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Research Article

Prevalence of Diarrhea and Its Associated Factors among Under-Five Children in Open Defecation Free and Non-Open Defecation Free Households in Goba District Southeast Ethiopia: A Comparative Cross-Sectional Study

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ABSTRACT

Background: In Ethiopia, diarrhea kills half a million under-five children every year and most cases of diarrhea spread in settings with lack of sanitation facilities. In effect, Ethiopia began to adopt a Community-Led Total Sanitation (CLTS) approach which aimed at generating a collective sense of intolerance towards open defecation through empowering local communities to find solutions for sanitation related problems such as diarrhea. Therefore, this study aimed to assess the prevalence of diarrhea and its associated factors among under-five children in open defecation free (ODF) and non-ODF households in Goba district, southeast Ethiopia.

Methods: A community-based comparative cross-sectional study was employed from March 1 to April 30, 2017, in Goba district. A total of 732 households (366 ODF and 366 non-ODF households) that had at least one under-five children were included in the study. Descriptive statistics and logistic regression analyses were computed.

Results: The two weeks diarrheal prevalence in under-five children among ODF and non-ODF households were 17.2% and 23.2%, respectively. A significant difference in the occurrence of diarrhea was observed between ODF and non-ODF households [x2(df)=3.93(1), p=0.04]. Unsanitary disposal of children`s faeces [AOR: 2.68; 95% CI: 1.66, 4.30], exclusive breastfeeding [AOR: 0.43; 95%CI: 0.26, 0.71], mother not attend formal education [AOR: 1.93; 95% CI:1.18, 3.15] were factors associated with diarrhoea in ODF households. On the other hand, latrine cleanliness [AOR: 0.41; 95% CI: 0.20, 0.82], presence of faces in the compound [AOR: 2.10; 95% CI: 1.05, 4.17], and child age [AOR: 1.93; 95%CI: 1.04. 3.57] were factors associated with diarrhea in non-ODF households.

Conclusion: The prevalence of diarrhea slightly higher in non-ODF households than ODF households. Therefore, intensifying Community-Led Total Sanitation and hygiene approach strongly recommended.

Keywords: Childhood diarrhea; Open defecation; Open defection free; Bale-Goba; Ethiopia

ABBREVIATIONS

AOR: Adjusted Odds Ratio; CI: Confidence Interval; CLTSH: Community-Led Total Sanitation and Hygiene; COR: Crude Odds Ratio; ODF: Open Defecation Free

BACKGROUND

Globally, a significant number of mortality and an estimated 1.7 billion diarrhea episodes occurred annually among under-five children [1,2]. In the year 2016 alone, diarrhea kills almost fifteen thousand under-five children in Ethiopia [2]. And a shortage of adequate sanitation facilities and safe water supply is a common risk factor for diarrhoeal disease in this age group [3]. Moreover, the lack of sanitation facilities even obliges people to practice open defecation (OD), which is a major risk factor for diarrhoeal disease [4].

According to the World Health Organization (WHO) estimate, worldwide 2.3 billion people lack basic sanitation services and

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over 892 million people still practice open defecation (OD) [5]. In sub-Saharan Africa, it is estimated that 23% (220 million) populations continue to engage in OD practice [5].

In Ethiopia, it is estimated that 27% of the population are practicing OD which contributes to the high prevalence of diarrhea-related morbidity and mortality [4,5]. In effect, the Federal Ministry of Health (FMoH) of Ethiopia began to adopt a Community-Led Total Sanitation and Hygiene (CLTSH) approach formally in the year 2011. The approach is aimed at generating a collective sense of intolerance towards open defecation through empowering local communities to find solutions to their poor and inadequate sanitation situation [6,7]. In spite of the CLTSH countrywide initiative, OD is still a huge problem in Ethiopia. The recent 2016 Ethiopia Demographic and Health Survey (EDHS) also demonstrated that 32.3% of the households in Ethiopia still practiced OD (6.9% urban and 38.8% of rural households). In addition, the survey reported that 12% of under-five children have experienced diarrhea two-week preceding the survey [8]. A systematic review also reported that the prevalence of childhood diarrhea in Ethiopia among under-five children is 22% range from 19-25% [9].

To tackle this high diarrhoeal prevalence, the FMoH of Ethiopia had promising to achieve a substantial improvement in safe water provision and sanitation facilities including a reduction in OD practice through CLTS approach [8-10]. In this regard, only a few studies were conducted in Ethiopia that demonstrates the prevalence of diarrhea among households living in ODF and non-ODF sub-districts [11,12]. And there is no study in southeast Ethiopia that described and quantified whether the CLTSH strategy has been made a remarkable improvement in the reduction of under-five diarrhea. Therefore, the present study aimed to assess the prevalence of diarrhea in ODF and non-ODF in Goba district, southeast, Ethiopia.

METHODS

Study setting

The study was conducted in Goba district, southeast Ethiopia. The district has 15 sub-districts, and after CLTS approach implementation in the District 7 (47%) of sub-districts becomes ODF and the remaining 8 sub-districts were non-ODF.

Study design and population

A community-based comparative cross-sectional study design was implemented from March 1 to April 30, 2017. All households that had at least one under-five children in ODF and non-ODF sub-districts of Goba Districts were the source population. And all randomly selected households that had at least one under-five in selected ODF and non-ODF sub-districts of Goba district were the study population. Only sub-districts that declare ODF status before one year were included in ODF setting. Households with a critically ill mother or caregivers during the survey were excluded from the study.

Sample size determination and sampling techniques

The sample size was determined using Epi-info version 7 statistics software by considering the prevalence of diarrhoea in ODF sub-districts 24.7% [10], 95% confidence interval (CI), 80% power, ratio of ODF to non-ODF sub-districts 1:1, to detect 2 odd ratios (OR), design effect of 2 and 10% non-response rate. Accordingly, the required sample size was 732 (366 from ODF and 366 from non-ODF) households that had at least one under five-children were included in the study.

A multistage sampling technique was employed to select study participants. In the first stage, all sub-districts were stratified by their OD status into ODF and non-ODF sub-districts (7 ODF and 8 non-ODF). Accordingly, three ODF and three non-ODF sub-districts were randomly selected using the lottery method from each stratum. Afterward, the calculated sample size was allocated proportionally to the size of households for each selected sub-districts. In the second stage, households with under-five children were selected by a systematic random technique using health post family folder as a sampling frame. If two or more under-five children are present in the same household the youngest child was eligible for the study since the youngest group are more vulnerable to main explanatory variables [11-13].

Study variables

Dependent variable: Last two-week diarrhoeal disease.

Independent variables

Socio-demographic factors: family monthly income, the age of the mother/caregiver, the age of the index child and educational status of the mother/caregiver.

Environmental factors: availability of latrine, ownership of latrine, latrine type, the presence of feces around latrine, latrine cleanliness status, and hand washing near the latrine.

Behavioral factors: breastfeeding practice, and child feces disposal method.

Operational definition

Diarrhea: is defined as a child with diarrhea or frequent loose stool at least 3 times in 24 hours as evidenced from mother/caregiver 2 weeks prior to the survey [3].

Open defecation free status is a status given by an independent, third-party group of relevant stakeholders for a given community whether village, sub-districts, district or an entire region has 100 percent latrine coverage and totally free of open defecation practices as per the ministry of health ODF verification and certification criteria [6].

Hand washing at a critical time: if a mother/caregiver reported to practiced hand washings with soap before eating, before food preparation, before child feeding, after child cleaning, and after latrine visiting was considered as "all practiced" unless considered as "partially practiced" [14].

Hygienic latrine: if there were no human or animal fecal matter present inside the facility-on seat, floor, door or walls [10].

Index child: a child that is included in the study from a household to have information on the demographic and health characteristics, and also to calculate the prevalence of diarrhea.

Unsanitary disposal of children's feces: includes put/rinsed feces into drain or ditch, feces were thrown into the garbage or feces left, or the child was not seen during defecation [15].

Data collection tool, data collection procedures, and data quality

Data were collected by trained healthcare workers using pre-tested structured questionnaire and observational checklist adapted from WHO and UNICEF, EDHS and from other related literature [8,15]. The data collection tool was first prepared in English and translated to local language (Afan Oromo) by the language expert. Consistency was checked by re-translating the Afan Oromo version back to English by another individual who is expert in both languages. The training was given for data collectors and supervisors for two days on the study instrument and data collection procedure. The data collection tool was pre-tested on 5% of the actual sample size and necessary corrections were made accordingly. Throughout the data collection process, close supervision was carried out to assure data completeness and consistency.

DATA ANALYSIS

Data were entered Epi Data 3.1 and analyzed using SPSS version 20 statistical software. Descriptive statistics were computed to describe the prevalence of diarrhea morbidity. Bivariate and multivariable logistic regression analysis was performed to identify factors associated with diarrhea morbidity among ODF and non-ODF households. The variables with the p-value ≤ 0.25 were further considered into the multivariate logistic regression analysis [14,16]. Multicollinearity test was performed to assess the existence of correlation among the predictor variables. The Hosmer-Lemeshow test for goodness of fit was also computed. Adjusted odds ratios (AOR) with 95% confidence interval (CI) were reported and p-values of<0.05 were considered as a statistical significance.

ETHICAL STATEMENT

Ethical clearance was obtained from Madda Walabu University Goba referral hospital public health department. A formal letter of permission was obtained from administrative bodies of the district and sub-district. Verbal consent was requested from every study participant before data collection. And confidentiality was assured throughout the data collection process. During data collection, child or the family with diarrhea advised consulting the nearby health institution for better management.

RESULTS

Socio-demographic distributions of the study participants

A total of 709 (355 households from open defecation free (ODF) and 354 from non-ODF) have participated in this study, which makes a response rate of 96.8%. From total household, 411 (58%) have less than or equal to five family member. Most of mothers or caregivers, 427 (60.2%) reported that they were not attended formal education, and 668 (94.2%) were married (Table 1).

Table 1: Socio-demographic characteristics of study participants in Goba district, Southeast Ethiopia (Note: ETB=Ethiopian Birr, Average exchange rate of 1 USD in Ethiopian Birr was=22.7469 during the study period (March-April, 2017)).

Characteristics		ODF status				Total (n=709)	
		ODF(n=355)		Non ODF (n=354)			
		No	%	No	%	No	%
Age of the index child	0-5 Month	18	5.1	16	4.5	34	4.8
	6-11 Month	43	12.1	53	15	96	13.5
	12-23 Month	99	27.9	92	26	191	26.9
	24-35 Month	89	25.1	93	26.3	182	25.7
	36-59 month	106	29.8	100	28.2	206	29.1
Birth order of the index child	First	56	15.8	59	16.7	115	16.2
	Second	90	25.4	84	23.7	174	24.6
	Third	86	24.2	87	24.6	173	24.4

	Fourth and above	123	34.6	124	35	247	34.8
Family size	≤ 5	207	58.3	204	57.6	411	58
	>5	148	41.7	150	42.4	298	42
Marital status of the mother	Married	333	93.8	335	94.6	668	94.2
	Not married	22	6.2	19	5.4	41	5.8
The education level of the mother	No formal education	214	60.3	213	60.2	427	60.2
	Formal education attended	141	39.7	141	39.8	282	39.8
Average monthly net income from parents	Less than 500 ETB	46	13	59	16.7	105	14.8
	501-1000 ETB	112	31.5	109	30.8	221	31.2
	1001-2000 ETB	133	37.5	126	35.6	259	36.5
	2001 ETB and above	64	18	60	16.9	124	17.5

Environmental and behavioural related characteristics of the study participants

The latrine coverage in ODF and non-ODF sub-districts were 328 (92.4%) and 284 (80.2%) respectively. Regarding the source of drinking water, 132 (37.2%) and 161 (45.5%) households in ODF and non-ODF used improved water source, respectively. Regarding hand washing practice at critical times, 36 (10.8%) and 33(9.9%) of households in both ODF and non-ODF sub-districts were washed their hands at all critical times, respectively. In this study, 268 (75.5%) of households in ODF sub-district had sanitary disposal of children feces and 227 (64.1%) in non-ODF sub-districts had sanitary disposal of children feces (Table 2).

Table 2: Environmental and behavioural related characteristics of study participants in Goba district, Southeast Ethiopia.

Characteristics		ODF Status				Total	
		ODF					
		No	%	No	%	No	%
Presence of household latrine	Yes	328	92.4	284	80.2	612	86.3
	No	27	7.6	70	19.8	97	13.7
Sanitation facility type	Improved	52	15.9	32	11.3	84	13.7
	Unimproved	276	84.1	252	88.7	528	86.3
Presence of faeces in the compound	Yes	70	21.3	95	33.5	165	27.0
	No	258	78.7	189	66.5	447	73.0
Latrine cleanliness status	Hygienic	239	72.9	185	65.1	424	69.3
	Unhygienic	89	27.1	99	34.9	188	30.7
Household drinking water source	Improved	132	37.5	161	45.5	293	41.3

	Unimproved	223	62.8	193	54.5	416	58.7
Washing hand with soap, detergent or ash	Yes	334	94.1	333	94.1	667	94.1
	No	21	5.9	21	5.9	42	5.9
Unsanitary disposal of children's faeces	Yes	87	24.5	127	35.9	214	30.2
	No	268	75.5	227	64.1	495	69.8
Exclusive breast feeding	Yes	251	75.8	240	72.1	491	73.9
	No	80	24.2	93	27.9	173	26.1

Prevalence of diarrhoeal disease

The overall past two-week diarrhea prevalence in the study area is 143 (20.2%). The prevalence of past two-weeks diarrhea morbidity among under-five children living in ODF sub-districts was 61 (17.2%), which is lower than children living in non-ODF sub-districts 82 (23.2%). A significant difference in the occurrence of under-five diarrhea was observed between ODF and non-ODF sub-districts in the study area [x2(df)=3.93(1), p=0.04].

Factors associated with diarrhea prevalence in ODF sub-districts

In multivariable logistic regression analysis showed, the odds of developing diarrhea was 70% less likely in children who were reported to be exclusively breastfed than those who were not exclusively breastfeeding [AOR: 0.30; 95%CI: 0.15, 0.56]. Children living in households that used unsanitary disposal of children feces were two and half times to develop diarrhea compared to children living in households that used sanitary disposal of children feces [AOR: 2.58; 95% CI: 1.36, 4.89]. And, the prevalence of diarrhea was two times higher among children whose mother's not attending formal education when compared with those children whose mother's attending formal education [AOR: 2.10; 95% CI: 1.05, 4.20] (Table 3).

Table 3: Factors associated with diarrhoea in ODF in Goba district, Southeast Ethiopia (Note: *p value<0.05, **p value<0.001, COR=Crude odds ratio, AOR=Adjusted odds ratio, CI=Confidence Interval, ETB=Ethiopian Birr, Average exchange rate of 1 USD in Ethiopian Birr was=22.7469 during the study period (March-April, 2017)).

Variables		Presence of diarrhoea		In non ODF Sub-districts	
		Yes	No	COR (95% CI)	AOR (95% CI)
Presence of household latrine	Yes	54	230	0.35 (0.20, 0.62)**	
	No	28	42	1	
Status of latrine cleanliness	Hygienic	25	160	0.38 (0.21, 0.39)*	0.41 (0.20, 0.82)*
	Unhygienic	29	70	1	1
Presence of faces in the compound	Yes	28	67	2.62 (1.43, 4.80)*	2.10 (1.05, 4.17)*
	No	26	163	1	1
Proper disposal of solid waste	Yes	37	159	0.58 (0.35, 0.96)*	0.69 (0.35, 1.36)
	No	45	113	1	1

Using hand to feed the index child	Yes	44	83	2.54 (1.52, 4.24)**	1.72 (0.87, 3.42)
	No	38	189	1	1
Unsanitary disposal of children's faeces	Yes	3	13	2.64 (1.59, 4.37)**	1.22 (0.39, 1.70)
	No	7	46	1	1
Age of the index child	0-5 Month	3	13	1.56 (0.39, 6.23)	1.09 (0.32, 5.85)
	6-11 Month	7	46	1.03 (0.38, 2.76)	0.41 (0.10, 1.67)
	12-23 Month	30	62	3.27 (2.58, 6.78)*	3.71 (1.50, 9.19)*
	24-35 Month	29	63	3.12 (1.50, 6.46)*	2.09 (0.85, 5.13)
	36-59 month	13	88	1	1

Factors associated with diarrhea prevalence in non-ODF sub-districts

In non-ODF households, hygienic latrine, age of index child and presence of feces in the compound were found to be independently associated with diarrhoeal morbidity. Children living in households with hygienic latrine were 59% less likely to develop diarrhea than children living in households with unhygienic latrine [AOR: 0.41; 95% CI: 0.20, 0.82]. The odds of developing diarrhea among children aged between 12-23 month were about 3.7 times higher when compared with children whose age was between 36-59 months [AOR: 3.71; 95% CI: 1.50, 9.19]. Again, children from households that were feces around the compound were about two times more likely to develop diarrhea than those children from households where feces were not observed around the compound [AOR: 2.10; 95% CI: 1.05, 4.17] (Table 4).

Table 4: Factors associated with diarrhoea in non-ODF in Goba district, Southeast, Ethiopia (Note: *p value<0.05, **p value<0.001, COR=Crude odds ratio, AOR=Adjusted odds ratio, CI=Confidence Interval).

Variables		Presence of diarrhoea		In non ODF Sub-districts	
		Yes	No	COR (95% CI)	AOR (95% CI)
Presence of household latrine	Yes	54	230	0.35 (0.20, 0.62)**	
	No	28	42	1	
Status of latrine cleanliness	Hygienic	25	160	0.38 (0.21, 0.39)*	0.41 (0.20, 0.82)*
	Unhygienic	29	70	1	1
Presence of faces in the compound	Yes	28	67	2.62 (1.43, 4.80)*	2.10 (1.05, 4.17)*
	No	26	163	1	1
Proper disposal of solid waste	Yes	37	159	0.58 (0.35, 0.96)*	0.69 (0.35, 1.36)
	No	45	113	1	1
Using hand to feed the index child	Yes	44	83	2.54 (1.52, 4.24)**	1.72 (0.87, 3.42)
	No	38	189	1	1

Unsanitary disposal of children's faeces	Yes	3	13	2.64 (1.59, 4.37)**	1.22 (0.39, 1.70)
	No	7	46	1	1
Age of the index child	0-5 Month	3	13	1.56 (0.39, 6.23)	1.09 (0.32, 5.85)
	6-11 Month	7	46	1.03 (0.38, 2.76)	0.41 (0.10, 1.67)
	12-23 Month	30	62	3.27 (2.58, 6.78)*	3.71 (1.50, 9.19)*
	24-35 Month	29	63	3.12 (1.50, 6.46)*	2.09 (0.85, 5.13)
	36-59 month	13	88	1	1

DISCUSSION

The prevalence of diarrhea morbidity among under-five children living in ODF sub-districts was 17.2%. The last two-week prevalence of diarrhea among ODF sub-districts was higher when compared with the study done in India [17], in Kenya [18] and in North-west Ethiopia [11], were reported the prevalence of diarrhea among ODF kebeles was 2.72%, 11%, and 9.9% respectively. This difference might be explained by ODF sub-districts in the present study have not achieved 100 percent latrine coverage and still practice open defecation when compared to previous studies. However, the prevalence of two-week diarrhea in ODF sub-districts was low as compared with the study done Ethiopia, Sidama zone among children living in ODF kebeles, which was 24.7% [10].

The prevalence of diarrhea morbidity among under-five children living in non-ODF sub-districts was 23.2%. The past two-week prevalence of diarrhea among non-ODF sub-districts was higher than the study done in non-ODF village in India [17] and Kenya [18]. This indicates that diarrhoeal diseases in under five children remains prevalent and needs more compressive approach despite CLTSH considerable improvements. On the other hand, the result was comparable with the study done in Southern Ethiopia 26.5% [10] and lower than a similar study from north-west Ethiopia 36.1% [11].

This study shows that there was a slightly higher prevalence of diarrhea among children residing in non-ODF households compared to those children's residing in ODF households. This difference might be due to the fact that the CLTS implementation in ODF sub-district and difference in the awareness level of households towards environmental sanitation among the sub-districts could be the possible explanation. In addition, dissimilarity in sanitation facilities coverage between this two-sub-district might be the possible reason for different diarrhea prevalence. In support of this, a multicentre study in Kenya reported that practicing open defecation was a risk factor for moderate to severe diarrheal diseases [19].

In ODF households, differences in diarrhea prevalence were observed among children whose mothers attending formal education than children whose mothers not attending formal education. This finding was similar to other studies conducted in Kenya [20], and Iraq [12], and in Ethiopia [14,21]. This might be due to mothers knowledge allows them to easily adapting behavioural change to prevent diarrhoeal disease.

A child's whose families practiced unsanitary disposal of children feces were more likely to develop diarrhea compared to children whose families were practiced proper children feces disposal. The finding was in line with other studies conducted in Iraq [12], Indonesia [22] and in Ethiopia [4]. This might be due to the fact that the field disposal of children`s feces did not usually remove the pathogen, rather the pathogenic organism reserves in the soil and later through the fecal-oral route, it is re-ingested resulting in repeated episodes of diarrhoeal disease [3,4].

Again in ODF households, children who reported to be exclusively breastfed were less likely to develop diarrhea than children who were not exclusively breastfed. In support of this different studies conducted in Kenya [20], Qatar [23] and in north-west Ethiopia [24] reported children who were exclusively breastfed were less likely to develop diarrhea [24,25].

The presence of hygienic latrine was an independent factor of diarrhoeal morbidity in non-ODF households. This result was in line with other studies conducted in Ethiopia [26,27]. Presence of human feces in the compound was another risk factor for diarrhoeal diseases in non-ODF sub-districts. In line with this finding, a study was undertaken in Ethiopia, Yaya Gulele District [28] showed that presence of feces in the compound of children lived in not implemented CLTS kebele were more likely to develop diarrhoeal diseases.

Children whose age was between 12-23 months were more likely to develop diarrhea when compared with children whose age was between 36-59 months. This result was consistent with other studies, conducted in Kenya [20], Iraq [12] and in different parts of Ethiopia [13,25,29].

Studies have shown that unimproved drinking water source was known to cause diarrhoeal disease since water from the contaminated source is the major cause of diarrhoeal disease. However, this study showed that drinking water sources were not the factor associated with diarrhoeal disease prevalence in both ODF and non-ODF sub-districts. This might be due to drinking water source coverage in both ODF and non-ODF sub-districts was more comparable.

Our findings should be interpreted in light of certain limitations. First, the findings of this study rely on self-reported data and there is a probability of recall bias and social desirability bias but it was tried to give training for data collectors on the data collection tool and respondent's data confidentiality was also tried to be assured. In addition, the effect of food hygiene and knowledge of mother or caregiver on diarrhea was not assessed. Another limitation is that our study was not considered seasonal variations in diarrhea prevalence. Again, the study focus on comparing diarrhea prevalence based on open defecation free status of the community, which is not related to the type of drinking water supply, since ODF status did not depend on drinking water coverage.

CONCLUSION

The prevalence of under-five diarrhea slightly higher in non-ODF sub-districts compared to ODF households. Maternal education reported exclusive breastfeeding, and unsanitary disposal of children's feces bears a significant impact on diarrhea morbidity in ODF sub-districts. In non-ODF sub-districts hygienic latrine, index child age 12-23 months and presence of feces were a risk factor for diarrhea morbidity. Therefore, aggressive health education and promotion activities on hygiene and environmental sanitation should be strengthened to reduce the burden of diarrhea morbidity in the study area. In addition, concerned stakeholders need to strength sanitary disposal of children feces, along with promoting proper utilization of latrine, and exclusive breastfeeding. Moreover, the Zonal health department with district health officials needs to continue and strength regular supportive supervision to sustain the ODF community.

AUTHOR'S CONTRIBUTION

SM: Conceived and designed the study, and analyzed the data. TB and BS: Contributed to the study design, analyzed the data and prepare the manuscript. All authors read and approve the final manuscript.

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