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ORIGINAL RESEARCH

Determinants of Acute Diarrhea Among Children Under-Five in Northeast Ethiopia: Unmatched Case–Control Study

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Mekdess Wesenyeleh Delelegn[1]
Aklilu Endalamaw[2]
Getaneh Mulualem Belay[1]

[1]Department of Pediatrics and Child Health Nursing, School of Nursing, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia; [2]Department of Pediatrics and Child Health Nursing, School of Health Sciences, College of Medicine and Health Sciences, Bahir Dar University, Bahir Dar, Ethiopia

Background: Diarrheal disease is the second leading causes of death among under-five children. Most of the death due to diarrhea is reporting in developing countries. To prevent this highly prevalent problem, identifying the contributing factors across different settings is necessary. Therefore, this study aimed to identify the determinants of acute diarrhea among under-five children in the Northeast part of Ethiopia.

Methods: An institution-based unmatched case–control study was conducted among 306 under-five children from March to April 2019. A systematic random sampling technique was employed to select study participants. Data were collected by face to face interviews using a pretested structured questionnaire. Data were entered using Epi-info 7 and analyzed with SPSS version 20.0. We applied logistic regression analysis. Those variables with p-value <0.05 were significant determinants of acute diarrhea.

Results: Improper child's stool disposal [AOR=4.12; 95% CI (1.25,13.5)], absence of home-based water treatment [AOR=2.85; 95% CI (1.27,6.42)], did not wash hand at critical times [AOR=5.47; 95% CI (1.68,17.8)], did not practice exclusive breastfeed [AOR=3.32; 95% CI (1.21,9.14], unable to get counseling from health professionals [AOR= 3.23; 95%,CI (1.15,13.5)], provide left over food to the child [AOR=2.96; 95% CI (1.19,7.32)], and maternal diarrhea [AOR=6.06; 95% CI (2.42,15.22)] were determinants of acute diarrhea among under five children.

Conclusion: Most of the determinants of acute diarrhea could be preventable. Thus, collaborative intervention by emphasizing health education about the importance of personal and environmental hygiene, safe food handling, exclusive breastfeeding practice, and home-based water treatment are essential.

Keywords: acute, diarrhea, determinants, Ethiopia, children

Introduction

Globally, there were nearly 1.7 billion cases of childhood diarrheal disease by the end of the 2017 year that is the second leading cause of death among under five years of children.[1] It contributes to one in eight deaths among children younger than 5 years.[2] Similarly, approximately 525,000 children continue to die each year.[1] Of these, 90% occur in Sub-Saharan Africa and South Asia.[3]

Likewise, acute diarrhea is one of the major contributors to the deaths of under-five-year-old children in Ethiopia. Based on the World Health Organization's (WHO) estimate, diarrhea contributes to more than one in every ten (13%) child deaths in Ethiopia.[4] According to the Ethiopian Demographic Health Survey

Correspondence: Aklilu Endalamaw
Department of Pediatrics and Child Health Nursing, School of Health Sciences, College of Medicine and Health Sciences, Bahir Dar University, P.O. Box 79, Bahir Dar, Ethiopia
Tel +251 945842524
Email yaklilu12@gmail.com

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(EDHS) 2016 report, 12% of under-5 children had a diarrheal episode within two weeks before the survey.[5] In addition to the major cause of child mortality, diarrhea predisposes children to malnutrition and infections.[1] The economic and educational consequences of diarrhea for children are clear with, for example, missed school days and workdays, affecting cognitive development and family resources that in turn influence health outcomes.[6]

As an opportunity, diarrheal diseases are both preventable and treatable through simple and affordable interventions.[1] Strengthening health systems to provide such interventions to all children will potentially save many young lives,[7] which helps to fulfill the aim of Sustainable Development Goals (SDG). The SDG-3 aims to end preventable deaths of newborns and under-five children by 2030.[8] Improvements in safe water and sanitation, improved nutrition,[9] increased use of oral rehydration therapy (ORT), exclusive breastfeeding practice, optimum supplemental feeding, vaccination, and food safety awareness are the recommended approaches to reduce diarrheal disease.[10,11] The Ethiopian government also have been implemented these various strategies to prevent and control diarrhea.[12] Besides, after the introduction of the rota vaccine, the burden of diarrheal diseases is decreasing. A single study in Ethiopia from 2011–2016 showed that the proportion of diarrhea hospitalizations due to rotavirus among children <5 years of age decreased by 17% from 24% in the pre-vaccine period and to 20% in post-vaccine introduction era. Similarly, a reduction of 18% in the proportion hospitalizations due to diarrhea due to rotavirus in children <12 months of age in the post (27%) vs pre-vaccine (33%) periods was observed.[13]

Despite the implementation of recommendations, the burden of diarrheal diseases in developing countries are associated with different variables. Insufficient access to adequate hygiene, poor sanitation, unsafe drinking water, malnutrition, low maternal education, early weaning practice, and poor economic status[1,2,11,14,15] were reported determinants acute diarrhea from the previous studies. To achieve the global and national aims of reducing childhood mortality, operational researches designed to identify the factors of diarrhea across the different geographical areas is required. This clue indicates there is a need to search further determinants of diarrhea to give input for health-care policy and/or decision-makers. Therefore, this research identified the determinants of acute diarrhea among under-five children in the Northeast part of Ethiopia.

Methods

Study Period, Design, and Setting

A hospital-based unmatched Case-control study was employed from March 5 to April 20/2019 in Dessie referral hospital, Northeast Ethiopia. This study was conducted on mothers/caregivers with their children aged less than five years visiting the Dessie referral hospital.

Sample Size Determination and Sampling Technique

The sample size was determined by using a double population proportion formula, by considering the following assumptions/: confidence level = 95%, power = 80%, control to case ratio = 3:1, the proportion of respondents who practiced home-based water treatment to be 60.1% and that did not practice home-based water treatment to be 79.05% from a study conducted in Pawi hospital Ethiopia. After assuming a non-response rate of 10%, the overall sample size was 306 (77cases and 229 controls).

The cases were children with acute diarrhea in the pediatric outpatient department (POPD) coming for treatment during the study period. The controls were recruited from children without diarrhea coming to the same department during the same period for the treatment of other cases. The previous monthly flow of under-five children visiting Dessie referral hospital with acute diarrhea and without diarrhea was 260 and 986 respectively. Thus, K case=260/77= 3.37 approximately 3 and K control=986/229=4.3 approximately 4. The controls and the cases were selected by using systematic random sampling with K=3 for cases and k=4 for controls.

Data Collection and Data Quality Control

Data was collected using a pretested structured questionnaires through face-to-face interview with mothers/caregivers in the POPD. The pre-test was conducted on 31 participants in Gondar comprehensive specialized hospital, Ethiopia. Based on the pretest, the questionnaire was assessed for clarity, understandability, flow, missed data, structure, and modified accordingly.

The first eligible case was selected for interview mother/caregiver at POPD after the child was diagnosed. But if the selected child referred to the inpatient ward, mothers/caregivers were interviewed in the inpatient ward, where their child received the appropriate drug and/or supportive therapy. The data collection tool was first

prepared in English and then translated to Amharic and back to English. The questionnaires have three parts including, socio-demographic characteristics of the child and parent, environmental sanitation factors, and behavioral and childcare practice. Weight scale and meter were used to measure the height and weight of the child. WHO Anthro software was used to calculate the height for age, weight for age, and weight for height. Two trained BSc nurses collected the data. Another one BSc nurse supervised the data collection process.

Statistical Analysis

The collected data was entered into Epi-info Version 7 and exported to SPSS version 20.0 for analysis. Chi-square assumptions were checked for all independent variables. Binary logistic regression analysis was run to check the presence or absence of association between the dependent variable with each independent variable. For model fitness, Hosmer-Lemeshow goodness of fit was tested. The multicollinearity of the independent variables was checked. Multivariable logistic regression analysis was done for variables with a p-value of less than 0.2 in the bivariable analysis. Adjusted odds ratio (AOR) with 95% confidence interval (CI) and p-value were used to identify significant associated factors of the outcome variable. Variables with a P-value of less than 0.05 were claimed as determinants of acute childhood diarrhea.

Operational Definitions

Acute Diarrhea: Having diarrhea for less than 14 days.

Diarrhea: Having three or more loose or watery stools in a 24-hours as entirely reported by the mother/caretaker of the child.

Improved water source: Protected spring and piped water.

Unimproved water source: Pond, river, unprotected dug well, an unprotected spring.

Hand-washing at critical times: Hand-washing after visiting the toilet, before preparing food, before eating food/feeding the child and after feeding children. In this study, it was categorized as "Yes", which means when all practiced unless it was considered as "No".

Vaccination Status

- Appropriate for age: Children received all basic vaccinations according to their age based on the Expanded Programme for Immunization (EPI) in Ethiopia.
- Inappropriate for age: Children did not receive all basic vaccinations according to their age based on the Expanded Programme for Immunization (EPI) in Ethiopia.

Ethical Consideration

Ethical clearance was obtained from the Ethical Review Committee of the School of Nursing on behalf of the Institutional Review Board (IRB) of the University of Gondar. Written permission was taken to Dessie referral hospital manager, Northeast Ethiopia. Then, the respective manager permitted the focal persons. All mothers and caregivers provided informed consent, and that this study was conducted in accordance with the Declaration of Helsinki.

The purpose and benefit of the study was explained for mothers and children. Name or identification numbers of study participants were not recorded. Any patient data was kept strictly confidential and used only for the study purpose.

Results

Sociodemographic Characteristics of Parents

A total of 306 participants (77 cases and 229 controls) were involved with the response rate of 100% for cases and controls. The mean age of mothers of cases and controls was 27.62 (standard deviation (SD) ± 5.12) with a range of 18–45 years and 28.99 (SD ± 5.1) with a range of 20–52 years, respectively. The majority (81.8%) of cases' and (88.6%) controls' mothers were married. Of the total cases, 35.1% of mothers had primary education and 59.7% were housewives. The largest proportion (41%) of mothers of controls were graduated from college or university (Table 1).

Sociodemographic Characteristics of the Child

The median age of children was 17 with a range (1 to 59) months. From the cases, more than half (54.5%) were males and 50.7% of controls were males (Table 2).

Environmental Characteristics

The majority (97.4%) of cases and controls were from a family with latrine. Of those latrines, 70.1% cases and 82.1% controls were owned privately. Eighteen (23.4%) of cases were not disposing of child stool in the latrine,

Table 1 Socio-Demographic Characteristics of the Parents of Under-Five Children in Northeast Ethiopia, 2019

Characteristics	Case (77)		Control (229)	
	Frequency	(%)	Frequency	(%)
Maternal age				
18–24	20	26	38	16.6
25–34	48	62.3	160	69.9
≥35	9	11.7	31	13.5
Marital status of a mother				
Married	63	81.8	203	88.6
Divorced	8	10.4	19	8.3
Widowed	6	7.8	7	3.1
Religion				
Muslim	38	49.4	112	48.9
Orthodox	31	40.3	105	45.9
Protestant	8	10.3	12	5.2
Residence				
Urban	51	66.2	183	79.9
Rural	26	33.8	46	20.1
Family size				
≤5	65	84.4	194	84.7
>5	12	15.6	35	15.3
Mother's educational status	15	19.5	32	14
No formal education	27	35.1	63	27.5
Primary	16	20.8	40	17.5
Secondary	19	24.6	94	41
University/college				
Mother's occupation				
Housewife	46	59.7	109	47.6
Governmental employee	16	20.8	71	31
Private gainful	15	19.5	49	21.4
Father's educational status				
No formal education	12	15.6	20	8.7
Primary	18	23.4	28	12.3
Secondary	14	18.2	30	13.1
Collage/University	33	42.8	151	65.9
Father's Occupation				
farmer	24	31.2	28	12.2
Government employee	27	35.1	138	60.3
Merchant	19	24.6	56	24.4
Other*	7	9.1	7	3.1
Monthly income				
≤1000	15	19.4	37	16.2
1000–5000	36	46.8	83	36.2
>5000	26	33.8	109	47.6
Family size				
≤5	65	84.4	194	84.7
>5	12	15.6	35	15.3

Note: Others*, Drivers and NGO workers.

whereas 94.8% controls disposed child stool in a latrine. Two hundred eighty-six participants used an improved source of water. About 82.5% of controls were treated drinking water at home, whereas 50.6% of cases did not use home-based water treatment (Table 3).

Childcare and Behavioral Characteristics

The majority (64.9%) of cases and 96.9% of controls were washed their hands at critical times. From controls, only 6.1% of mother's/caregivers had used only water to wash their hands, whereas 93.9% used both water and soap to wash their hands. Around three-fourth of the cases and 93% of controls had practiced exclusive breastfeeding. The majority (81.8%) of cases and 93% of controls were heard about diarrhea prevention and transmission. Thirty-four (44.2%) of cases and 7.4% of controls had a maternal history of diarrheal in the previous 2 weeks. Most of 88.3% of cases and 81.5% of controls were received appropriate immunization for their age (Table 4).

Determinants of Acute Diarrhea

After adjustment for the possible effects of confounding, in the multivariable analysis, seven factors remained significant determinants of acute diarrhea. These were improper child stool disposal, absence of home-based water treatment, did not wash hand at critical times, did not practice exclusive breastfeeding, did not get counseling from health professionals, feed the child with leftover food, and maternal history of diarrhea within the previous two weeks.

This study showed that children whose stool disposed of improperly were four times more likely to develop

Table 2 Socio-Demographic Characteristics of Under-Five Children in Northeast Ethiopia, 2019

Variables	Case (77)		Control (229)	
	Frequency	(%)	Frequency	(%)
Child age				
<6 month	11	14.2	14	6.1
6–11 month	22	28.6	57	24.9
12–23 month	16	20.8	59	25.8
24–35 month	11	14.3	39	17
≥36 month	17	22.1	60	26.2
Sex				
Male	42	54.5	113	49.3
Female	35	45.5	116	50.7
Birth order				
First	27	35.1	77	33.6
Second	29	37.7	90	39.3
Third	12	15.5	36	15.7
≥fourth	9	11.7	26	11.4
#U-5 children in the house				
1	55	71.4	183	79.9
≥2	22	28.6	46	20.1
Place of delivery				
Health facility	74	96.1	222	96.9
Home	3	3.9	7	3.1

acute diarrhea than children disposed of their stool in latrine [AOR=4.12; 95% CI (1.25,13.5)]. The odds of developing acute diarrhea were around three times higher among children whose families did not treat drinking water compared with children whose families treated water for drinking [AOR=2.85; 95% CI (1.27,6.42)]. This study revealed that children whose mothers/caregivers did not wash their hands at the critical time were nearly five times more likely to develop diarrhea than children who did handwashing at the critical time [AOR=5.47; 95% CI:1.68,17.8]. Children who did not exclusively breastfeed were three times more likely to experience acute diarrhea compared to those children who breastfeed exclusively [AOR= 3.32; 95% CI (1.206,9.14)]. Children whose mothers had not been counseled by health professionals were three times more likely to develop acute diarrhea compared to children whose mothers counseled by health professionals [AOR= 3.23; 95% CI (1.15,9.09)]. Children who consumed left-over food were nearly three times more likely to have acute diarrhea compared with children who did not consume left-over food [AOR=2.96; 95% CI (1.19,7.32)]. This study also revealed that children mother who had a history of diarrhea in the previous two weeks was six times more likely to develop diarrhea than without a history of maternal diarrhea in the previous 2 weeks [AOR= 6.06; 95% CI (2.42,15.22)] (Table 5).

Discussion

The result of this study revealed that preventable factors remained significant determinants of acute diarrhea. Children whose stool did not dispose of properly were more likely to develop acute diarrhea than children whose stool disposed of properly. This finding is supported by the study conducted in Benishangul Gumuz region Ethiopia,[16] Pawi Hospital Ethiopia,[17] west Gojjam Ethiopia,[18] and India.[19] An increase in the unsafe disposal of children's stool in the community also increased the risk of diarrhea in children.[19] Improper stool disposal could be including dump waste on the ground, in surface waters, in a landfill, or open field. These create an opportunity for diarrhea causative agents to finish their lifecycle and/or continue their chain of transmission after they are ingested by animals or humans.[20] Therefore, the proper disposal of a child's stool has a great contribution to the prevention of excreta-related disease.

Water can be contaminated by diarrheal causes of pathogens, harmful chemicals, industrial wastes and pesticides, and human and animal wastes.[21] For this, globally, household water-treatment system, like boiling, household slow sand filter, domestic chlorination (Wuha agar, and aqua tabs), filter machine is recommended to be implemented.[22] According to the current study, the odds of developing acute diarrhea was higher among children whose families did not treat drinking water as compared to their counterpart. This finding is consistent with a study conducted in Derashe district Ethiopia,[23] Wolaita-Soddo Ethiopia,[24] and Harar Ethiopia.[24] The possible hypothesis might be water can be contaminated during transport, storage, or by the method to take water from storage containers. Subsequently, it creates a suitable environment for the multiplication of protozoan, bacterial, viral, fungal, and parasitic causes of water-borne diseases in non-treated water and they could cause diarrhea disease after they enter into a human body.[25]

In this study, among the behavioral practices, children whose mothers/caregivers did not wash their hands at the critical time more likely to develop diarrhea than children whose mothers did hand-washing at critical times. This

Table 3 Environmental Characteristics Among Under-Five Children in Northeast Ethiopia, 2019

Characteristics	Case (77)		Control (229)	
	Frequency	(%)	Frequency	(%)
Animal lives in the same house				
No	57	74	186	81.2
Yes	20	26	43	18.8
Availability of latrine				
No	2	2.6	6	2.6
Yes	75	97.4	223	97.4
Latrine ownership				
Privately	54	70.1	188	82.1
Shared	21	27.3	35	15.3
Open field (those who did not have latrine)	2	2.6	6	2.6
Child faces disposal				
In latrine	59	76.6	217	94.8
Not in latrine	18	23.4	9	5.2
Waste disposal				
Pit	20	26	68	29.7
Open field	4	5.2	3	1.3
Burning	16	20.8	36	15.7
Garbage can	37	48	122	53.3
Water source				
Improved	63	81.8	214	93.4
Not Improved	14	18.2	15	6.6
Distance to a drinking water source				
≤15 minutes	63	81.8	195	85.2
>15 minutes	14	18.2	34	14.8
Home-based Water treatment				
No	39	50.6	40	17.5
Yes	38	49.4	189	82.5
Type of water Storage container				
Pot	9	11.7	16	7
Bucket	17	22.1	81	35.4
Jerican	46	59.7	126	55
Other **	5	6.5	6	2.6
Duration of water without changing				
≤1 day	25	32.5	79	34.5
>1 day	52	67.5	150	65.5
Does the container have cover				
No	5	6.5	3	
Yes	72	93.5	226	1.3
				98.7
Method of drawing				
Pouring	44	57.1	131	57.2
Deepening	33	42.9	98	42.8
Presence of Handwashing facility near to a toilet				
No	30	39	43	18.8
Yes	47	61	186	81.2
Type of floor of house-made from				
Cement	49	63.6	171	74.7
Mud	28	36.4	58	25.3
Number of rooms				
<3	26	33.8	56	24.5
≥3	51	66.2	173	75.5
Separate kitchen				
No	14	18.2	28	12.2
Yes	63	81.8	201	87.8

Note: Other**, water tanker.

finding is supported by a study conducted in Addis Ababa Ethiopia,[26] west Gojjam Ethiopia,[18] and Zambia.[15] This can be justified by the fact that handwashing remains the most effective way of preventing germs and spread of diseases, like diarrhea and it can reduce diarrhea episodes by one third.[27] Furthermore, hand washing after defecation, after handling of fecal materials, before preparing food and after feeding the child could reduce the occurrence of childhood diarrhea.

The result of this study also showed that children who did not exclusively breastfeed were more likely to experience acute diarrhea as compared to those children who breastfeed exclusively. This finding is consistent with a study conducted in Zambia[15] and Uganda[28] and Vietnam.[29] This finding is explained by the fact that exclusively breastfeed for the first six months of life is a key to achieve optimal growth, development, health and it gives

Table 4 Child Care and Behavioral Characteristics Among Under-Five Children in Northeast Ethiopia, 2019

Characteristics	Case (77)		Control (229)	
	Frequency	(%)	Frequency	(%)
Handwashing at a critical time				
No	27	35.1	7	3.1
Yes	50	64.9	222	96.9
Method of Handwashing				
Water only	15	35.1	14	6.1
Water and substrate	50	64.9	215	93.9
Exclusive breastfeeding				
No	18	23.7	16	7
Yes	58	76.3	213	93
Initiationof complementary feeding				
Before 6 month	19	25	21	9.4
After 6 month	57	75	203	90.6
Prepare the child food using a separate instrument				
No	17	22.4	30	13.4
Yes	59	77.6	194	86.6
Food cover after preparation				
No	3	4	5	2.3
Yes	73	96	219	97.7
Food/fluid child mostly receiving				
Cow milk	19	25	66	29.3
Adult food	26	34.2	102	45.4
Powder milk	16	21.1	22	9.8
Gruel	13	17.1	29	12.7
Other***	2	2.6	6	2.8
Method of feeding				
Hand	13	17.1	47	21
Bottle	30	39.5	62	27.5
Cup and spoon	20	26.3	62	27.5
Child feed him/herself	13	17.1	54	24
Heard about diarrhea prevention and transmission				
No	14	18.2	16	7
Yes	63	81.8	213	93
Source of information				
Television	45	58.4	159	69.4
Radio	55	71.4	158	69
Magazine/newspaper	9	11.7	48	21
Other****	4	5.2	9	3.9
Counseling from health professionals				
No	21	27.3	18	7.9
Yes	56	72.7	211	92.1
Feed the child leftover food				
No	45	58.4	213	93
Yes	32	41.6	16	7
Maternal history of diarrheal in the previous 2 wks.				
No	43	55.8	212	92.6
Yes	34	44.2	17	7.4
Vaccination status				
Appropriate for age	68	88.3	213	93
Inappropriate for age	9	11.7	16	7
Weight for height Z-score				
Normal	60	77.9	198	86.5
Wasted	17	22.1	31	13.5
Height for age Z score				
Normal	44	57.1	162	70.7
Stunted	33	42.9	67	29.3
Weight for age Z score				
Normal	53	68.8	185	81.5
Underweight	24	31.2	42	18.5

Notes: Other***, packed infant food; Other****, formal education and from other person.

extra protection against illness as a result.[30,31] Besides, EBF could prevent diarrhoeal illness among infants on EBF practice because they are relatively safe from contaminated foods, liquids, and unsafe water drinking.

Children whose mothers did not get counseled by health professionals were likely to develop acute diarrhea as compared to those counterparts. This might be accounted for counseling given by health professionals

Table 5 Bivariable and Multivariable Logistic Regression Analysis of Determinants of Acute Diarrhea Among Under-Five Children Northeast, 2019

Variables			COR (95% CI)	AOR (95% CI)
	Case	Control		
Residence				
Urban	51	183	1.00	
Rural	26	46	2.03 (1.14,3.59)	0.56(0.14,2.27)
Mothers educational status				
No formal education	15	32	2.32 (1.06,5.09)	1.92 (0.36,10.1)
Primary	27	63	2.12 (1.08,4.14)	1.67 (0.49,5.67)
Secondary	16	40	1.98 (0.92,4.24)	1.5 (0.4,5.3)
Collage/university	19	94	1.00	
Father's educational status				
No formal education	12	20	2.74 (1.22,6.16)	4.06 (0.57,7.53)
Primary	18	28	2.94 (1.46,5.93)	1.93 (0.37,9.96)
Secondary	14	30	2.13 (1.02,4.47)	3.2 (0.67,15.4)
Collage/University	33	151	1.00	
Father's occupation				
farmer	24	28	1.00	1.00
Government employee	27	138	0.23 (0.11,0.45)	0.51 (0.199,1.32)
merchant	19	56	0.39 (0.18,0.84)	0.47 (0.16,1.37)
other*	7	7	1.16 (0.35,3.8)	3.6 (0.76,17.76)
Monthly income				
≤1000	15	37	1.7 (0.81,3.55)	0.24 (0.04,1.19)
1000–5000	36	83	1.82 (1.02,3.25)	0.56 (0.18,1.72)
>5000	26	109	1.00	
Child age				
<6 month	11	14	2.77(1.06,7.21)	4.93 (0.8,30.29)
6–11 month	22	57	0.41 (0.65,2.82)	2.17 (0.66,7.1)
12–23 month	16	59	0.95(0.44,2.07)	1.09 (0.32,3.6)
24–35 month	11	39	0.99(0.42,2.35)	1.77 (0.46,6.69)
≥36 month	17	60	1.00	
Under-five children in the house				
1	55	183	1.00	1.22 (0.44,3.41)
≥2	22	46	1.59(0.881,2.87)	
Animal lives in the same house				
No	57	186	1.00	1.78 (0.54,5.82)
Yes	20	43	1.52(0.82,2.78)	
Child faces disposal				
In latrine	59	217	1.00	4.12(1.25,13.5)
Not in latrine	18	12	5.52(2.52,12.1)	
Latrine ownership				
Privately	54	188	1.00	0.66 (0.20,2.17)
Shared	21	35	2.08(1.124,3.88)	
Home-based Water treatment				
No	39	40	4.849 (2.76,8.51)	2.85(1.27,6.42)
Yes	38	189	1.00	

(*Continued*)

Table 5 (Continued).

Variables			COR (95% CI)	AOR (95% CI)
	Case	Control		
Cover of water container				
No	5	3	5.23 (1.22,22.4)	1.54 (0.08,26.82)
Yes	72	226	1.00	
Presence of Handwashing facility near to the toilet				
No	30	43	2.76 (1.57,4.86)	1.53 (0.43,5.45)
Yes	47	186	1.00	
Number of rooms				
<3	26	56	1.57 (0.89,2.75)	0.78 (0.23,2.65)
≥3	51	173	1.00	
Separate kitchen				
No	14	28	1.59 (0.79,3.22)	0.49 (0.11,2.27)
Yes	63	201	1.00	
Handwashing at a critical time				
No	27	7	3.715 (1.7,8.115)	5.47(1.68,17.8)
Yes	50	222	1.00	
Method of Handwashing				
Water only	15	14	3.715 (1.7,8.115)	0.332 (0.06,1.66)
Water and substrate	50	215	1.00	
Exclusive breastfeeding				
No	18	16	4.13 (1.98,8.60)	3.32(1.21,9.14)
Yes	58	213	1.00	
Complementary feeding				
Before 6 month	19	21	3.22 (1.62,6.4)	0.35 (0.21,1.73)
After 6 month	57	203	1.00	
Prepare the child food using a separate instrument	17	30	1.86 (0.96,3.6)	0.32 (0.08,1.22)
No	59	194	1.00	
Yes				
Heard about diarrhea				
No	14	16	2.95(1.37,6.39)	0.22 (0.03,1.31)
Yes	63	213	1.00	
Counseling from HP				
No	21	18	4.39(2.19,8.8)	3.23(1.15,9.09)
Yes	56	211	1.00	
Feed the child leftover food				
No	45	213	1.00	1.00
Yes	32	16	9.46 (4.79,18.7)	2.96(1.19,7.32)
Maternal history of diarrheal in the previous 2 wks.				
No	46	212	1.00	6.06(2.42,15.2)
Yes	31	17	8.4(4.29,16.45)	
Weight for height z-score				
Normal	60	198	1.00	0.91 (0.25,3.3)
Wasted	17	31	1.81 (0.93,3.49)	

(*Continued*)

Table 5 (Continued).

Variables			COR (95% CI)	AOR (95% CI)
	Case	Control		
Height for age Z score				
Normal	44	162	1.00	1.07 (0.37,3.06)
Stunted	33	67	1.81 (1.06,3.09)	
Weight for age Z score				
Normal	53	185	1.00	2.1 (0.59,7.49)
Underweight	24	42	1.99 (1.11,3.58)	

Note: Others*, Drivers and NGO workers.

may improve mothers' knowledge towards child health and could modify women's beliefs about disease causation. Thus, it could influences both childcare practices and the use of modern healthcare services. Mothers are important promotor of counseling and practices within the home and the benefits of their knowledge extend to their children and others.

Children who consumed left-over food were at higher risk to develop acute diarrhea compared with children who did not consume left-over food. This finding is supported by a study conducted in Harar Ethiopia[24] and Derashe district Ethiopia.[23] Those studies showed that the occurrence of acute diarrhea was significantly associated with the consumption of leftover food. This might be due to improper food storage induces the growth of bacteria and leads the food to be easily contaminated[32]].

Children whose mothers had diarrhea in the past two weeks were more likely to develop acute diarrhea than those children whose mothers did not have a history of diarrhea within the previous two weeks. This finding is in agreement with a study conducted in Harar Ethiopia that showed that maternal history of diarrhea predicts the occurrence of diarrhea in children.[24] This might be because mothers are the main childcare providers. As a result, maternal morbidity may compromise childcare.[33] Besides, mothers usually participate in food preparation or cooking in the family, the poor hygienic practice of the mothers during illness may result in diarrhea in children.

Limitation of the Study

As to limitations, some behavioral practices, including handwashing practices were self-reported by the respondents. Self-reported data have been found to introduce bias to estimate behavioral practices.

Conclusions

In summary, the study revealed that improper child stool disposal, did not have home-based water treatment, mother did not wash hand at critical times, not exclusive breastfeeding, not getting counseling from health professionals, feed the child leftover food, and history of maternal diarrhea within the previous two weeks were determinants of acute diarrhea among under-five children. Thus, collaborative intervention by emphasizing health education about the importance of personal and environmental hygiene, safe food handling, exclusive breastfeeding practice, and home-based water treatment are essential.

Abbreviations

CI, confidence interval; CDDs, congenital diarrheal disorders; DD, diarrheal disease; EPI, Expanded Program of Immunization; EDHS, Ethiopian Demographic Health Survey; HEWs, health extension workers; IRB, Institution Review Board; OR, odds ratio; ORT, oral rehydration therapy; POPD, pediatric outpatient department; SPSS, Statistical Package of Social Science, SDGs, sustainable development goals; UNICEF, Unite Nation International Children's Emergency Fund; WHO, World Health Organization.

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Disclosure

The authors declared that they have no competing interests in this work.

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