ENVIRONMENTAL DETERMINANTS OF DIARRHEA AMONG UNDER-FIVE CHILDREN IN NEKEMTE TOWN, WESTERN ETHIOPIA

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ABSTRACT

BACKGROUND*: Though the relationship between environmental risk factors and the occurrence of diarrhea in children have been documented elsewhere, there are limited studies in Ethiopia in general and in Nekemte Town in particular. The present study assessed the prevalence and environmental determinants/factors of under-five diarrheal morbidity*.
METHODS: *Community-based cross-sectional study was conducted in Nekemte town, western Ethiopia from October 15–November 26, 2007. Four hundred seventy seven mothers/ care takers of index under-five children living in the households selected randomly from Kebeles in the town constituted the study population. Data were collected using structured and pre-tested questionnaire, entered into a computer, edited and analyzed using SPSS for windows version 12.0.1. Stepwise logistic regression model was used to calculate the Odds ratios and 95% confidence interval for the different risk factors.*
RESULTS*: Out of 477 sampled mother/caretaker-child pairs, 461 participated in the study giving a response rate of 96.6%. The mean ages of the respondents and the index children were 32.4 (±8.8 SD) years and 25.27(±15.16 SD) months, respectively. Prevalence of diarrheal morbidity over a period of two weeks preceding the study was about 28.9%. In the Bivariate analysis, a number of risk factors including distance from drinking water sources (time taken to-and-from the sources), availability & ownership of the latrine, refuse disposal, the presence of feces around the pit-hole (P<0.001) and presence or absence of pit-hole cover & feces seen in the compound (P<0.05) appeared to be significantly associated with under-five childhood diarrheal morbidity. However, absence of refuse disposal facility and presence of feces around the pit-hole were the only significant variables on multivariate analyses (P< 0.05)*.
CONCLUSION*: As diarrhea morbidity was major problem among under-five children in Nekemte town. appropriate intervention programs targeting availability of refuse disposal facilities and appropriate care of latrines should be designed*
KEY WORDS: *Diarrhea, Environmental factors, Under-five children, Nekemte, West Ethiopia.*

INTRODUCTION

Globally, diarrhea is the third largest cause of morbidity and the sixth largest cause of mortality among population of all ages (1). A ten-year review of the global problem of diarrheal disease has shown that there are 1 billion episodes and 3 million deaths occurring each year among under-five children (2). It is one of the leading causes of morbidity and mortality in developing countries, especially among children under the age of five (3). In Africa, a child experiences five episodes of diarrhea per year, and 800,000 children die each year from diarrhea related dehydration (4). A more recent estimate indicated the two-week period prevalence of diarrhea in under-five children is about 30.6% and 17.7% in Ethiopia and Oromia region, respectively (5).

The relationship between environmental factors and the occurrence of diarrhea in children have been addressed in a number of studies. Environmental factors include water quantity, access to improved water sources, availability of toilet facilities, compound hygiene, housing condition, and refuse disposal (4, 6). Globally, more than 125 million children under-five years of age live in households without access to an improved drinking-water source, and more than 280 million children under-five live in households without access to improved sanitation facilities (7). In the developing world; unsafe drinking water, inadequate availability of water for hygiene and lack of access to sanitation together contribute to about 88 % of deaths from diarrheal diseases or more than 1.5 million children under- five perish from diarrhea each year (7). In Ethiopia, about 61% of households in the country have access to an improved source of drinking water and only 38 % have access to sanitation facility (5). According to the information obtained from Nekemte Health Center diarrheal disease is one of the major public health problems in the area and it is among one of the top ten diseases causing morbidity and mortality in under-five children (8).

Domestic water supplies are one of the fundamental requirements for human life. Without water, life cannot be sustained beyond a few days and the lack of access to adequate water supplies leads to the spread of disease. Children bear the greatest health burden associated with poor water and sanitation (9). A comparative study on differentials of child health in urban areas of Brazil, Egypt, Ghana and Thailand

showed that environmental factors such as drinking water sources, availability and quality of water, availability of toilet facility and housing condition are strongly associated with childhood diarrheas (6).

Another study from the Republic of Congo revealed that children coming from households that obtain water from protected sources were less likely to have diarrhea as compared to those who get their water supply from unprotected sources (10, 11). Reports from Gondar, Northwest Ethiopia, indicated that the use of unprotected water sources was significantly associated with diarrheal morbidity (12). The report from Kefa -Sheka Zone, Southwest Ethiopia also showed the mean per capita water consumption was lower in households where children had diarrhea (11).

Reports from different parts of the world showed, lack of excreta disposal facility, the presence of excreta in the yard, lack of latrines and absence of refuse disposal pit were associated with higher diarrhea morbidity (10,13,14,15).

Although, there exists a difference with their study findings the influence of improved water supply and sanitation factors on the prevalence of diarrheal diseases has been addressed in a number of studies. Despite the aforementioned implications and the need for ongoing research, very few studies have assessed the influence of environmental factors on prevalence of diarrhea among under-five children in Ethiopia in general and in Nekemte town in particular. This study, therefore attempted to investigate the prevalence of diarrheal morbidity and the influences of the associated Environmental factors among under-five children in Nekemte town, Western Ethiopia.

METHODS AND MATERIALS

A community-based cross-sectional study was conducted in Nekemte Town, East Wollega zone from October 15– November 26, 2007. East Wollega zone is one of the 17 zones in Oromia Regional State located in the western part of the region at 331 km away from Addis Ababa. Nekemte Town is administratively divided into 6 Kebeles. According to the 2006 Federal Central Statistics Agency (CSA), Nekemte's total population is estimated to 88,536 and with about 14,541 households (16) and is estimated to be 91,103 total population and 18,220 households when projected for 2007 by considering 2.9% as rate of natural increase for Oromiya region. The total number of under-five children in the town was estimated to be 16,398 at the end of 2007 based on the assumption that 18 % of the total population is under-five children (17).

The source population was all mothers/ care givers-under-five children pairs living in the town prior to the survey and the study subjects were a sample of them in the selected households. The two-week period prevalence of diarrhea among under-five children of the study area was not identified and studied before. Hence, the regional two-week period prevalence of diarrhea (17.7%) among under-five children was taken from the recent report of the Demographic and Health Survey to calculate the sample size (5). Using the assumptions of design effect 2, desired precision 5%, confidence level 95% and an anticipated non–response 10%, a total sample size of 477 was determined.

Multi-stage sampling procedure was employed, first by selecting three Kebeles from the six using lottery method. Then, all households in the selected kebeles were registered through a house-to-house survey by fifteen trained enumerators from October 15 - 31 2007 and a total of 5928 households of which 1348 from BekeJama, 2206 from BurkaJato and 2374 from Cheleleki Kebeles were listed. Households were allocated to each Kebele proportional to size. Systematic sampling (every 12^{th} households) from the enumerated households in the Kebeles were included for the study. In case, where there were more than one under-five children in the same household, only one index child was selected by lottery method to collect information on child's health characteristics. Mothers/ care givers of index under-five children who had other health problem, critically ill and those who did not live at least six-months in the town prior to the survey were excluded.

Data were collected using a structured questionnaire which was translated into Afaan Oromo by fluent speaker of both languages to ensure its validity and consistency, and again back translated to English. Fifteen 10^{th} grade complete and above interviewers and three supervisors from Nekemte Health center who were fluent in Afaan Oromo were recruited and trained. The supervisors were fully responsible to lead and handle the whole session of data collection process, and correct any problem along with the principal investigator.

Five percent of the questionnaires were pre-tested in another Kebele with the same level in every aspects of basic infrastructure and socio-demographic characteristics in the study area. The result of the pretest was used to correct some unclear ideas and statements. Moreover, the completed questionnaires were checked everyday after data collection for completeness, clarity and consistency by the supervisors and the principal investigator.

In the study, the occurrence of any episode of diarrhea in a child two-week preceding the survey was considered to be the dependent/outcome variable and environmental factors (such as type of water source, distance from the drinking water source (time spent to-and-from the source), amount of daily water consumption; availability, type and ownership of toilet facility; presence or absence of pit hole cover; refuse disposal method, housing floor, latrine and compound cleanliness) as exposure/independent variables. The types of facility that were considered as having improved water supply facilities include: household connection/pipe; public standpipe, borehole, protected dug well, protected spring, and rainwater collection. Those considered as having improved sanitation

facilities include: connection to a public sewer, connection to septic system, pour-flush latrine, simple pit latrine and ventilated improved pit latrine.

The data were edited, entered into a computer using SPSS for windows version 12.01, and analyzed. The frequencies, measures of central tendencies and variations were obtained and displayed mainly on the tables and word expressions.

Bivariate analysis was also used to see the association between the explanatory and outcome variables. Logistic regression model was used to determine Odds ratio and 95% confidence interval for the different risk factors of diarrhea and describe the strength of association between the selected study variables by controlling for the effect of possible confounders and prediction of population parameters. Then, multivariate analysis was employed by selecting only variables that appeared to be statistically significant ($P<0.05$) in the bivarate analysis.

Ethical clearance was obtained from the Ethical Committee of the Faculty of Public Health, Jimma University. Then the concerned officials in the zone at each level were communicated through formal letters from the School of Environmental Health Science, Faculty of Public Health, Jimma University. Informed verbal consent was obtained from the mothers of the children. Interview was conducted privately and then confidentiality of information was ensured. Children who were found to be sick during the visits were advised to visit the nearby health institution.

RESULTS

A total of 477 households with at least one under-five children were planned to participate in the study, out of which 461 were enrolled making a response rate of 96.6 %.

One hundred twenty-four of the mothers/caretakers (26.9%) were above 35 years of age while the majority, 270 (58.6%) were in the age range of 25-35 years. The mean age of the respondents was 32.4 years (±8.8 SD). The majority of mothers 395 (85.7%) were married, Orthodox 196(42.5%) by religion,Oromo 347 (75.3%) by ethnic group, 314 (68.1%) were housewives and 403 (87.4%) mothers had formal education. The mean household size of the study population was 5.5 (±2.0 SD) persons. There was only one under-five child in 383 (83.1 %) households, and only 78 (16.9%) households had two or more under-five children (Table 1).

Table 1. Socio-economic and demographic characteristics of the respondents, Nekemte town, February 2008.

Variables	Response category	Frequency(N=461)	%
Total persons in HH*	<5	263	57
	5-8	164	35.6
	>8	34	7.4
No of under 5 children in HH	One	383	83.1
	Two & above	78	16.9
Age of Mothers	<18	8	1.7
	18-24	59	12.8
	25-35	270	58.6
	>35	124	26.9
Marital status	Single	10	2.2
	Married	395	85.7
	Divorced	33	7.2
	Widowed	23	5
Religion	Orthodox	196	42.5
	Protestant	183	39.7
	Muslim	80	17.4
	Others	2	0.4
Ethnicity	Oromo	347	75.3
	Amhara	103	22.3
	Gurage	8	1.7
	Others**	3	0.7
Maternal Education	Illiterate	58	12.6
	Elementary	196	42.5
	Secondary& above	207	44.9
Occupation of mother	Housewife	314	68.1
	Government employee	63	13.7
	Private gainful work	83	18
	Non-government employee	1	0.2
Average monthly income of HH	≤500	171	37.1
	501-1000	186	40.3
	>1000	104	22.6

*Household; **Tigre

The majority, 256(56.0%) lived in houses floor made of mud and 456(98.9%) households used drinking water from a protected sources which is mainly piped water. Three hundred seventy-five (81.3%) claimed to have spent 15 minutes or less time walk to fetch water. The mean per capita per day water consumption of the study households was 5.4 (±3.9) liters. Four hundred twenty-three (91.8%) of the study households had privately owned or shared latrine facility and 38 (8.2%) did not have the facility. Out of those who had latrine, 363(85.8%), 33 (7.8%) and 27 (6.4%) households had simple pit latrine, ventilated improved pit latrine and pour-flush latrine, respectively. Of those households who had simple pit latrine 143(39.4%) did not have superstructure. Out of 423 households with latrine facility, the majority were observed that the pit hole do not have a cover 272 (64.3%). With regard to refuse disposal facility, 203(44%), 200(43.4%) and 58 (12.6%) reported to have disposed their refuse in open field, burnt or buried and used garbage bin, respectively (Table 2).

Table 2. Environmental characteristics of the study households, Nekemte town, February 2008.

Variables	Response category	Frequency	Percent
Housing floor material (n=461)	Mud	258	56
	Cement	198	43
	Wood	5	1
Drinking water source(N=461)	Protected	456	98.9
	Unprotected	5	1.1
Time spent to fetch water (in minutes) (N=461)	≤15	375	81.3
	>15	39	8.5
	Do not know	47	10.2
Daily water consumption (in liters) (N=461)	≤20	456	98.9
	>20	5	1.1
Latrine availability(N=461)	Available	423	91.8
	Not available	38	8.2
Type of latrine(N=423)	Simple pit latrine	363	85.8
	Ventilated improved pit latrine	33	7.8
	Pour-flush latrine	27	6.4
Latrine ownership(N=423)	Privately owned	366	86.5
	Shared	57	13.5
Presence or absence of pit-hole cover(N=423)	Present	151	35.7
	Absent	272	64.3
Feces seen around the pit-hole/slab/floor of latrine(N=423)	Yes	154	36
	No	269	64
Feces seen in the compound(N=461)	Yes	112	24.3
	No	349	75.7
Refuse disposal method(N=461)	Pit/Burning	200	43.4
	Garbage bin	58	12.6
	Open field	203	44

The mean age of the index children included in this study was 25.27(±15.16) months and 260 (56.4%) of the children were male by sex.

Upon further questioning to identify the history of diarrhoea during their lifetime, 329(71.4%) study participants had reported that their child had a history of diarrhoea. 65(14.1%) reported that their child have history of diarrhoea during the survey. Moreover, the study participants were also asked about the history of their childhood diarrhoea in the past two-weeks period prior to the survey. Accordingly, the majority reported that their children do not have diarrhoea and 133(28.9%) reported that their children had history of diarrhoea in the past two weeks period. Out of the two week report of diarrhoeal history 118(88.7%) mentioned that a child exhibit a watery type of diarrhoea and 15(11.3%) had bloody & mucus diarrhoeal type.

In the Bivariate analysis, a number of risk factors including distance of drinking water source (time taken to-and-from the source), availability & ownership of the latrine, refuse disposal, the presence of feces around the pit-hole (P<0.001) and presence or absence of pit-hole cover & feces seen in the compound (P<0.05) appeared to be significantly associated with under-five childhood diarrheal morbidity (Table 3).

Multivariate logistic regression model was employed to evaluate associations between factors and dichotomous variables designed to measure environmental risk factors and under-five childhood morbidity in the last two-weeks prior to survey. Among the above variables, only absence of refuse disposal facility and presence of feces around the pit-hole were found to be independently associated with under-five childhood diarrheal morbidity. Children from those households disposing refuse in pit/burnt are 69% less likely to have diarrhea compared to children from the households who claimed disposing their refuse indiscriminately in open field [OR: 0.31, 95% CI (0. 11, 0.87)]. Children from those households in which feces were observed around the pit-hole/on the slab had about three times more likely to have diarrhea compared to those children from houses in which feces had not observed around the pit-hole [OR : 3.13, 95%CI (1.04,9.45)] (Table 3).

Table 3. Environmental characteristics associated with under-five childhood diarrheal morbidity, Nekemte town, February, 2008.

Variables	Diarrhea		Crude OR (95% CI)	Adjusted OR (95% CI)
	Yes (%)	No (%)		
Distance (to-and-from) of drinking water source (in minutes)				
≤15	99(26.4)	276(73.6)	1.00	
>15	24(61.5)	15(38.5)	0.22(0.11,0.45)†	
Latrine availability				
Available	103(24.3)	320(75.7)	0.86(0.04,0.19) †	
Not available	30(78.9)	8(21.1)	1	
Latrine ownership				
Private	88(24)	278(76)	0.21(0.12,0.37) †	
Shared	34(60)	23(40)	1	
Presence or absence of pit-hole coverφ				
Present	35(23)	116(77)	1	
Absent	87(32)	185(68)	1.58(1.02,2.45) †	
Feces seen around the pit-hole/slab/floor of latrine				
Yes	70(45)	84(55)	1	3.13 (1.04,9.45)ϒ
No	52(19)	217(81)	0.29(0.19,0.45) †	1
Feces seen in the compound				
Yes	42(37.8)	69(62.2)	1	
No	91(26)	259(74)	0.58(0.37,0.91) †	
Refuse disposal method				
Pit/Burning/Garbage bin	57(22.1)	201(77.9)	0.47(0.32,0.71) †	0.31 (0.11,0.87)ϒ
Open field	76(37.4)	127(62.6)	1	1

† P < 0.05 on bivariate analyses ϒp < 0.05 on multivariate analysis

DISCUSSION

A number of studies revealed that poor environmental factors contribute to under-five morbidity, including diarrheal disease (18,19).

The two-week period prevalence of childhood diarrhea morbidity in this study was 28.9%. This finding is almost consistent with the study done in different parts of the southwestern Ethiopia which was about 33.7% and 36.5% in Manna district and Jimma town, respectively (14,20). But the finding is not in agreement with the one reported from Keffa-Sheka Zone, southern Ethiopia which showed about 15% of two- week period prevalence of diarrheal morbidity (11). The difference might be attributed to the difference in the socio demographic characteristics of study households and the time of the study.

The present Showed association ($P<0.05$) between under-five childhood diarrheal morbidity and refuse disposal. Children from the households disposing refuse in pit/burn it were 69% less likely to have diarrhea compared to children from the households who claimed disposing their refuse indiscriminately in open field [OR: 0.31%, 95%CI (0.11, 0.87)]. This was supported by report from Zimbabwe which revealed that the absence of refuse disposal pit was associated with higher diarrheal morbidity (15).

The presence or absence of feces around the pit-hole was another factor associated with under-five diarrheal morbidity. Children from households where there was feces around the pit-hole/on the slab were about three times more likely to have diarrhea than those children from the households where feces was not observed around the pit-hole [OR : 3.13, 95%CI (1.04,9.45)]. Consistent with our findings another study reported that the presence of excreta in the yard showed strong association with under-five childhood diarrheal morbidity (13). This has an important implication that the mere presence of latrine facility does not have a great contribution for prevention excreta-related disease but it is the proper utilization that had a vital importance.

Although availability and ownership of latrine facility showed an association with the occurrence of childhood diarrhea in the bivariate analyses, it exhibited no significant association when other variables were controlled in the final model (multivariate analyses). However, many studies indicated that the absence of excreta disposal facility were strongly associated with the occurrence of diarrheal morbidity (10, 13, 14).

In our study, significant association was not observed between drinking water sources and diarrheal morbidity. This is might be due to the fact that no great differences exist in the sample households with respect to the use of drinking water sources. In contrary to this finding, studies reported that drinking water source is an important environmental determinant of diarrheal morbidity (10, 11, 12).

Amount of water consumption per capita per day was not also significantly associated with under-five diarrheal morbidity which is not in agreement with a research result from southwestern Ethiopia, in Keffa Sheka Zone which showed that the mean per capita water consumption was lower in households where child had diarrhea (11).

In conclusion, diarrhea morbidity was major problem among under-five children in Nekemte town. The presence of feces around the pit-hole and absence of refuse disposal facility were factors associated with under-five diarrheal morbidity. Appropriate intervention programs targeting availability of refuse disposal facilities and appropriate care of latrines should be designed.

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