Factors Associated with Acute Diarrhea among Children Aged 0-59 Months in Harar Town, Eastern Ethiopia

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Abstract

Background: Diarrhea is one of the leading causes of morbidity and mortality among children in sub-Saharan Africa, including Ethiopia. In Ethiopia in general and in Harar in particular, there is a scarcity of information on determinants of acute diarrhea and on mothers' feeding practice of their children aged 0-59 months.

Objective: The aim of this study was to identify the determinants of acute diarrhea among children aged 0-59 months in Harar Town, Ethiopia, from May 10 to 20, 2015.

Methods: A community based case control study was conducted on 358 mothers/caregivers (cases = 179, and controls = 179) of under-five children. The study participants were selected by a simple random sampling technique. Twelve experienced data collectors, supported by two supervisors, collected the data from the study participants using a pretested structured face-to-face interview questionnaire. The data were entered into Epi Data Version 3.1and processed with SPSS Version16.0. A bivariate and a multivariate logistic regression analyses were done to measure the association between the dependent and independent factors, and results are reported using Odds ratio and its 95% confidence interval (CI).

Results: The odds of diarrhea was five time higher among the children who hadn't been exclusively breastfeed [AOR=5.23, 95% CI (2.458-11.153)]. The children whose mothers' had history of diarrhea in the past two weeks [AOR=4.25, 95% CI (1.469-12.342)] and from households which hadn't practiced home based drinking water treatment [AOR=4.27, 95%CI (2.118-8.603)] were four time higher odds of diarrhea. Children consumed leftover foods [AOR=3. 17, 95% CI (1.249-8.059)], and from households contain feces around their latrine [AOR=3. 86, 95% CI (1.88-7.44)] were three time higher odds of diarrhea than their counterparts.

Conclusion: Poor practice of drinking water treatment, presence of feces around the latrine, maternal history of diarrhea, and inadequate exclusive breastfeeding were the major factors associated with the occurrence of acute diarrhea. Hence, continuous target specific education on home-based drinking water treatment, personal hygiene, environmental sanitation, and improved child-feeding practices should be strengthened.

Key work: *Acute diarrheal disease, Children feeding practice, Environmental Sanitation, Haramaya University*

Introduction

Worldwide, diarrhea remains as one of the leading sources of under-5 mortality, regardless of the many efforts against it. It accounts for more than 2,100 under-5 deaths daily (CDC, 2013), of which more than three-quarter occur in less developed countries (UNICEF/WHO, 2012), 42% in sub-Saharan Africa (UNICEF/WHO, 2009). The main causes of the deaths due to diarrhea were suboptimal infant feeding practice, lack of safe drinking water, poor personal hygiene, poor sanitation, and improper use of latrines (Ahs, *et al*, 2010; UNICEF/WHO, 2012). Furthermore, some mothers/ caregivers provide their children less quantities of fluid and food during diarrheal episode than the quantity they usually

provide. Some mothers even deny children anything to eat or drink during such conditions, which exposes the children to dehydration and death (Mohammad *et al.,* 2009).

As the UNICEF/WHO recommendation, infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development, and health. Infants should receive nutritionally adequate and safe complementary foods, side by side with breastfeeding for up to the age of two years a minimum (WHO, 2003).

Diarrhea is a major public health problem in Ethiopia. A survey in 2016 reported that 12% of the children aged 0-59 months and 23%-25% of those 6–23 months had diarrhea (FMOH, 2016; CSA and ICF, 2012; CSA and ICF, 2016). The prevalence of diarrhea is highest among the children of families that use water from unprotected wells (18%). The fatality related to diarrhea is still high in many developing countries, for instance in Ethiopia, according to the 2012 report, the infants and under-five mortality rate were 59 and 88 deaths per 1,000 live births (CSA and ICF, 2012).

In the study area, although many formal and informal sources of information indicate children are frequently affected by acute diarrhea, there is a scarcity of organized information on the factors of the disease and the mothers' feeding practice of their children during and after diarrhea episodes. Therefore, this study can give a clear picture of the determinants of acute diarrhea in Harar town. Study findings from this study can be used for designing intervention programs that will guide public health intervention targeting the acute diarrhea for this age group.

Materials and Methods
Study design and setting
A community-based quantitative case-control study design was conducted from March 10 to 20, 2015. The study was conducted in Harar town, Harari Regional State. Out of the 232,000 total population of the region, the number of children aged 0-59 months was 12.9% and the under-five mortality rate in the region was 72 per 1000, which is higher than the national figure-- 67 per 1000 live births (CSA and ICF, 2016). All the 0-59 months children living in Harar town were the source population whereas those living in randomly selected kebeles were the study population (Kebel is the smallest administrative unit in Ethiopia).

Sample Size Determination
The sample size was calculated using a double population proportion formula by considering the following assumptions: the proportion of respondents that had exclusively breastfed their children to be 13% and who did not exclusively feed to be 32% (Wondwossen, 2008). Eighty percent power, 95% confidence interval, and a 1:1 ratio of cases and controls used in the calculation. This gave 170 cases and 170 controls for the initial sample and 5% was added for non-response rate. Hence, the total sample size was 358 (179 cases and 179 controls)

Inclusions and exclusion criteria
All the under five years of age children who experienced acute diarrhea and no diarrhea in the preceding two weeks of the survey were taken as cases and controls, respectively. Children with persistent diarrhea were excluded from the study

Sampling procedure
Of the 19 kebels in Harar town, six were selected using a simple random sampling technique. We made a preliminary survey to identify the households that had at least one under-five child. We identified under-five children with diarrhea in kebels 13, 16 and 18. Children without diarrhea were registered from kebels 02, 06 and 09. A total of 752 cases from 2,425 households and 3032 controls from 1,916 households were enumerated.

The cases and controls were assigned proportionally to each kebeles. A sampling frame that enlisted all the eligible study participants was prepared; 179 cases and 179 controls were selected by using a simple random sampling technique. Where there was more than one child that had diarrhea in the same household, the one with recent history of the diarrhea was selected. Likewise, where there was more than one control in the same household, one child was selected using a lottery method.

Data Collection Technique and Tools
The data were collected from the study participants using a pretested structured face-to-face interview questionnaire prepared based on the WHO/ UNICEF core questionnaires related to diarrhea (WHO/UNICEF, 2006;WHO, 2005). It was first written in English, and then translated into Afan Oromo and Amharic languages, and finally translated back into English to assure its accuracy.

Data Quality control
The questionnaire was pretested and translated into Afan Oromo and Amharic languages to obtain quality data. The data collectors were trained for the purpose for two days and the supervisors made close supervision on daily bases and checked any incompleteness and inconsistency. Double data entry was used to decrease the data entry using EpiData version 3.1and analyzed by SPSS Version16.0.

Data processing and Analysis
Occurrence of acute diarrhea is the dependent variable and socio-economic status, environmental determinants, and behavioral factors were considered as independent factors. Diarrheal disease is the

occurrence of diarrheal episode in two weeks' time prior to the survey. Acute diarrhea is a diarrheal episode of three or more loose or liquid stools per day or as having more frequent stools than is normal for that child which lasts less than 14 days. Persistent diarrhea is a condition in which a child experiences loose or watery stools at least three times a day and persistently for more than 14 days. Leftover food is food remaining after others have eaten and left for a long time at room temperature before eaten afterwards.

Using SPSS Version 16.0, descriptive analysis was done to describe the study subjects, and a binary logistic regression was used to measure the association between the dependent and the independent factors. Odds ratio and its 95% confidence interval was used to report the output. For the multivariate analysis, the explanatory variables with p value of 0.2 or less in the crude analysis were considered; and statistical significance was set at P< 0.05.

Ethical Consideration
Prior to the data collection, we obtained an ethical clearance from the Institutional Research Ethics Review Committee of the Haramaya University. The study participants were informed about the purpose and the benefits of the study. Informed written consent was obtained before starting interviewing the mother/care giver. They were informed that the study would help us understand and identify of the determinants of acute diarrhea and the households' feeding practice of children aged 0-59 months, which will benefit to improve the services currently available. Participants' name and identification number was not documented in the questionnaire and that the information would not be used for another purpose.

Results
Socio-demographic and Economic Determinants
A total of 179 cases and 179 controls were expected to participate in the study, but, 175 cases (98%) and 177 controls (99 %) were participated. The mean age of the respondents was 29.2 years (±6.71 SD). The mean number of person in the household was 4.9 (±1.75 SD). In bivariate analysis, the occurrence of acute diarrhea had statistically significant association with family size, maternal age and monthly income of the family. The children of the mothers that did not attend formal education were three times more likely to have diarrhea compared to the children whose

mothers attended secondary education and above (Table 1).

Behavioral and environmental determinants
The mothers/caretakers' history of diarrhea, feeding children leftover food, and lack of exclusively breastfeeding were two, three, and four times more likely to cause acute diarrhea, respectively (Table 2).

In this study, the factors that had statistically significant association with acute diarrhea were the presence of feces around latrine, the practice of open field disposal of child feces, hand washing with only water (e.g. not using soap), and lack of home based drinking water treatment (Table 3).

In the final model, five factors remained significant predictors of acute diarrhea. These were lack of home-based drinking water treatment [AOR: 4.27, 95% CI:(2.12-8.60)], presence of feces around latrine [AOR: 3.74, 95% CI:(1.88-7.44)], lack of exclusive breastfeeding [AOR: 5.24, 95% CI: (2.46-11.15)], consumption of leftover food [AOR: 3.20, 95% CI: (1.26-6.51)], and maternal/caregiver's history of diarrhea [AOR: 4.26, 95% CI: (1.47-12.34)] (Table 4).

Table 1. Socio-demographic factors associated with acute diarrhea among children aged 0-59 months in Harar town, Ethiopia, 2015

Variable	Case (n=175)	Control (n=177)	COR (95% CI)	P-value
	N<u>o</u> (%)	N<u>o</u> (%)		
Family size				
<=3	34(19.40)	54(30.50)	1	
4-6	104(59.40)	102(57.60)	1.619 (0.97-2.69)	0.063
>=7	37(21.10)	21(11.80)	2.798 (1.41-5.56)	0.003
Age of the mother				
15-24	34(19.4)	40(22.50)	1	
25-34	89(50.8)	114(64.40)	0.918(0.54-1.57)	0.755
>=35	52(29.7)	23(12.90)	2.66(1.36-5.20)	0.004
Marital status				
Single	21(12)	20(11.29)	1.070(0.56-2.05)	0.838
Married	154(88)	157(88.7)	1	
Maternal education				
Unable to read and write	52(29.70)	29(16.4)	2.16(1.26-3.74)	0.003
Literate	123(70.30)	148(83.6)	1	
Occupation of the mother				
Government employee	25(14.30)	31(17.50)	1	
Housewife	107(61.10)	106(59.80)	1.25(0.69-2.26)	0.457
Merchant	26(14.80)	24(13.50)	1.34(0.63-2.89)	0.450
Private gainful work	17(9.70)	16(9.03)	1.32(0.56-3.12)	0.531
Educational status of the father				
No formal education	23(13.60)	18(10.70)	1. 46 (0.74 -2.19)	0.275
Primary	53(31.50)	45(26.70)	1.34(0.83-2.19)	0.233
Secondary and above	92(54.70)	105(62.50)	1	
Occupation of the father				
Government employee	56(33.30)	72(42.85)	1	
Farmer	12(7.10)	11(6.50)	1.40(0.576-3.41)	0.456
Merchant	35(20.80)	28(16.66)	1.61(0.88-2.95)	0.126
Private work	65(38.69)	57(33.90)	1.47(0.89-2.41)	0.132
Average monthly income				
<1000	41(23.40)	11(6.21)	9.32(2.45-35.48)	0.001
1000-5000	130(74.30)	156(88.10)	2.08(0.64-6.80)	0.224
>5000	4(2.28)	10(5.60)	1	

Significant association, p<0.05;

Table 2. Behavioral, child feeding related factors to acute diarrhea among children aged 0-59 months in Harar town, Ethiopia, 2015

Variables	Cases (n= 175) No (%)	Controls (n=177) No (%)	COR (95% CI)	P-value
Age of index child				
0-5 month	15(8.57)	19(10.70)	1.443(0.639-3.258)	0.378
6-11 month	39(22.20)	22(12.40)	3.240(1.623-6.468)	0.001
12-23 month	55(31.40)	49(27.60)	2.051(1.132-3.717)	0.018
24-35month	37(21.10)	34(19.20)	1.989(1.039-3.808)	0.038
>35 month	29(16.50)	53(29.90)	1	
Birth order				
First	40(22.85)	53(29.90)	1	
Second	42(24)	43(24.30)	1.29(0.717-2.337)	0.392
Third	36(20.57)	38(21.50)	1.255(0.68-2.318)	0.468
Fourth and above	57(32.57)	43(24.30)	1.756(0.99-3.107)	0.053
Child starts complementary feeding (n=166)				
After 6 months	96(57.80)	109(65.66)	1	
Before 6 months	70(42.16)	57(34.34)	1.394(0.87-2.23)	0.142
Exclusively breastfeed for 6 months				
Yes	105(60)	154(87)	1	
No	70(40)	23(12.90)	4.46(2.621-7.602)	0.000
Use leftover food to feed the child (n= 166)				
Yes	40(24.09)	15(9.40)	3.196(1.63-6.508)	0.000
No	126(75.90)	151(90.60)	1	
Still being breastfed				
Yes	113(64.57)	127(71.75)	1	
No	62(35.42)	50(28.24)	1.394(0.888-2.187)	0.149
Mother/caregiver had diarrhea in the last two weeks				
Yes	27(15.40)	13(7.34)	2.301(1.145-4.625)	0.019
No	148(84.57)	164(92.65)	1	
Serve uncooked foods to child				
Yes	135(81.30)	142(88.75)	1.812(0.968-3.390)	0.061
No	31(18.60)	18(11.20)	1	

Significant association, p≤0.05;

Table 3. Environmental factors associated with acute diarrhea among children aged 0-59 months in Harar town, Ethiopia, 2015

Variables	Cases (n=175)	Controls (n=177)	COR (95% CI)	P-value
	No (%)	No (%)		
Number of rooms				
<3	158(90.20)	153(86.40)	1	
≥3	17(9.70)	24(13.50)	0.686(0.355-1.327)	0.263
Source of drinking water				
Improved	159(90.85)	169(95.48)	1	
Unimproved	16(9.14)	8(4.50)	2.126(0.885-5.104)	0.086
Home based water treatment				
Yes	64(36.57)	120(67.79)	1	
No	111(63.40)	57(32.20)	3.651(2.350-5.672)	0.000
Presence of faces around the latrine				
Yes	64(48.10)	26(16.00)	4.852(2.827-8.326)	0.000
No	69(51.87)	136(83.95)	1	
Presence of feces in the compound				
Yes	47(26.85)	40(22.50)	1.258(0.774-2.044)	0.355
No	128(73.10)	137(77.40)	1	
Child stool disposal				
Child used the toilet	108(61.70)	129(72.80)	1	
Throw into garbage	37(21.10)	39((22.00)	1.133(0.67-1.902)	0.630
Left in the open field	30(17.10)	9(5.10)	3.98(1.81-8.75)	0.001
Maternal/caregiver use for hand washing				
Soap or detergent	122(69.70)	161(90.96)	1	
Only water	53(30.28)	16(9.03)	4.371(2.383-8.018)	0.000

Significant association, p≤0.05;

Table 4. Predictors of acute diarrhea among children aged 0-59 months in Harar town, Ethiopia, 2015

Characteristics	Cases (n=175)	Controls (n=177)	AOR (95%CI)
	No (%)	No (%)	
Family size			
<=3	34(19.40)	54(30.50)	1
4-6	104(59.40)	102(57.60)	1.509 (0.663-3.431)
>=7	37(21.10)	21(11.80)	2.388 (0.752-7.585)
Age of the mother			
15-24	34(19.40)	40(22.50)	1
25-34	89(50.80)	114(64.40)	1.286 (0.538-3.070)
>=35	52(29.70)	23(12.90)	3.037 (0.965-9.555)
Maternal education			
No formal education	52(29.70)	29(16.50)	1.405 (0.656-3.008)
Primary	62(35.40)	46(25.90)	0.703 (0.274-1.804)
Secondary and above	61(34.850)	102(57.60)	1
Home based water treatment			
Yes	64(36.57)	120(67.79)	1
No	111(63.40)	57(32.20)	4.269 (2.118-8.603)*
Use for hand washing			
Only water	53(30.28)	16(9.03)	1.513 (0.589-3.889)
Soap or detergent	122(69.70)	161(90.96)	1
Presence of feces around latrine			
Yes	64(48.10)	26(16.00)	3.742 (1.881-7.444)*
No	69(51.87)	136(83.95)	1
Exclusively breastfeed			
Yes	105(60)	154(87)	1
No	70(40)	23(12.90)	5.235 (2.458-11.153)*
Age of index child			
0-5 month	15(8.57)	19(10.70)	0.881 (0.128-6.070)
6-11 month	39(22.20)	22(12.40)	2.172 (0.773-6.101)
12-23 month	55(31.40)	49(27.60)	0.985 (0.414-2.344)
24-35month	37(21.10)	34(19.20)	1.819 (0.751-4.404
>35 month	29(16.50)	53(29.90)	1
Stool disposal			
Child used the toilet	108(61.70)	129(72.80)	1
Throw into garbage	37(21.10)	39((22.00)	1.638 (0.685-3.917)
Open field disposal	30(17.10)	9(5.10)	1.009 (0.152-6.711)
Feed the child leftover food (n = 166)			
Yes	40(24.10)	15(9.04)	3.196 (1.263-6.508)*
No	126(75.90)	151(90.96)	1
History of Mothers/caregivers had diarrhea in last two weeks			
Yes	27(15.40)	13(7.34)	4.258 (1.469-12.342)*
No	148(84.57)	164(92.65)	1

Significant association, $p \leq 0.05$; AOR, Adjusted Odds Ratio

Discussion

In this study, lack of home-based drinking water treatment, the presence of feces around latrine, lack of exclusive breastfeeding of a child, maternal/ caregiver's history of diarrhea, and consumption of leftover food were identified as the major determinants of acute diarrhea among the children.

The children whose families did not practice home based treatment of drinking water were four times more likely to get acute diarrhea (AOR:4.3, 95% CI: 2.1-8.6) compared to their counterparts. This finding is higher than the result of the study conducted in Derashe district in Southern Ethiopia, where it was two times more likely to get acute diarrhea AOR: 2.3, 95% CI: 1.4-3.6 (Godana and Mengistie, 2013). The difference might be attributed to the socio-demographic difference among the study households.

Diarrhea was significantly associated with exclusive breastfeeding. In this study, 40% of the cases were not exclusively breastfeed (EBF), and the risk of developing acute diarrhea among such infants was higher and statistically significant (AOR:5.24; 95% CI:2.46-11.15) compared to their counter parts (13% of the controls). This finding is consistent with the one reported from Qatar, where 33% did non-EBF with p value of less than 0.001 (Mohammad *et al.,* 2009). Exclusive breastfeeding limits exposure to ingestion of enteric bacteria from contaminated water, food and bottle-feeding, and offers extra protection against illness, hence reduces the episodes of diarrhea.

The study showed that maternal history of diarrhea predicts the occurrence of diarrhea morbidity in children. The fact that mothers are food handlers of the family and the main childcare providers; hence, the possibility of diarrhea among children with caretakers who had diarrhea is no surprise. It also indicates poor hygienic practice in the household results in the incidence of diarrhea among children. This is consistent with studies found in Southern Ethiopia (Alemu *et al.,* 2014) and in Debrebirehan, (Ayele and Awraris, 2014).

The cases in our study were nearly three times more likely to consume leftover food than the controls, which is a practice that facilitates bacterial growth, which can result in diarrhea. This finding is similar with the study finding in Derashe District, Southern Ethiopia, where children with diarrhea were two-time more likely to consume leftover food by the cases (Godana and Mengistie, 2013).

Children whose families used home based water treatment were less likely to experience diarrhea compared to their counterparts. This is related to water contamination during fetching, transportation and storage, which might increase the risk of diarrhea. This result is consistent with a study result reported from southern Ethiopia (Godana and Mengistie, 2013).

The presence of feces around latrine was another independent predictor of under-five children diarrheal morbidity [AOR: 3.7; 95%CI: 1.9-7.4]. The finding is consistent with the study finding in Debre Berhan Town [AOR: 3.13; 95%CI: 1.5 -6.5] (Alelign et al, 2016). This is an important implication that the mere presence of latrine does not have a great contribution to the prevention of excreta related disease, unless used properly and kept its cleanliness.

In the current study, source of drinking water did not show statistically significant association with diarrhea morbidity. This finding is inconsistent with the results of the study conducted in Derashe district, Southern Ethiopia (Godana and Mengistie, 2013) and in Eastern Ethiopia, where source of drinking water showed a significant association with diarrhea morbidity (Mengistie et al, 2013). This difference might be attributed to less information exposure about the risk the factors of acute diarrhea and their prevention methods among the participants of this study.

The mothers/caregivers who used water only for hand washing were four times more likely to have acute diarrhea compared to the mothers who used soap or any detergent for hand washing (COR= 4.4, p<0.000). This finding is similar to the study finding in Derashe district, Southern Ethiopia, where two times more likely to get acute diarrhea (COR=1.8, P<0.03) (Godana and Mengistie, 2013).

The children whose mothers/caretakers had diarrhea were more likely to experience diarrhea compared to the children whose mother/caretakers were literate. This result is consistent with Harith's and Abebaw's results in Iraq (AOR=3.7) and Enemay district, northwest Ethiopia (AOR =2.5) (Harith *et al.,* 2014; Abebaw *et al.,* 2014). Mother's literacy influences hygiene practices, child feeding, and sanitation practices, which in turn very important factor for childhood diarrhea

Limitation of the study

As the study design was a case control, there might be a recall bias; however, this was minimized by using reported diarrheal prevalence of cases limited to a 2-week period.

Conclusion and recommendations

Lack of home-based drinking water treatment, lack of exclusive breastfeeding of children, maternal/caregiver history of diarrhea, consumption of leftover food, presence of feces around latrine, and improper disposal of infant feces were the main determinants of acute diarrhea among under-five children. All the predictors are amenable through strengthening and hands-on training of mothers/caregivers about home based drinking water treatment through health extension program should be emphasized. Maximizing environmental hygiene and good sanitation practice such as clean and proper use of latrine is paramount importance. Adequate information for mothers/caregivers on child feeding practices, especially during diarrhea episode to follow of WHO recommendations. Emphasizing on exclusive breastfeeding is crucial to reduce child morbidity and mortality from acute diarrhea.

Acknowledgments

Conflict of interest

We declare that we do not have any financial and non-financial competing interests

Authors' Contributions

BG, BM and FM participated from inception of idea, proposal development, data collection, analysis and final write up. BM and RA has participated in the amendment of proposal and draft manuscript, analysis, and interpretation of data; critically revised the manuscript. All authors read and approved the final draft of the manuscript.

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