01,0.22)]. children in the households who treat water before drinking were 1.9 times less likely to had diarrhea compared to children in the households who do not treat water at home before using (AOR = 0.15, 95% CI: (0.04, 0.62). The odds of under five years of age children who live in house with one room had 6.01 times more risk of diarrhea as compared to the odds of children who live in house with more than two rooms [(AOR = 6.01, 95% CI(1.01,36.01)]. Children living with animals in the same house were more likely to develop diarrhea compared to children live in the house separately from animals [AOR: 8.31, 95% CI (2.46,28.06)]. Children who take gruel type of food were four times less likely to develop diarrhea as compared to children taking other type of food [AOR: 0.24, 95% CI (0.07,0.81)](Table 8)

Discussion

In this study the magnitude of under-five diarrhea in this study was 28.4% which is relatively similar with study conducted in India 25.2% [11], Cameron 23.8% [12], Rwanda 26.7% [13], Jabithennan District 26.1% [14], Jigjiga district 27% [15], and eastern Ethiopia kersa, Demographic Surveillance and Health Research Center (KDS-HRC) field site 22.5% [10]. However, the current finding was higher than the finding of the Ethiopian demographic and

Table 7. Analysis of behavioral characteristics of the respondents and health characteristics of index child (P. value<0.2) in Harena Buluk district, Oromia region, Ethiopia, 2018.

Variables		**No diarrhea n (%)**	**Diarrhea n (%)**	**COR(95% C.I)**
Current breast feeding status	Exclusive breast feeding	*36(90)*	*4(10)*	1
	Partial breast feeding	124(66.7)	62(33.3)	**4.5(1.53,13.21)**
	Not on breast feeding	162(72.3)	62(27.7)	**3.44(1.18,10.08)**
Taking Grule of food the child take	Yes	179(73.7)	64(26.3)	**0.64(0.416,0.98)**
	No	107(64.1)	60(35.9)	1
Eating unwashed fruit	Yes	123(62.1)	75(37.9)	1
	No	163(76.9)	49(23.1)	**0.493(0.32,0.76)**
Eating uncooked food	Yes	42(56.8)	32(43.2)	**2.02(1.2,3.39)**
	No	244(72.6)	92(27.4)	1
Prepare child food separately	Yes	169(78.2)	47(21.8)	**0.42(0.27,0.65)**
	No	117(60.3)	77(39.7)	1
Utensil washing Methods	Water only	171(66.3)	87(33.7)	**1.58(1.01,2.48)**
	Water and soap	115(75.7)	37(24.3)	1
Methods of child feeding	Hand	160(66.9)	79(33.1)	0.70(0.32,1.54)
	Cup and spoon	109(76.8)	33(23.2)	**0.43(0.19,0.99)**
	Bottle	17(58.6)	12(41.4)	1
Hand washing Before Food preparation	Yes	206(88)	28(12)	**0.16(0.098,0.254)**
	No	116(53.7)	100(46.3)	1
Hand washing Before Food serving	Yes	239(76.1)	75(23.9)	**0.49(0.32,0.76)**
	No	83(61)	53(39)	1
Hand washing After visiting latrine	Yes	215(82.1)	47(17.9)	**0.29(0.19, 0.44)**
	No	107(56.9)	81(43.1)	1
Hand washing After cleaning child bottom	Yes	142(87.7)	20(12.3)	**0.24(0.14,0.40)**
	No	180(62.5)	108(37.5)	1
Means of hand wash	Soap or Ash	181(75.1)	60(24.9)	0.69(0.46,1.04)
	Water only	141(67.5)	68(32.5)	1
Child measles vaccination status	Vaccinated	221(77.5)	64(22.5)	**0.26(0.16,0.42)**
	Not vaccinated	49(47.6)	54(52.4)	1
Child Rota vaccination status	Vaccinated	208(78.8)	56(21.2)	**0.43(0.28,0.65)**
	Not vaccinated	**114(61.3)**	**72(38.7)**	**1**

Table 8. Multivariate analysis of determinants (Value<0.05) of under-five diarrhea in Harena Buluk district, Oromia region, Ethiopia, 2018.

Variable name		COR(95%C.I)	AOR(95%C.I)
Number of under five children in the household	Two and Less	0.239(0.152-0.375)	**0.268 (0.08,0.902)**
	More than two	1	1
Cleanness of latrine	No faces seen in the pit	0.65(0.37,1.14)	**0.298 (0.097,0.918)**
	Faces seen pit of the latrine	1	1
Time to fetch water from source	30 minute and less	0.262(0.17,0.41)	**0.046 (0.009,0.219)**
	More than 30 minute	1	1
Home water treatment	Yes	0.52(0.33,0.82)	**0.153 (0.038,0.619)**
	No	1	1
Number of rooms	One	3.6(1.74,7.41)	6**.025(1.008, 36.007)**
	Two	1.69(0.98,2.897	0.871(0.231,3.274)
	More than two	1	1
Animals live in same house	Yes	3.90(2.52,6.04)	**0.313 (2.463,28.058)**
	No	1	1
Type of food the child take	Gruel	0.64(0.416,0.98)	**0.243 (0.073,0.806)**
	Other type of food	1	1
Hand washing before food preparation	Yes	0.158 (0.098,0.254)	**0.195 (0.066,0.574)**
	No	1	1

health survey 2016 [8], in which the magnitude of diarrheal disease among children younger than 5 years old was 12%, and also the current finding also relatively high compared to a study done in Adama rural district 14.7 % [14] and relatively low compared to a study done in Enderta woreda, Tigray 35.6% [15]. This difference could be attributed to the sample size, study period (rainy season), socio-economic and cultural difference, and basic environmental and behavioral characteristics of the respondents.

Of all the socio-economic variables considered, only the number of under five children in the household remained significant after controlling child demographic and health, environmental and other socio-economic variables. The finding on number of under five children in the household had impacts on the occurrence of diarrhea in children. It proposed that households with small number of under-five children experienced low chance of a child being spared of diarrhea compared to household with large number of under five children. This study is consistent with cross-sectional studies done in Benishangul Gumuz [24], west Gojam zone [16] and eastern Ethiopia [10]. This might be due to the incapability of the caregiver to care for a large number of children. It is possible to suggest that child birth spacing might have a positive influence on prevention of diarrhea.

Children of household who had clean latrine or not faces seen around the pit or on the floor of latrine were three times less likely to develop diarrhea compared to children of household who had not clean latrine or faces seen around the pit of the latrine. This study is consistent with the study conducted in Idiofa, Democratic Republic of the Congo [17]. This explored that there is a strongly positive relationship of the presence of feces around the pit hole with the higher prevalence of diarrhea.

In this study walking time to fetch water from source was an important determinant of diarrhea. Children in households who spend less than 30 min to get water access for domestic purpose were the least vulnerable to diarrhea compared with those with who spend 30 and more minutes to get drinking water. This finding was in agreement with studies conducted in different study areas on the relationship between household walk time to water source and child health outcomes identified walk time to water source as an important determinant of child health such as study done in Haremaya , kersa [18] and in Shebedino by Bezatu Mengistu, 2013 [10]. These may be due to the time burden of water fetching has been suggested to influence the volume of water collected by households as well as time spent on income generating activities and child care. In addition even if the water is obtained from an improved source, when the water needs to be fetched from a source that is not immediately accessible to the household, it may become contaminated during transport or storage.

This study also revealed that availability of home based drinking water treatment practice was an independent predictor of diarrheal morbidity. Children whose household's families used home based drinking water treatment were less likely to prone for diarrheal disease when compared to those who did not use any home based water treatment. Because collected water is prone for contamination during collection, transportation and storage which may in turn increase risk of diarrheal diseases. This finding is in agreement with study conducted in Senegal [19], but contradicts with other previous studies done in different parts of Ethiopia [16] This difference might be attributed to the various methods of home based water treatment, and difference in the overall sanitation of the environment, access to safe drinking water, consumes drinking water of poor quality due to lack of proper handling and hygiene during transport and storage steps, and lifestyle of the community.

Children of mothers, who washed their hands before preparing/cooking food, one of the critical times for hand washing, were significantly negatively associated with the occurrence of diarrheal morbidity. Children of mothers who washed their hands before preparing food were more than five times less likely to report diarrhea, compared to children of mothers who were not washed their hand before preparing/cooking food. The finding was in agreement with similar study conducted in Jigjiga District, Somali Region [15]. Eastern Ethiopia, in Sheko district, Southwest Ethiopia [20] where mothers' hand washing habits affected the occurrence of diarrheal disease among their children. This indicates that since the mothers were the main caregivers for their children they should wash their hands before preparing food infants and young children to tackle the occurrence of hygiene related disease. Studies have also indicated that the proper hand washing before feeding. This study also indicated that poor maternal hand washing practices were positively associated with the occurrence of diarrheal morbidity.

Children living in the house of less than two rooms were found to have significantly higher of developing diarrhea morbidity compared to children from household that had more than two rooms. This finding is in agreement with study conducted in Meskanena, Mareko Woreda, Southern Ethiopia [21] and Debre Birhan [22].

This study also shows that households living together with the cattle in the same house were positively associated with the occurrence of diarrhea morbidity. who live separately from cattle were more than seven times less likely compared to Children from the household who live together with cattle in the same house. This study is supported by study conducted in Debre Birhan [22]. Unlikely most of the studies this study revealed that gruel type of food that children took had four times less likely to develop diarrhea compared children who took other type of food (powder milk, cow milk and adult food). This may be due to most of gruel types of foods are eaten after cooked and cooked separately for children; this may contribute for the food

hygiene and to make it free of pathogen organisms when compared to cow milk or powder milk.

In this study, the sanitary facility (availability of hand washing facility, availability of latrine, type of latrine, and waste disposal method) were not showed any significant association with under-five diarrhea after controlling the other factors. This is in line with the findings from Sheko district rural community [23]. But it is in contrast with cross-sectional studies done in Benishangul-Gumuz Regional State [24] and west Gojam zone [16]. This may be explained by having of this facilities doesn't necessarily indicate their utilization and again may be due to the homogeneous effect of the populations.

Conclusion

From this study we conclude that the magnitude of diarrhea among under five children was 28.4% and this was relatively high despite health extension package and water and sanitation programs were conduct in the district. The independent variables that were found to be the major predictors of under-five diarrhea were number of under five children in the household, number of rooms in the house, sanitation status/cleanness of latrine, living with animal in the same house, hand washing before food preparation, time take to fetch water from the source, home based water treatment, and type of food children take. The sanitation facilities (availability of latrine, type of latrine, hand washing facility, and waste disposal method) and source of water supplies were not showed any significant relation with the occurrence of diarrhea. So, expanding family planning service and improve the utilization rate, constructing improved water source and giving HE to the community about home and environmental sanitation and hand washing methods at critical hand washing time were recommended.

Competing Interest

The authors declare that they do not have conflict of interest.

Authors' Contribution

SG have conceived and designed the study, performed the data analysis and write up of the final result. AT participated in designing the study, performed the statistical analysis, writing the results and discussion and prepared the manuscript.

Acknowledgement

We would like to thank Madda Walabu University Goba Referral Hospital, Department of public health for their support in the study. We would also like to thank data collectors and study participants for their time and support during the study

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