Environmental Determinant of Acute Diarrheal Disease among Under five Children: Unmatched Case Control Study in Babile District, East Hararghe Zone, Oromia Region, East Ethiopia

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Abstract

Introduction: Diarrhea is defined as passing of loose or watery stool for three or more times during a 24 hours period. Diarrhea is one of the leading causes of mortality in developing countries, especially among children under the age of five years. The objective of the study was to assess environmental determinant of acute diarrheal disease among under five children in Babile district, East Hararghe Zone, Oromia Region, East Ethiopia.

Methods: A community based unmatched case control study design was used and data collection period was from May 10-30, 2016. Multi-stage sampling procedure was employed to select four kebeles. Then; Proportionate sample was drawn from each kebele by simple random sampling .Analyses were performed using SPSS software and ethical clearance was obtained.

Result: A total of 396 sample (132 cases and 264 controls) were interviewed in this study making 100% response rate. Occurrence of Acute diarrhea in under five children in Babile district was significantly associated with non improved toilet facility (AOR=3.363,95% CI: 1.701-6.647), improper disposal of solid waste (AOR=9.196, 95% CI: 4.623-18.294) and unimproved water source (AOR=5.164,95% CI: 2.798-9.531).

Conclusion: Environmental predictors of acute diarrhea in under five children were non improved toilet facility, absence of solid waste disposal pit and unimproved water source. Therefore; the recommendations forwarded were community led total sanitation, safe & adequate water supply.

Introduction

Diarrhea is defined as passing of three or more episodes of loose or watery stools during a 24-hour's period.[1] According to Mini EDHS 2014 report, 57% of the households in Ethiopia have access to an improved source of drinking water, with a much higher proportion among urban households (94%) than among rural households (46%).[2] The most common source of improved drinking water in urban households is piped water, used by 87% of urban households.[2]

The 2014 Mini EDHS study showed that only 4% of households in Ethiopia use improved toilet facilities that are not shared with other households, 11% in urban areas and 2% in rural areas. The vast majority of households (88%), use non-improved toilet facilities (97%) in rural areas and 58% in urban areas.[2]

Under five diarrheal disease is known to kill 2195 children daily exceeding deaths from AIDS, malaria and measles together. As diarrhea is the second leading cause of deaths, it accounted for760,000-801,000 child mortality yearly. According to CDC estimate, one in nine deaths was attributable to diarrhea.[3,4]

According to EDHS(5) report, under five mortality in Ethiopia was 88 death/1000 live birth in 2011 while under five mortality for Oromia National Regional State was 112/1000 live birth in the same period. However; the CSA population projection of Ethiopia indicated that under five mortality in Oromia Region for the year 2013-2017 is 90.9/1000 live births.[6]

Although reduction of acute diarrhea related deaths for the past decades observed world wide, diarrhea remained as the second leading causes of deaths among under five children.[7] There is knowledge gap in identifying the predictors of acute diarrheal disease in Babile district, Ethiopia. The objective of this study is to assess the determinant of acute diarrheal disease among under five children.

Methods

Study Period and Area

The data collection period was from May 10-30, 2016. The study area was Babile district, which is found in East Hararghe Zone, Oromia National Regional Sate, East Ethiopia. It is located at a distance of 544km from Addis Ababa.

Babile Woreda has 22 kebeles, health posts at each kebele and four health centers. According to CSA Woreda population Projection[37], the total population of Babile Woreda was estimated to be 118,537 in 2015. Out of this, males were for 59,298 while females were 59,139. On the other hand; 26,058 people were living in urban area while 92,479 people have been residing in rural areas. According to CSA population projection 15.13% of the population were under five children in 2015.[8] Thus; under five children in Babile district was estimated at 17,934.

Study Design

A community based unmatched case control study was employed to assess determinant of acute diarrheal disease among under five children in Babile district.

Study Population

A selected cases of under five years old children with acute diarrhea in two weeks preceding the census in se-

lected kebeles as reported by mother/care giver.
A selected controls of under five children without acute diarrhea in two weeks preceding the census in selected kebeles as reported by mother/care giver.

Inclusion and Exclusion Criteria

Inclusion criteria

Inclusion criteria for cases were all under five children with acute diarrhea in selected kebeles of Babile district.
Inclusion criteria for controls were all under five children without acute diarrhea in selected kebeles of Babile district.

Exclusion criteria

Exclusion criteria for cases: Mother/care givers who could not respond because of serious illness and mother/care givers who did not lived in the area for at least six months was excluded from the cases. Moreover; children who were healthy and chronically ill were excluded from the study as cases.

Exclusion criteria for controls: Mother/care givers who could not respond because of serious illness and mother/care givers who did not lived in the area for at least six months was excluded from the study. Moreover; children who were ill with diarrhea for two weeks preceding the census were excluded from the study as a control.

Sample Size Determination

The Sample size was determined using the formula for the difference between two population proportions.

$$n = \frac{\left[Z\alpha/_2\sqrt{(1+1/r)\,p(1-p)} + Z_{1-\beta}/r\sqrt{p_1(1-p_1)+p_2(1-p_2)}\right]^2}{(P_1-p_2)^2}$$

Where,

n =Sample size
Zα/2=critical value at 95% C.I=1.96
Z1-β =power of the study = 80% (0.84)
p1 = estimated exposure among cases
p2 = estimated exposure among control
p = pooled estimate of p1 and p2 (p1+rp2/1+r)
r = cases to control ratio[2]

Sample size was calculated and compared for the key variables and decision was made to take predictor which provide larger sample size. Thus, unimproved water source was selected as main predictor of the outcome variable. Calculation of sample size was done taking p1= 0.5326, p2=0.3715, Z1-α/2=1.96 (95% C.I) Z1−β =0.84 (power of 80%),ratio of cases to controls 1:2, the sample size was 360(Cases=120 and Controls=240).Finally; adding 10% non response rate made the final sample size to be 396 (Cases=132 and Controls=264).

Variables of the Study

The study variables were selected after review of related literatures on the study subject

Dependent variable

Acute diarrheal disease status among under five children two weeks preceding the census in Babile District, East Hararghe Zone, Oromia Region, East Ethiopia,2016.

Independent variables

Socio-economic and environmental variables.

Sampling procedures

Multi-stage sampling procedure was used to select four kebele out of 22 kebeles. Then, all under five children who have diarrhea and who did not have diarrhea within 14 days preceding census date were registered with qualified Bsc Nurses in accordance of case definition. Finally, cases as well as controls were selected using simple random sampling method from the list of cases and controls respectively. Proportionate sample size allocation was used for each chosen kebeles to get the final sample size. The tool used for data collection was structured and pre-tested standardized core questionnaire of WHO/Unicef which was designed to assess the factors related to acute diarrheal diseases.

Data collection, processing and analysis

Data collection were conducted by four trained B.sc Nurses. There were also three health professional supervisors including the principal investigator in follow up of data collection and supervision. Pre-test was done on 5% of the sample before the beginning of actual data.Statistical package for social sciences (SPSS) 20th version was used for data entry, cleaning and analysis.

Data Quality Management

Standardized, structured and pre-tested questionnaire was used for data collection. The questionnaire was translated into local language (Affan Oromo) from its

English version then back to English. Training was provided for the data collectors for two days. Checking of consistency and completeness was performed on daily basis up to the final data collection day.

Operational Definitions

Improved drinking water sources:- Are piped water into dwelling, piped water to yard/plot, public tab or stand pipe, tube well or borehole, protected dug well, protected spring, rainwater harvested from roof.[9]

Improved toilet facilities:- Are piped sewer system, septic tank, flush/pour flush to pit latrine protected/covered, VIP latrine, pit latrine with slab and compost latrine.[9]

Ethical Considerations

Ethical clearance was obtained from the research and ethical review committee of Wollega University. Babile district health office and health centers was communicated legally for their permission and each of the interviewee was asked for their consent before the interview. Confidentiality was assured by not recording interviewee name on the questionnaire.

Results

Descriptive Statistics of Variables

A total of 396 sample(132 cases and 264 controls) were interviewed in the study making the response rate of 100%.

The Mean±SD age of index child was 25.34±13.25 months for cases and 28.90±12.63 months for controls. The Mean±SD of mother/care givers age were found to be 27.60±4.88 years and 30.61±5.90 years in cases and controls respectively. Concerning sex of index child, males were 57(43.2%) and 121(45.8%) in cases and controls while females were 75(56.8%) and 143(54.2%) in cases and controls respectively. The median monthly income of the household in cases was 1333 birr while it was 1816 birr in controls.

Socio-economic Factors Related to Acute Diarrheal Disease in under Five Children

The bivariate analysis showed that children living with mother with no education(p=0.004) and who can read and write(p=0.033 were more likely to develop diarrhea than children who have mother with tertiary education. Children living in household who got monthly income less or equal to 1200 birr have more likely to have (p=0.000) acute diarrhea than their counterparts (Table 1).

Table 1. Bivariate analysis of socio-economic factors associated with acute diarrheal disease among under five children in Babile district, East Hararghe zone, Oromia Region, East Ethiopia, 2016.

Variables	Category	Cases(%)	Controls(%)	COR (95% CI)	P-value
Education of mother/Care giver	No education	85(64.4)	127(48.1)	2.263 (1.294-3.958)	0.004
	Read & write	21(15.9)	71(26.9%)	1.902 (1.054-3.433)	0.033
	Primary education	19(14.4)	54(20.5)	1.472 (.494-4.389)	0.487
	Secondary education	5(3.8)	11(4.2)	.335 (.030-3.749)	0.375
	Tertiary education	2(1.5)	1(0.4%)	1	
Monthly income of the HH	≤1200birr	40(32.5)	28(11.1)	3.855 (2.236-6.647)	0.000
	>1200	83(67.5)	224(88.9)	1	

Table 2. Bivariate analysis of environmental factors associated with acute diarrheal disease among under five children in Babile district, East Hararghe zone, Oromia Region, East Ethiopia, 2016.

Variables	Category	Cases(%)	Controls(%)	COR (95% CI)	P-value
Toilet facility	Improved toilet facility	81(61.4)	239(90.5)	1	
	Non improved toilet facility	51(38.6)	25(9.5)	6.019 (3.505-10.337)	0.000
Waste disposal pit	Yes	16(12.1)	166(63.1)	1	
	No	116(87.9)	97(36.9)	12.407 (6.949-22.151)	0.000
Water source	Improved water source	60(45.5)	223(84.5)	1	
	Unimproved water source	72(54.5)	41(15.5)	2.949 (1.314-6.61)	0.009

Environmental Factors Related to Acute Diarrheal Disease in Under Five Children

Acute Diarrheal disease among under five children had statistically significant association with toilet facility(p=0.000), waste disposal pit(p=0.000), water source (p=0.009) and time to collect water(p=0.000) (Table 2).

Factors Independently Associated with Acute Diarrheal Disease in Under Five Children

All variables which showed statistical significance association with acute diarrhea disease among under five children (p<0.05) in the crude analyses were entered in to final logistic regression to avoid an excessive number of variables and unstable estimates in the subsequent model. In multivariate analysis; only three environmental factors were independently associated with acute diarrheal disease among under five children in this study (Table 3).

Children living in household with non improved toilet facility had 3.363 times higher odds of developing acute diarrhea than their counterparts (AOR=3.363,95% CI:1.701-6.647). Children living in household without solid waste disposal pit were 9.196 times more likely to develop acute diarrheal disease compared to children in household with solid disposal pit(AOR=9.196, 95% CI: 4.623-18.294).The result also indicated that the odds of developing acute diarrheal disease was 5.164 times higher among children in household with unimproved water source compared to children in household with improved water source (AOR=5.164,95% CI: 2.798-9.531) (Table 3.).

Discussion

In this study, the odds of developing acute diarrheal disease was 3.363 times higher among children in household with non-improved toilet facility compared to children in household with improved toilet facility. The finding of this study had similarity to studies undertaken in Derashe, Mecha districts of Ethiopia and Ghana which showed higher odds of developing diarrheal disease among children without toilet compared to their counterparts.[10,12,11] Yet; the finding was in contrast to the study result of Eastern Ethiopia.[13] This might be due to study design difference and time lag.

Children living in household without solid waste disposal pit were 9.196 times more likely to develop acute diarrheal disease compared to children in household with solid waste disposal pit. The finding of this study was also supported by the result of South West Ethiopia study, which showed higher odds to develop acute diarrhea in children living in household without proper solid waste disposal than their counterparts.[14] Moreover; the result was also in line with the finding of the study done in East Ethiopia which showed high odds of developing acute diarrhea in children living in household with out proper waste disposal pit than their counterparts.[13] Nevertheless; the result varied from the finding of the study conducted by Mohamed et al.[15] which depicted no significant association between waste disposal pit and occurrence of acute diarrheal disease among under five years old children in South Ethiopia. The reason of this inconsistency may be attributed to the fact that the study done in South Ethiopia was on rural communities and also used cross sectional study design.

The study revealed that there was 5.164 times higher odds of developing acute diarrheal disease among children in household with unimproved water source compared to their counter parts. The finding of this study was

Table 3. Multivariate analysis of environmental factors associated with acute diarrheal disease among under five years old children in Babile district, East Hararghe zone, Oromia Region, East Ethiopia,2016.

Variables	Category	COR (95% CI)	AOR (95% CI)	P-value
Education of mother/Care giver	No education	2.263 (1.294-3.958)	1.793(.842-3.817)	0.130
	Read & write	1.902 (1.054-3.433)	0.749(0.341-1.645	0.472
	Primary education	1.472 (.494-4.389)	0.331(0.093-1.177)	0.088
	Secondary education	0.335 (.030-3.749)	0.226(0.006-8.012)	0.414
	Tertiary education	1	1	
Monthly income of the HH	>1200	1	1	
	≤1200birr	3.855 (2.236-6.647)	1.393(0.684-2.838)	0.361
Toilet facility	Improved toilet	1	1	
	Non improved toilet	6.019 (3.505-10.337)	3.363(1.701-6.647)	0.000
Waste disposal pit	Yes	1	1	
	No	12.407 (6.949-22.151)	9.196(4.623-18.294)	0.000
Water source	Improved source	1	1	
	Unimproved source	2.949 (1.314-6.61)	5.164(2.798-9.531)	0.000

in agreement with the results of other researches made in South Ethiopia which showed high odds to develop acute diarrheal disease among children living in household with unimproved water source compared to children from household with improved water source respectively (10,15).However; the finding was in contrast with earlier study carried out in Nekemte town, South west Ethiopia(16).This may be due to the fact that the study was conducted in urban setting and time lag.

Strenght and limitations of the study

The study employed standardized, structured and pre-tested core questionnaire of WHO/Unicef. The limitation of this study arise from the retrospective nature of the study and there might be recall bias of respondents.

Conclusions

It was concluded that Environmental predictors of acute diarrheal disease among under five children in Babile district were non improved toilet facility, absence of waste disposal pit and unimproved water source.

Recommendations

Based on the findings of this study, the following recommendations were forwarded:-

- Woreda health office be supposed to enhance community led total sanitation
- The district water office ought to provide safe and adequate water supply for the community
- Further research on causative agents & associated factors of diarrheal disease among under five years old children

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