Health Education and Care

Research Article ISSN: 2398-8517

Socio-economic, behavioral and environmental factors associated with diarrhea among under five children in health development and non-health development army member mothers in Wondogenet, south Ethiopia

Fekadeselassie Berhe Zedie[1] and Dejene Hailu Kassa[2]

[1]Hawassa University College of Medicine and Health Science, Hawassa, Ethiopia

[2]Hawassa University College of Medicine and Health Science, School of Public Health Hawassa, Ethiopia

Abstract

Introduction: Diarrhea is one of the leading causes of death in children in sub-Saharan countries where socio-economic, behavioral and environmental factors play significant roles in causation and distribution of the disease. Ethiopia has established Health Development Army (HDA), a neighborhood women group which enhances active participation of women in health promotion activities. Despite HDA has been implemented for the last couple of years, its effect on the major childhood diarrhea has not been studied in Ethiopia. The purpose of this study was to assess the effect of HDA initiative and other factors related to childhood diarrhea.

Method: A community based comparative cross-sectional study was conducted to compare prevalence of diarrhea among 406 children from HDA and 402 non-HDA member mothers. Households with under five children were included. Data were collected using pre- tested questionnaire through a household survey. Multivariate logistic regression was used to measure the association between diarrhea and independent variables. Odds ratios with 95% confidence intervals were used to report the relative effect of explanatory variables on diarrhea.

Result: The reported prevalence of under five diarrhea among children from HDA (11.1%) was lower than among those from non-HDA (18.4%) member households (P. Value=0.004). Under five years children from non-HDA member households were two folds more likely to have diarrhea compared to those in HDA members [AOR: 1.88, 95%CI (1.05, 3.37)]. Child from privately employed mothers[OR: 5.08, 95%CI (1.88, 13.66)], distance of latrine from the house [OR: 2.63, 95%CI (1.16, 5.97)], households without separate kitchen[OR: 3.42, 95%CI (1.77, 6.62)], washing hands without soap [OR: 2.37, 95%CI (1.06, 5.27)] and improper disposal of child feaces [OR: 0.10, 95%CI (0.05, 0.23)] predicted child diarrhea.

Conclusion: Prevalence of diarrhea was reduced among children from HDA member households. Safe Hygiene practices should be emphasized in order to prevent diarrhea among children.

Introduction

Diarrhea is among the top causes of mortality and morbidity in children. In 2015, 9 percent of global child mortality was caused by diarrhea. This indicates that nearly 526,000 children under five years of age die per year which means 1400 children are lost a day or 1 child per 60 seconds [1]. The highest rates of child mortality occur in sub-Saharan Africa which is 15 folds higher than the average for developing regions. Despite the evidence from different sources that the mortality of under five children has generally decreased since 1990, the morbidity has not shown significant improvement in some countries [1-3].

Ethiopia is one of the 15 countries reported high burden of under five deaths due to pneumonia and diarrhea in 2015 [3]. In the country, under five mortality rate was 67 deaths per 1000 live births in 2016. This means that 1 in 15 children in Ethiopia die before reaching age of five years [4]. In 2015, pneumonia, neonatal sepsis, malnutrition, diarrhea, malaria and low birth weight were among the ten major causes of child mortality [5]. According to health indicator of the country, diarrhea is the first cause of outpatient visit (24.88%) and the second cause of hospital admission (11.94%) [5]. The national child survival strategy estimates that 88% of under five child deaths due to diarrheal can be prevented by simple interventions [6]. In the Southern Nations, Nationalities and Peoples Region (SNNPR), under five mortality and morbidity (two week diarrheal prevalence) was 88 deaths per 1000 and 13.9 % is greater than the national value of 67 deaths per 1000 and 11.8 %, respectively [4]. And it was one of the leading causes of morbidity in the study area in 2016 G.C according to the district health department report.

The risk factors associated with diarrheal disease in the country include, unhygienic and unsafe environment, child age, low educational status of mothers, overcrowding, unhygienic disposal method of feaces and wastes, poor handling of drinking water, lack of personal hygiene

Correspondence to: Hawassa University College of Medicine and Health Science, Hawassa, Ethiopia, E-mail: fekadese_berhe@yahoo.com

Key words: *health development army, under five diarrhea, risk factors*

Received: December 12, 2018; **Accepted:** December 21, 2018; **Published:** December 24, 2018

and lack of access to sanitation facilities are the main ones [7-9]. There are also known and proven cost-effective child survival interventions for risk factors including: vaccinations, exclusive breast feeding, complementary feeding, water sanitation and hygiene, micronutrient supplementation and oral dehydration therapy. In many countries, progress has been made in the delivery or promotion of several of these interventions to reduce child mortality and morbidity. But, these available interventions are not being effectively delivered to most at risk, in poor settings and children in hard to reach communities who need them [10]. Ethiopia is one of the countries trying to reach this disadvantaged group of people by implementing different kinds of strategies. One of these strategies is called health extension program (HEP). Ethiopia has made progress in expanding coverage of key interventions. The HEP which is a primary health care strategy [11] has been the foundation for expanding and bringing primary health care services closer especially to the rural communities. Accordingly, the ministry of health has implemented multi-pronged approaches to bring about reduction in child morbidity and mortality. One of the approaches believed to improve access to-and increase the demand of child care is establishment and mobilization of health development army (HDA). The HDA consists of voluntary women groups established in villages for dissemination of key maternal health services to women in the reproductive age to improve an overall awareness. The aim of this innovative intervention was to extend health extension program (HEP) deeper into the community and to reach every household for health promotion activities. HDA is the key strategy in Ethiopia to scale up best practices by organizing and mobilizing networks of 5 households. One of the women who are a HDA member and are practicing healthy behavior, leads the network and gradually influences the rest of the households to acquire skills and changes in attitude towards healthy behavior and thinking in the network creates favorable conditions to engage communities and providers in health in a dialectical process of behavior change. All the HDA members are expected to participate in regular meetings, evaluated by a committee established at kebele level for their active participation in group discussions and practices made in disease prevention activities at household level, technically supported by the Health Extension Workers (HEWs), and they are responsible for facilitating and follow-up their activities [11-13]. In this study we considered a woman who says I "am not a member", who is not regularly attending the meetings, do not have evaluation results and could not tell meeting schedules six months preceding the study.

Since the establishment of HDA in 2010, few studies have published findings of HEP on improvements in primary health /services/ units [14, 15]. However, none of them investigated the role of HDA in improving morbidity and mortality among the children. Therefore, the objective of this study was to assess the effect of HDA membership at a household level and associated risk factors on childhood diarrhea.

Methods

This study was conducted using a community based comparative cross-sectional survey. It was done in Wondogenet district located 268 kilometers south of Addis Ababa, the capital of Ethiopia. The district was selected purposively because of high burden of diarrheal diseases in children under five years old as reported by the district health office in 2016 G.C. There are 16 rural kebeles (the smallest administrative unit in Ethiopia's government structure) in the study district. During the study period, a total of 24,681 under five children reportedly live in the district. About 90% of the residents are farmers who receive primary health care services from five public health centers (each serve up to 25,000 population) and 13 health posts (each serve 5, 000 populations).

The minimum sample size required was estimated based on predetermined assumptions including: 95% confidence interval, 80% power of study, 1:1 ratio of HDA to non- HDA, 16.4 % prevalence of diarrhea in under five in SNNPR [16] and OR of 2.0. Thus, the calculated sample size was 196 from HDA and 196 from non-HDA households and a total of 816 women-child pairs were required considering a 5% non-response rate and a design effect of 2.0 to account for large sampling error due to cluster sampling (kebeles).

The study employed a multistage sampling technique since the target populations are distributed over a wider range of geographical area. At the first stage, 4 kebeles from a total of 16 rural kebeles were randomly selected using table of random numbers. At the second stage, all households with children aged under five year were identified from the reference populations residing in the selected kebeles and listed to establish a sampling frame for both HDA and non-HDA households. This was done through a house to house enumeration prior to the actual data collection. Then, by using a systematic sampling technique, households were selected from both HDA and non- HDA member households and included in the study. The number of households with children under 5 to be enrolled to the study was determined in proportion to the size of reference population in each kebele. In case of more than one child in a given household, the lottery method was used to select one child.

The data were collected in April 2016 by trained data collectors. A structured questionnaire was developed in English in a way that includes variables like socio economic, demographic, environmental and behavioral characteristics to meet the desired objectives. The questionnaire was then translated to Amharic (local language) for better understanding of the enumerators and the respondents.

Before the data collection date, HDA and non- HDA household were coded. In addition to that, both the interviewers and supervisors were given interview guide which was developed before the training, and observing them how data collectors administer the questions to the respondents to minimize interviewer bias. Some households were also checked, to make sure that none are missed by the data collectors. All collected questionnaires were checked for the completeness at the end of the day by the data collectors and supervisors. Frequencies and proportions were calculated and used to describe the characteristics of the study population. SPSS version 20 was used for data analysis. Adjusted odds ratios with 95% confidence interval were calculated using multiple binary logistic regressions to control for known confounding factors.

At the first step of data analysis, a chi-square test was run to verify whether there is difference in demographic, socio-economic status and behavioral factors between respondents from HDA and non-HDA households. Then, a bivariate logistic regression analysis was used examine the association between the dependent and independent variables. All variables which were found to have a p-value <0.25) were selected as potential candidates for multivariable logistic regression model. Finally, a multivariate logistic regression analysis was run to assess the association between explanatory variables and the outcome factor and Hosmer-Lemesho test was found insignificant confirming the model fitness.

The Institutional Review Board of Hawassa University Health Science College approved the study and official letter of permission was obtained from the concerned body to conduct the study. Data collection was started after verbal consent was obtained from individuals. At the time of data collection, individuals were informed about the purpose, confidentiality, the right not to participate or withdraw at any time.

During the study period, children that found sick were referred to nearby health institution for further case management.

Results

A total of 406 and 402 women-child pairs from HDA and non-HDA households respectively were enrolled making a response rate of around 99.5% in both groups. The majority in HDA and non-HDA members reported a family size of at most five persons. More than ninety percent in HDA and non- HDA member mothers were housewives and almost two thirds HDA and non-HDA members attended primary education as shown in Table 1.

Nearly one fourth, of under five children from HDA and one third from non-HDA member respondents were in the age range of 12-23 months and close to half children residing in both household members were male. At least one under five child was reported from majority of HDA and non-HDA households. Diarrhea episodes reported in two weeks preceding the survey were compared between HDA and non-HDA households. The prevalence of diarrheal diseases among children whose mothers were non- HDA member was higher 74(18.4%) compared to 45 (11.1%) among children whose mothers were HDA members (P.Value=0.004). The majority of the cases, 20(44.4%) in HDA and 26(35.5%) non-HDA members attended health institutions to seek treatment for their sick children.

As shown in Table 1, environmental and hygiene related characteristics, over half HDA and two thirds of non-HDA dwellers live in houses with mud-floors. Less than one fifth women in HDA and non-HDA, reported that they had no latrines to use while, more than 97% of the latrines were owned privately in two household groups. In both household categories, close to half and little more than that of the latrines was constructed in a distance between 6 to 10 meters in HDA and non-HDA households, respectively. Excreta were observed in the yards of 51(12.6%) HDA and (40 10%) non-HDA member households. Open refuse disposal method was practiced in 90 (22.2%) HDA and 71 (17.7%) non- HDA households, respectively. For more than one thirds of the study groups, domestic animals shared rooms with human in HDA and non-HDA households. Improper disposal of children's stool was observed in one tenth of households in each category. Hand washing after visiting toilets was always exercised by non-HDA respondents than respondents from HDA members, Tables 1 and 2 below.

The study showed that being a member of HDA, mothers' occupation, distance of latrine from the house, availability of separate kitchen, hand-washing practice with soap, proper disposal of children's feaces and child age were significant predictor of under five diarrhea.

Children from non- HDA members were 1.88 times more likely to have diarrhea than those whose mothers were member of HDA [OR: 1.88, 95%CI (1.05, 3.37)]. In this study, mothers status of work was related to childhood diarrhea; children whose mothers were self or private employed were 5 times more likely to concede diarrhea than children whose mothers were housewives [OR: 5.08, 95%CI (1.88, 13.66)]. Children residing in households whose latrines were located between 6 to 10 and above 10 meter from the household were 2.64 and 3.22 times more likely to concede diarrhea than children whose household latrines were situated less than or equal to 6 meters [OR: 2.63, 95%CI (1.16, 5.97)] and [OR: 3.22, 95%CI (1.26, 8.24)], respectively. Children from households that had no separate kitchen were 3.43 times more likely to concede diarrhea than children whose households had separate kitchen [OR: 3.42, 95%CI (1.77, 6.62)]. Children whose mothers did not treat water at home were 12.88 times more likely to concede diarrhea than their counterparts [OR: 12.88, 95%CI (1.42, 116.57)]. Children whose mothers used soap sometimes or didn't use at all for hand washing were 2.37 and 33.33 times more likely to concede diarrhea than children whose mothers used soap always for hand washing [OR: 2.37, 95%CI (1.06, 5.27)], and [OR: 33.33, 95%CI (13.58, 76.98)], respectively. Children from households that disposed child feaces in a latrine or into a dug pit were 89% and 94% less likely to have diarrhea as compared to those that disposed in open field [OR: 0.10, 95%CI (0.05, 0.23)] and [OR: 0.05, 95%CI (0.01, 0.22)] respectively. Children in the age between 12 to 23 months were 3.74 times more likely to have diarrhea than children with age less than 6 months [OR: 3.74, 95%CI (1.23, 10.53)] as shown in Table 3.

Discussion

This study assessed the role of HDA membership in the prevention of diarrhea among under five children and identified associated factors. The findings show that being a member of the HDA by women in the community has reduced under five diarrhea by an absolute difference of 7.5% points compared to children from non-HDA member mothers. Moreover, age of the children, distance of the latrine from the house, home water treatment and hand-washing practice, presence of separate kitchen and disposal practices of children's faeces were identified as independent predictors of under five diarrhea.

Different community interventions improved the health of the community particularly the health of children. HDA is one of the community interventions believed to improve the health status of children in Ethiopia. This study revealed that the two week period prevalence of diarrhea in under five children was significantly lower among children from HDA member mothers compared to those from non- HDA mothers. This difference may be attributed to the fact that, health extension workers technical support, follow-up and facilitation may improve knowledge, attitude and skill of HDA member mothers to practice more positive health behaviors than non-HDA member women. In addition to that, the follow-up made by HDA leaders is a source of encouragement for practicing healthy behaviors in a better way than non-HDA members. The frequent meeting of the members provides an opportunity for better understanding the causes and methods of preventing diarrhea in children under five years of age and thus, might be one possible reason for such observed differences in prevalence of diarrhea among children whose mothers are HDA members and the non-HDA members [11,13,17]. This was supported by literature which indicated that, households who regularly followed and technically supported by health extension workers show less diarrheal incidence among under five children than those who were not regularly supported [18].

Children whose families practiced open disposal of child feaces were more likely to develop diarrhea when compared to children whose families practiced safe methods of child feaces disposal. When households dispose child feaces indiscriminately, the probability of contamination of the surrounding environment is very high and a child crawling and playing nearby could easily be contaminated. The study conducted in different areas indicated that children whose stools were disposed in open field had higher risk of diarrhea than their counterparts [19-21].

In this finding, age of the child showed statistically significant associations with diarrhea, children in the age between 12-23 months were more affected compared to 0-5 months of age which was consistent with study conducted in Ethiopia [22, 23]. Children at these

Table 1. Socio demographic, economic and Environmental condition of Health development army and non-Health development army HHs, Wondogenet, Southern Ethiopia, April 2016

Variables	HDA HHs (406)		Non –HDA HH (402)			
	No	%	No	%	X^2Test	P value
Family size						
<5	244	60.1	286	71.1	10.92	0.291
>5	162	39.9	116	28.9		
Maternal age group						
15-24	109	27	141	35.3		
25-34	221	54.8	186	46.6	7.09	0.463
35-49	73	18.1	72	18		
Maternal educational status						
No formal education	99	24.4	99	24.6		
Primary educ. complete	261	64.3	270	67.2	2.80	
Secondary educ. Complete	36	8.9	28	7		0.871
Tertiary educ. complete	10	2.5	5	1.2		
Maternal occupation						
House wife	374	92.1	376	93.5		
Private employed	25	6.2	24	6	2.78	0.061
Government employed	7	1.7	2	0.5		
Possession of radio						
Yes	223	54.9	160	39.8	18.53	0.131
No	183	45.1	242	60.2		
Does the family have livestock						
Yes	292	71.9	285	70.9	0.1	0.507
	114	28.1	117	29.1		
No						
Type of floor						
Mud	222	54.7	273	67.9	14.90	0.025
Cement/ timber	184	45.3	129	32.1		
Number of room						
1	103	25.4	99	24.6		
2	86	21.2	114	28.4	5.91	
≥ 3	217	53.4	189	47		0.541
Do domestic animals Share rooms with humans						
Yes	100	34.2	117	41.1	2.85	0.488
No	192	65.8	168	58.9		
Latrine availability to use						
Yes	324	79.8	350	87.1	7.70	0.256
No	82	20.2	52	12.9		
Feaces seen around pit hole or floor?						
(observation (n=674))						
yes	60 18.5	18.5	86	24.6	3.63	0.236
no	264 81.5	81.5	264	75.4		
Feace seen around the house compound?						
(by observation)						
yes	51	12.6	40	10	1.38	0.416
no	355	87.4	362	90		
The house hold have hand washing facility around the latrine (674)						
Yes	50	15.8	47	13.4	0.55	0.250
No	274	84.6	303	86.6		
How do you dispose refuse?						
open field	90	22.2	71	17.7	2.57	0.943
burning	159	39.2	193	48	6.43	0.442
pit	68	16.7	93	23.1	5.16	0.671
decomposition	82	20.2	40	10	16.55	0.096
The HH have separate kitchen?						
yes	230	56.7	218	54.2	0.48	0.001
No	176	43.3	184	45.8		
Drinking water storage container has a cover?						
(by observation)						
yes	343	84.5	328	81.6	1.20	0.203
No	63	15.5	74	18.4		

Table 2. Childhood characters, maternal child care giving and hygiene related behavior characteristics of Health development army and non Health development army HHs, Wondogenet, Southern Ethiopia, April 2016

Variables	HDA HHs(406)		Non- HDA HH(402)		X^2 test	P value
	No	%	No	%		
Number of under 5 children in house hold						
1	233	57.4	207	51.5	3.08	0.08
2	164	40.4	187	46.5		
>=3	9	2.2	8	2		
child age in month						
≤ 5	56	13.8	51	12.7		
06-11	53	13.1	60	14.9		
12-23	99	24.4	125	31.1	7.46	0.003
24-35	96	23.6	87	21.6		
36-47	57	14	48	11.9		
48-59	45	11.1	31	7.7		
Diarrhea in the last two weeks						
Yes	45	11.1	74	18.4	8.63	0.004
No	361	88.9	328	81.6		
Water treatment at home						
Yes	31	7.6	23	5.7	1.19	0.024
No	375	92.4	379	94.3		
Hand wash before feeding a child						
yes always	233	57.4	259	64.4		
Yes some times	170	41.9	139	34.6	4.61	0.031
not at all	3	0.7	4	1		
Disposal method of child feaces						
Dispose in to open field	46	11.3	41	10.2		
Dispose in to latrine	325	80	318	79.1	3.66	
Dispose in to dug pit or buried	33	8.1	43	10.7		0.001
child always uses latrine	2	0.5	0	0		
Mother history of diarrhea in 2 wks						
Yes	21	5.2	31	7.7		
No	385	94.8	371	92.3	2.16	0.001
Use of soap/ash when washing hands						
Yes always	129	31.8	149	37.1		
Yes some times	208			43.8		
Not at all	69	51.2	176	19.2	4.52	0.001

age range are crawling or walking, have hand to mouth character could be easily be vulnerable to contaminated environment and may ingest disease causing microorganisms.

Other significant predictor of under five diarrhea was occupation of the mothers. Children whose mothers worked privately (outside of home) employed were more likely to develop diarrhea when compared to children whose mothers were house wives. These finding are consistent with study done in Central Ethiopia [24] which indicated that, children whose mothers were privately employed were more vulnerable to diarrhea compared to those whose mothers are housewives. This is related to the fact that mothers who spend more time outside of their house are less likely to give care to their children and they also could be exposed to different kind of microorganisms which could easily be transmitted to their children if they are not carefully taken care of themselves and their children [25].

Another source of remarkable difference in the prevalence of childhood diarrhea between children whose mothers were HDA and non-HDA members was observed in relation to hand-washing practices of mothers. Children whose mothers did not regularly wash hands with soap were more likely to develop diarrhea compared to those whose mothers always washed hands with soaps. This was consistent with the study conducted in Sheko and Jabithennan district in Ethiopia indicating that, mothers who wash hands using soap were less likely to report child diarrhea than mothers who use water only [18, 26].

Distance of larine was associated with occurrence of under five diarrhea. Households with latrines located at a distance greater than 6 meters had higher risk of diarrhea compared with children from households whose latrines were situated less than or equal to six meters. This may be related to a situation that the probability of using latrines far away from homes during night could be difficult. Guidelines prepared by the Loughborough University about design of latrines suggest that latrines should not be far away [27]. A document prepared for community led total behavior change in hygiene and sanitation in Ethiopia also recommends that the location of latrine needs to be 6 meter away from the house [28].

Children from households with no separate kitchen were more at risk of diarrhea than children living in households with separate kitchen; this finding is consistent with a case control study conducted in middle-income countries [29].

In our study, the prevalence of diarrhea was highest among the households which did not treat water at home. It is obvious that water

Table 3. Variables significantly associated with child hood diarrhea morbidity, Wondogenet, April 2016

Independent variable	**Childhood diarrhea**		**Crude OR (95%CI)**	**Adjusted OR (95%CI)**
	Yes (%)	No (%)		
House hold status				
Health development army	45(11.1)	361(88.9)	1.00	1.00
Non Health development army	74(18.4)	328(81.6)	1.81(1.21-2.69)*	1.88(1.05-3.37)*
Mother occupation				
House wife	105(14)	645(86)	1.00	1.00
Private/self employed	13(26.5)	36(73.5)	2.22(1.13-4.32)*	5.08(1.88-13.66)*
Government employed	1(11.1)	8(88.9)	0.76(0.09-6.20)	0.525(0.02-25.42)
Distance of latrine from the house				
Less than or equal to 6m	11(6.4)	160(93.6)	1.00	1.00
Between 6-10 m	51(14.8)	294(85.2)	2.52(1.27-4.97)*	2.63(1.16-5.97)*
Greater than 10m	33(20.9)	125(79.1)	3.84(1.86-7.90)**	3.223(1.26-8.24)*
Availability of separate kitchen				
Yes	48(10.7)	400(89.3)	1.00	1.00
No	71(19.7)	289(80.3)	2.04(1.37-3.04)**	3.42(1.77-6.62)**
Water collection container covered				
Yes	89(13.2)	585(86.8)	1.00	1.00
No	30(22.4)	104(77.6)	1.89(1.19-3.01)*	1.52(0.73-3.16)
Water treatment at home				
Yes	1(1.9)	53(98.1)	1.00	1.00
No	118	636(84.4)	9.83(1.347-71.799)*	12.88(1.424-116.567)*
Wash hand after visiting latrine				
Yes always	14(10.4)	353(89.6)	1.00	1.00
Yes some times	65(18.9)	279(81.1)	2.00(1.31-3.05)*	1.00(0.53-1.90)
Do not wash	13(18.6)	57(81.4)	1.96(0.99-3.89)*	0.64(0.23-1.81)
Use soap /ash when washing hands				
Yes always	13(4.7)	265(95.3)	1.00	1.00
Yes some times	50(13)	334(87)	3.05(1.62-5.73)*	2.37(1.06-5.27)*
Not at all	56(38.4)	90(61.6)	12.68(6.62-24.27)**	33.33(13.57-76.98)**
Child feces disposal method				
Dispose in to open field	35(40.2)	52(59.8)	1.00	1.00
Dispose in to latrine	72(11.2)	571(88.8)	0.187(0.114-0.307)**	0.10(0.05-0.23)**
Dispose in to dug pit or buried	12(15.8)	64(84.2)	0.27(0.13-0.59)*	0.05(0.01-0.22)*
child always uses latrine	0(0)	2(100)	0	0
Mother caught diarrhea in the last 2wks				
Yes	17(32.7)	35(67.3)	1.00	1.00
No	102(13.5)	654(86.5)	1.81(1.21-2.69)**	0.467(0.18-1.15)
No of child				
1	54(12.3)	386(87.7)	1.00	1.00
2	61(17.4)	290(82.6)	1.50(1.01-2.23)*	1.30(0.72-2.34)
>=3	4(23.5)	13(76.5)	2.19(0.69-6.99)	1.11(0.57-2.18)
Child age				
<= 5 months	8(7.5)	99(92.5)	1.00	1.00
6-11 months	16(14.2)	97(85.8)	2.04(0.83-4.98)	1.82(0.56-5.90)
12-23 months	50(22.3)	174(77.7)	3.55(1.62-7.80)*	3.74(1.23-10.53)*
24-35 months	28(15.3)	155(84.7)	2.23(0.97-5.10)	2.52(0.86-7.37)
36-47 months	10(9.5)	95(90.5)	1.30(0.49-3.44)	1.75(0.48-6.35)
48-59 months	7(14.7)	689(85.3)	1.22(0.43-3.62)	1.70(0.42-6.78)
Floor type				
Mud	84(17)	411(83)	1.00	1.00
Cement/timber	35(11.2)	278(88.8)	0.61(0.40-0.94)*	1.11(0.57-2.18)

Variables entered: mothers occupation, distance of latrine, availability of separate kitchen, does collection container has a cover, water treatment at HH level, do you wash hands after visiting toilet, use soap/ash when washing hands, mother history of diarrhea in last 2 wks, membership of health development army, number of child, child feces disposal method, type of floor, child age

N.B *indicate significance at P <0.05, ** indicate significance at P <0.001

may be contaminated from the source up to the time of consumption unless it is carefully kept. Findings from previous studies [30] indicated that household water treatment can significantly decrease childhood diarrhea.

Despite these useful findings reported in this study, there are some potential limitations that worthies mentioning in this study. Data for this study were collected in dry season (April 2016) when the prevalence of diarrhea is low, and hence the prevalence reported in the current study could be underestimated. In Ethiopia both HDA and non-HDA households are situated in a close neighborhood which might lead to information dissemination between the households which may bias the true effect of being member of HDA on childhood diarrhea.

Conclusion

Childhood diarrheal morbidity among non-HDA members is higher than children from HDA member households. The finding indicated that being a HDA member has a positive impact on diarrhea morbidity among under five children. Therefore, regular support and follow-up should be there to non-HDA households by the Health Extension Workers, in order to upgrade them to HDA members. Maternal education on hygiene practices, specially, for children whose mothers are self/privately employed, household water treatment, safe disposal method of child faces, short distance of latrines and availing separate kitchen are important to meaningfully reduce under five diarrhea in the community.

Authorship and contribution

Fekadeslassie Berhe has Masters in Public Health and is staff of Hawassa University, College of Medicine and Health Science, Ethiopia. Dejene Hailu (PhD) is Associate Professor in Public Health at Hawassa University, College of Medicine and Health Science, Ethiopia.

Both authors participated from the inception to the final write up of the study and read and approved the manuscript.

Acknowledgments

The authors thank the College of Medicine and Health Sciences of Hawassa University for the financial support for the study. Field workers, the study participants, and Wondogenet Woreda Health Office deserve special thanks for their diligent work during data collection, and facilitating the conduct of this study.

Funding

The study was funded by Hawassa University College of Medicine and Health Science.

Competing interests

The researchers declare that they have no any competing interest.

References

1. UNICEF (2016) One is too many: Ending child deaths from pneumonia and diarrhea. United Nations Children's Fund.
2. UN Inter-agency Group: UNICEF/WHO/UN/WORLD BANK (2015) Levels and Trends in Child Mortality estimation.
3. IVAC (2016) Johns Hopkins Bloomberg School of Public Health. Pneumonia and Diarrhea Progress Report: Reaching Goals through Action and Innovation. International Vaccine Access Center.
4. Central Statistical Authority and The DHS program ICF Rockville, Maryland, USA (2017) Ethiopia Demographic and Health Survey 2016, Addis Ababa, Ethiopia.
5. Federal Ministry of Health (2015) Health and Health Related Indicators EFY 2007 E.C.
6. Federal Democratic Republic of Ethiopia Ministry of Health, Family Health Department (2005) National Strategy For Child Survival In Ethiopia, Addis Ababa Ethiopia.
7. Mengistie B, Berhane Y, Worku A (2013) A Prevalence of diarrhea and associated risk factors among children under-five years of age in Eastern Ethiopia: A cross-sectional study. *Open Journal of Preventive Medicine* 3: 446-453.
8. Mohammed S, Tilahun M, Tamiru D (2013) Morbidity and associated factors of diarrheal diseases among under five children in Arba-Minch district, Southern Ethiopia. *Science Journal of Public Health* 1: 102-106.
9. Hashi1 A, Kumie A, Gasana J (2016) Prevalence of Diarrhea and Associated Factors among Under-Five Children in Jigjiga District, Somali Region, Eastern Ethiopia. *Open Journal of Preventive Medicine* 6: 233-246.
10. World Health Organization/The United Nations Children's Fund (UNICEF) (2013) Ending Preventable Child Deaths from Pneumonia and Diarrhea by 2025. The integrated Global Action Plan for Pneumonia and Diarrhea (GAPPD).
11. Federal Democratic Republic of Ethiopia Ministry of Health (2015) Health Sector Transformation Plan (HSTP); 2015/16 - 2019/20 (2008-2012 EFY).
12. Federal Democratic Republic of Ethiopia Ministry of Health. HEALTH SECTOR DEVELOPMENT PROGRAMME IV ANNUAL PERFORMANCE REPORT EFY 2003 (2010/11).
13. Bekele T, Rasschaert F, Assefa Y, Berhe A, Damme WV (2011) Disease Control Programs contribution to Health System Strengthening: Good practices and new approaches for scale up. A study by the Federal Ministry of Health, Ethiopia and The Institute of Tropical Medicine, Antwerp.
14. Bekele A, Kefale M, Tadesse M (2008) Preliminary Assessment of the Implementation of the Health Services Extension Program: The case of Southern Ethiopia. *Ethiop J Health Dev* p. 22.
15. Admassie A, Abebaw D, Woldemichael A (2009) Impact evaluation of the Ethiopian Health Services Extension Program. *J Dev Effect* p. 1.
16. Central Statistical Authority and ORC Macro, Ethiopia Demographic and Health Survey 2011, Addis Ababa, Ethiopia.
17. Federal Democratic Republic of Ethiopia Ministry of Health (2013) POLICY AND PRACTICE INFORMATION FOR ACTION Better Information Better Decision Better Health. *Quarterly Health Bulletin* p. 5.
18. Gebru1 T, Taha M, Kassahun W (2014) Risk factors of diarrhoeal disease in under-five children among health extension model and non-model families in Sheko district rural community, Southwest Ethiopia: comparative cross-sectional study. *BMC Public Health* 14: 395. [Crossref]
19. Bawankule R, Singh A, Kumar K, Pedgaonkar S (2017) Disposal of children's stools and its association with childhood diarrhea in India. *BMC Public Health* 17: 12.
20. Cronin AA, Sebayang SK, Torlesse H, Nandy R (2016) Association of Safe Disposal of Child Feces and Reported Diarrhea in Indonesia: Need for Stronger Focus on a Neglected Risk. *Int J Environ Res Public Health* 13: 310. [Crossref]
21. Sinmegn T, Asres G, Shimeka A (2014) Determinants of childhood diarrhea among under five children in Benishangul Gumuz Regional State, North West Ethiopia. *BMC Pediatr* 14: 102. [Crossref]
22. Gedamu G, Kumie A, Haftu D (2017) Magnitude and Associated Factors of Diarrhea among Under Five Children in Farta Wereda, North West Ethiopia. *Quality in Primary Care* 25: 199-207.
23. Dessalegn M, Kumie A, Tefera W (2011) Predictors of under-five childhood diarrhea: Mecha District, West Gojam, Ethiopia. *Ethiop J Health Dev* 25: 192-200.
24. Mamo A, Hailu A (2014) Assessment of Prevalence and Related Factors of Diarrheal Diseases among Under-Five Year's Children in Debrebirehan Referral Hospital, Debrebirehan Town, North Shoa Zone, Amhara Region, Ethiopia. *Open Access Library Journal* pp:1-14.
25. Gupte S, Kaur T, Kaur M (2015) Virulence Factors of Environmental Microbes in Human Disease. *J Trop Dis* 3: 2.
26. Alamrew Z, Andargie K, Tarekegn M (2017) Prevalence and determinants of acute diarrhea among children younger than five years old in Jabithennan District, Northwest Ethiopia. *BMC Public Health* 17: 99 [Crossref]
27. Read B (2014) Latrine Pit Design. WEDC, Loughborough University.
28. Amhara Regional State Bureau of Health Water and Sanitation Program/ World Bank USAID/Hygiene Improvement Project (HIP) (2007) Preparing for Community-led Total Behavior Change in Hygiene and Sanitation Participant Source Book.

29. Ferrer SR, Strina A, Jesus SR, Ribeiro HC, Cairncross S, et al. (2008) A hierarchical model for studying risk factors for childhood diarrhoea: a case–control study in a middle-income country. *Int J Epidemiol* 37: 805-815.

30. Mengistie B, Berhane Y, Worku A (2013) Household Water Chlorination Reduces Incidence of Diarrhea among Under-Five Children in Rural Ethiopia: A Cluster Randomized Controlled Trial. *PLOS ONE* p. 8. [Crossref]