

Environmental determinants of reported diarrhea among under 5-year old children in Mogadishu, Somalia

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Received June 2018
Accepted September 2018

Abstract

Purpose - The objective of this study was to assess the effects of environmental exposure on diarrhea incidence among U5 children in Mogadishu.

Design/methodology/approach - A cross-sectional community-based study was conducted among 195 caregivers of families with U5 children. They were recruited from four districts in Banadir region; and the study was performed from June to September 2016. Binary logistic regression was applied to identify factors associated with the diarrhea. Almost all caregivers were mothers who therefore were the primary interviewees.

Findings - About 17.4% of families with U5 children in the study area reported a case of diarrhea within the previous 30 days. Knowledge of diarrhea among mothers was at poor level (80.5%). Only 38.5 % drank treated water from a vendor tank or private well. The hygiene practices of mothers (77.9%) and food preparation practices (70.3%) were relatively good. Household environmental and latrine sanitation 72.3% were at poor level. The risk of diarrhea among families of U5 children increased 3.11 fold (95%CI 1.12-8.71) among families with poor level of food hygiene practices, also increased with an increasing number of U5 children in the family. The longer the duration of living in the capital of Somalia elevated the risk of family with U5 diarrhea.

Originality/value - The importance of knowledge on diarrhea, hygiene practices along with household environment and latrine sanitation should be strengthened within the community.

Keywords Diarrhea, Environmental determinants, Under 5-year old children, Somalia

Paper type Research paper

Introduction

Diarrheal disease is the second leading cause of death in children under five years old, and is responsible for killing a million children worldwide with children in fragile states like Somalia carrying a heavy burden [1]. The mortality caused by diarrhea has been reduced by oral rehydration, but effect of diarrhea on morbidity has accounted approximately for 1.7 billion cases per year [2, 3]. In Africa 696 million deaths due to diarrhea occur each year [4, 5]. Diarrhea is still the most public health problem, which attributes 19% mortality cause and the second mortality ranking of children under 5 years (U5) in Somalia [4]. Geographically, Africa and Southeast Asia were recorded as the places where the number of diarrhea deaths was the greatest in U5 [6]. Diarrhea a major public health problem, is often the clinical signs of an infection in the digestive system, especially intestinal part, has different of causative microorganism including bacteria, virus and parasites. Diarrhea can transmit through water contamination by fecal matter. Approximately 90% of the diarrheal disease among U5 is attributed to unsafe water, in adequate sanitation and poor hygiene [7, 8].

Somalia has faced on the armed conflict over 25 years. Similar to all wars, influence the health of the people especially among U5. Somalia has still been a severe situation where few of the critical signs have been found. Mortality ratio of less than five years children is especially high and child mortality has a slightly decrease during the last 3 years [5]. Ongoing in safety, few of government concern

Journal of Health Research
Vol. 32, Suppl.2, 2018
pp. S235-S245
doi: 10.14456/jhr.2018.27

of services of health care across most of the region of Somalia, coupled with the absence of essential health care, water-sanitation and hygiene (WASH), lack of access vaccine and immunization facilities, is resulting in the higher level of diarrhea morbidity and mortality among U5. To tackle these childhood diarrhea problem, the Somalia Ministry of Health and many NGOs have been increasing to clean drinking water supply, build latrines and health education program. It helps to show the sources of diseases via water such as diarrhea and to implement water supply with available quality and system distributes water available to urban and rural areas, while trying to perform the approach to the highest risky and poor member of communities [4]. The unfavorable hygiene and environmental conditions and in adequate access to safe drinking water are major factors enhancing the risk of diarrhea disease. Occupation of caregivers played an important role in the effective management of childhood diarrhea by correctly considering when their child has diarrhea, and perform appropriate action. To prevent dehydration, adequately trained and experienced caregivers can start oral rehydration early in the process of a child's illness. High importantly, caregivers can decide if a child's episode of gastroenteritis needs to be examined at a health facility or if they can control this episode at home by their capacity [9, 10]. The result of this study will be facilitating the government to plan some project to improve water and sanitation hygiene (WASH) for prevention of diarrhea among U5 children. This study aimed to assess the environmental exposure and diarrhea prevalence among U5 children in urban Mogadishu.

Methods

Study area

This study was conducted in urban of Mogadishu, the capital of the Federal Republic of Somalia located in the coastal Banadir region on the Indian Ocean. It consisted of 17 districts. The mean temperature annually in the city is around 27°C, with an average minimum 24°C. During the twenty years, Somalia faced long term political unsafely induced the collapse of government services and has caused extensive population movement.

Study design

This community-based cross-sectional study was conducted to assess the prevalence and its associated factors of diarrhea among the U5 children. Face-to-face interview and observation on household environment and latrine sanitation in urban Mogadishu was performed.

Study population

The study population was mother of U5 whereby their mothers were interviewed about diarrhea in the last 1 month, if mother was not available father was replaced. Mother or father of U5 and living in Mogadishu and agreed to participate by signing an informed consent was included into the study. Those who felt uncomfortable to answer the questions and refused to continue answering questionnaire and discontinue the interaction were excluded.

Sampling and sample size

A two-stage cluster sampling with probability proportional to size (PPS) of U5 in each village was applied to recruit mothers of U5 children living in Mogadishu into this study. Since prevalence of diarrhea among U5 in Mogadishu was not known, we assumed that diarrhea among this age group was 50% with the maximum allowable error not more than 10%, and the two-stage PPS cluster sampling was adopted to recruit the target, at 5% significance level and the design effect not more than 2, total

of 195 U5 children was included into the study [11]. By assuming that there was only one U5 per household, total of 195 households was recruited from 15 villages and 13 households with U5 per village. Since there are 29 villages in 4 districts and 17 sub districts of Mogadishu. Selection of 15 villages to represent all villages of Mogadishu by using sampling with probability proportional to size of number of households in each village, the larger the village was the more the chance of being included was performed at the 1st stage. Then from the list of households with U5 in the 1st stage sampled villages, 13 households were recruited using simple random sampling.

Measurements

Diarrhea among U5 years was classified as the child experienced on the passage of 3 or more loose or liquid stools per day or bloody or mucous stool within the last 1 month prior to the interview. Family with U5 diarrhea was identified as the family had at least one of their U5 members experienced diarrhea in the last one month.

Questionnaire and observation checklist

Six parts of structure questionnaire and a part of sanitation observational checklist were utilized in this study. The forms were prepared in English, and then translated to Somali language.

Part 1 consisted of family characteristics included parental characteristics including age, marital status, occupation of parents, education and length of staying in Mogadishu and information of U5 in the family including total U5 in the family and their diarrhea status in the last one month.

Part 2 measuring knowledge of U5 diarrhea, comprised of 5 different sub-categories of diarrhea related; definition, causes, spread, sign and symptoms, and prevention of diarrhea. They were "Yes -No" type of question, score "1" was assigned to the correct answer, other else assigned "0". Score to each question was summed up to become the score of each subcategory as well as overall score of knowledge, the higher the score was the better knowledge. The level of knowledge as overall and subgroups were classified into 3 groups do not know (score=0), poor (below 80% of total score) and good ($\geq 80\%$ of total score).

Part 3 Hygiene practices included 24 items on child's hand washing before eating, caregivers hand washing after toilet, child defecate, before child's feeding and before food preparation and cleansing drinking water storage and utensils for child feeding.

Part 4 Food preparation and feeding practices comprised of 5 questions on cleansing dishes and cutting board, washing hand with soap before cooking, keeping leftover food and washing hands with soap before child's feeding.

Part 5 Latrine practices of household members included questions on availability of latrine at home; if not where did their member defecate. For those having latrine all members included U5 used latrine, cleaning child's bottom and management of child's feces.

For Part 3 to Part 5, score 0-2 was assigned to the response no never, yes sometimes and yes always, then they were added up and classified into 2 groups: poor and fair using above and below 40% of total score, except part 5 using 80% as cutoff point.

Part 6 Child drinking water and treatment before drinking. Sources of child drinking water and its treatment were included.

The last part was observational checklist on environmental and sanitation, there were 16 yes-no type of questions included sub-item of environmental especially on stool feces seen in the toilet and home surrounding, flies seen in the kitchen garbage/rubbish, donkey/sheep/chicken and animal feces seen in house and

household surrounding and kitchen swept/clean and latrine sanitation. There were 3 negative and 13 positive items Score 0 and 1 was assigned to “No” and “Yes” of the positive questions and the reverse score was assigned to the negative item. Score to each question was summed up and become to be the score of environmental and latrine sanitation observation, the higher the score was the better the environmental and latrine sanitation. Then it was classified into 2 groups: poor and fair using 60% from total score as the grouping criteria.

Content validity of questionnaire was validated by 3 experts in the field of communicable diseases (especially diarrhea), environment, and behavior. Improvement according to expert opinion was performed before actual data collection.

Data collection

Two medical students were recruited as research assistance on data collection. They were trained on how to reach the sampled household and explained on each question including in the data collection form until they clearly understood before the implementation of data collection. Any problems encountered during data collection, the two assistants could make it clear with the researcher on daily basis. The observation of mother domestic hygiene practices; home hygiene condition, household and latrine sanitation was performed at time of interview. The interviewers were trained and practiced on how to observe and record from the researcher.

Ethics approval was obtained from Thammasat University Ethics Committee, COA154/2559. A written informed consent was obtained from all respondents before interviewing and household observation.

Statistical analysis

Number, percent, mean, median, mode and standard deviation were applied to describe each variable. Simple binary logistic was applied to identify factors related to diarrhea. Factors with p -values <0.25 from chi-square test were selected for further multiple logistic regression. Both crude and adjusted odds ratio (cOR and aOR) along with its 95% confidence interval (CI) were performed.

Results

Family characteristics

Almost all (99.0%) respondents were mothers of their U5 children. The length of stay in Mogadishu was from 2 months to 40 years with an average 8.63 years (SD=6.4 years). Half of the families with U5 had lived in the capital of Somalia not more than 7 years. However, 81.6% of the families had been living in the capital city of Somalia more than 5 years.

Characteristics of U5 and diarrhea status

Total of 195 families with 346 of U5 children were included into this study, 84.2% was from the family with 1-2 U5. About half of them (53.5%) were girl. Their ages ranged from 2 to 59 months. Those children younger than 2 years accounted for 64.1%, 76.9% had received measles vaccination, 10.1% reported that their U5 had diarrhea in the last one month before interviewing. Of total sampled 195 families, there were 34 families or 17.4% with at least one of their U5 had diarrhea in the last one month, as depicted in Table 1.

Parental characteristics of U5 children

Half of mother and father were younger than 24 and 33 years of age. Fathers were older than mothers with an average age of 33.20 and 24.50 years respectively. Educational attainment of father was better than mother. Overall, 60.6% and

Table 1. Characteristics of U5 children and their diarrheal status, duration of living in Mogadishu of 195 sampled households

Family and U5 characteristics	n	%
Relationship of U5 and respondent		
Mother	193	99.0
Father	2	1.0
Duration (in years) of living in Mogadishu		
0-4	66	33.9
5-9	57	29.2
10-14	51	26.2
15-40	51	26.2
Mean = 8.63 Median = 7.00 SD = 6.4		
Child characteristics and diarrhea status		
Number of U5 children in family		
1	68	34.9
2	98	50.3
3-8	29	14.9
Mean= 1.88, SD=0.97, Median=2		
Sex of 346 U5		
Boy	161	46.5
Girl	185	53.5
Age in months of 346 U5		
2-11	128	37.0
12-23	87	25.1
24-30	75	21.7
26-59	56	16.2
Measles vaccination of 346 U5		
266 76.9		
Experienced diarrhea in last one month of 346 U5		
35 10.1		
Family having at least one of their U5 diarrhea		
34 17.4		

Table 2. Parental characteristics of families with U5 children (n = 195)

Parental characteristics	Father		Mother	
	n	%	n	%
Age in years				
≤ 24	1	0.5	108	55.4
25-29	43	22.1	72	36.9
30-34	79	40.5	9	4.6
35-49	71	36.4	6	3.1
UNK	1	0.5		
Mean±SD	33.20±4.48		24.50±3.86	
Min – Max	23-47		18-39	
Educational attainment				
No schooling	119	61.0	150	76.9
Primary	22	11.3	18	9.2
Secondary	45	23.0	15	7.7
University	9	4.7	12	6.2
Main occupation				
Unemployed	15	7.7	5	2.6
Self-employed	160	82.1	5	2.6
Business man	17	8.7	-	-
Housewife & Student	-	-	185	94.9
Others	3	1.5	-	-

76.9% of the father and mother had no schooling, the rest of mother and father had attended secondary and primary school. Majority of the main occupation, 82.1% of father was self-employed where almost all mothers (94.9%) were housewife and student, as shown in Table 2.

Knowledge of caregiver on U5 diarrhea

Only 13.8%-18.5% of the caregivers were at good level of knowledge on U5 diarrhea in 5 dimensions being measured as shown in Table 3. The overall level of knowledge at good level was 14.4%. Knowledge on prevention seemed to be better than other dimensions; whereas knowledge on the spread of diarrhea as well as sign and symptom were considered the lowest. In regards to the correct response to each item of knowledge on U5 diarrhea, percent of correct answer ranged from 18.5%-19.0% were found in diarrhea prevention. The correct response to the knowledge on transmission and sign and symptom ranged between 14.4% - 15.4%. Details of correct answer to each item were not shown.

Table 3. Level of knowledge on diarrhea of caregivers of U5 (n = 195)

Knowledge	Don't know at all		Fair		Good	
	n	%	n	%	n	%
Overall knowledge	157	80.5	10	5.1	28	14.4
Definition	161	82.6	4	2.1	30	15.4
Causes	160	82.1	4	2.1	31	15.9
Spread	165	84.6	2	1.0	28	14.4
Signs and symptoms	164	84.1	4	2.1	27	13.8
Prevention	158	81.0	1	0.5	36	18.5

Table 4. Factors related to family with U5 diarrhea (n=195)

Environment and family characteristics	Total samples		Family with U5 diarrhea		Crude analysis		Adjusted analysis		
	n	%	n	%	cOR ¹	p-value ²	aOR ³	95%CI aOR	
							LB	UB	
Knowledge on diarrhea						0.096			
Poor	157	80.5	31	19.7	2.87		1.82	0.38	8.61
Good	38	19.5	3	7.9	ref		ref		
Environmental risk exposures						0.235			
Child drinking water									
Treated water from vender tank & private well	75	38.5	11	14.7	ref		ref		
Un-treated water from vender tank	28	14.4	8	28.6	2.30		1.98	0.51	7.75
Un-treated water from private well	92	47.2	15	16.3	1.10		1.21	0.38	3.81
Hygiene practice						0.001			
Poor	43	22.1	15	34.9	3.75		3.11	1.12	8.71
Fair	152	77.9	19	12.5	ref		ref		
Food preparation and feeding practices						0.233			
Poor	58	29.7	13	22.4	1.60		0.73	0.26	2.10
Fair	137	70.3	21	15.3	ref		ref		
Latrine Practices						0.246			
Poor	71	36.4	15	21.1	1.56		1.42	0.55	3.71
Good	124	63.6	18	14.6	ref		ref		

(continued)

Table 4. (continued)

Environment and family characteristics	Total samples		Family with U5 diarrhea		Crude analysis		Adjusted analysis		
	n	%	n	%	cOR ¹	p-value ²	aOR ³	95%CI aOR	
							LB	UB	
Environmental and sanitation observation						0.150			
Poor	141	72.3	28	19.9	1.98		0.87	0.27	2.83
Fair	54	27.7	6	11.1	ref		ref		
Family characteristics									
Number of U5 in family						0.098			
1	68	34.9	9	13.2	ref		ref		
2	98	50.3	16	16.3	1.28		2.01	0.69	5.85
3-8	29	14.9	9	31.0	2.95		4.32	1.11	16.75
Duration of living in Mogadishu (years)						0.003			
0-4	66	33.8	14	21.2	ref		ref		
5-9	57	29.2	5	8.8	0.36		0.19	0.05	0.71
10-14	51	26.2	6	11.8	0.50		0.41	0.13	1.31
15-40	21	10.8	9	42.9	2.79		1.85	0.53	6.46
Age of father (years)						0.110			
23-29	44	22.5	12	27.3	2.58		2.82	0.91	8.90
30-34	79	40.5	12	15.2	1.23		0.95	0.30	2.98
35+	72	37.0	9	12.7	ref		ref		
Main occupation of father						0.116			
Unemployed /student	16	8.2	5	31.3	2.42		3.79	0.97	14.79
Self-employed/Business man	179	91.8	28	15.8	ref		ref		

Note: ¹ cOR=Crude OR; ² p-value by chi-square test; ³ aOR=Adjusted OR (Adjusted for factors with p-values <0.25 of chi-square test from crude analysis)

Environmental exposure of U5

U5 children in this study area exposed to rather poor environment which was prone to diarrhea. Only 38.5% drank treated water which mainly from venter tank and private well. Family food hygiene and food preparation practices were at fair level, 77.9% and 70.3% respectively. For personal hygiene practice, 63.1% was at good level. Only 63.1% was at fair level of latrine practices. From latrine sanitation and environmental observation inside and surrounding the residence, 72.3% was at poor level, as shown in column total sample of Table 4.

Factors related to family with U5 diarrhea

Using family of U5 as the unit of analysis on the risk of U5 diarrhea, factors significantly associated to U5 diarrhea family of crude analysis were food hygiene practice, number of U5 in the family, duration of living in Mogadishu at p-values <0.05. When included those variables with p-values <0.25 into multiple binary logistic regression analysis, factors significantly related to family with U5 diarrhea were number of U5 in the family, duration of living in Mogadishu, age and main occupation of father when control for other variables in the model. The risk of diarrhea of their U5 in the family increased 3.11 times (95% CI: 1.12-8.71) when the family were at poor level of food hygiene practices. The risk of having U5 diarrhea in the family was elevated as an increasing number of U5 in the family. The risk of 3-8 U5 in the family was 4.32 times (95%CI: 1.11-16.75) as compared to those family with only one U5 child. The longer as well as the shorter length of stay in the capital city of Somalia was also increased the risk of their U5 diarrhea compared to those living in this city 5-9 years. Even though characteristics of father which were age and schooling did not play a significant role on the U5 diarrhea in the family, but it

showed that family whose father age below 30 and 30-34 years, the risk of their U5 children diarrhea was increased 2.82 times more than those whose father's age 35+ years (95% CI: 0.91-8.90), U5 family whose father's age 30-34 years had 5% lower risk than those of age 35+ years (aOR=0.95, 95%CI:0.30-2.98). Occupation of father was not played a significant role on the U5 diarrhea, the risk of their U5 in the family increase among unemployed father 3.79 times more than the employed father (95% CI: 0.97-14.79), when control for other variables in the model as the detailed shown in Table 4.

Discussion

Our results revealed that 17.4% of the family with U5 in Mogadishu having at least one of their U5 members with diarrhea in one month before interviewing, while U5 diarrhea was 10.1%. The magnitude of U5 diarrhea in this study is slightly difference from a study in Egypt 19.5%, the prevalence in the last 6 months [12, 13], and in Laelay- Maychew district, Tigray region, Ethiopia 18% [14]. This difference in prevalence is due the time reference in each study and socio-demographic, basic environmental and behavioral characteristics of the people in each country. The result of this study shown that drinking untreated water from both water tank delivery and private well, their U5 were risky to diarrhea more than those drink the treated water from both drinking water sources. Chlorination and boiling were more common drinking water treatments among families drink the water from private wells and vendor tank delivery. Child drinking water, 61.6% of the families with U5 in Mogadishu drank untreated water.

Regarding the child drinking water, some studies in Ethiopia [15, 16] children from households use improved water source were less vulnerable to experience diarrhea as compared to children from households using unimproved water source. It can be explained that improved water source tends to be less contaminated by pathogenic microorganisms than unimproved water source and thus decrease the risk of diarrhea. Only 38.5% of the households treated water from private wells and vendor water tank delivery before drinking, but type of drinking water was not significantly related to diarrhea when control for other variables e.g. hygiene practices, number of U5 in the family, length of stay in Mogadishu, as well as age, and occupation of father. The finding of this study was different from the study in Tanzania [17-19].

It was found that treating child drinking water with any methods reduce risk of diarrhea, but contradicted to a study in Kenya [14] which showed that drinking water treatment methods were not significant associated to diarrheal status of U5.

All families in Mogadishu had pit latrine and 99.0% of their members use latrine but only 62.1% of the U5 always use latrine. Management of child after defecation and child feces among families with U5 was rather poor. There is no association between latrine practices and family with U5 diarrhea. In contrast to a study in Ethiopia [20, 21], which showed that latrine use and type of toilet were the protective factors of U5 diarrhea. This means that children of families with used latrine and improved toilet facilities had a lower prevalence of diarrhea disease than those households not used latrine. Not only having and toilet use among family members but environmental and latrine sanitation of households with U5 play a significant role on diarrhea especially among children of under 5 years.

The observation of environment and latrine sanitation, 72.3% was at poor level. Only 41.0% of the toilet was clean, 6.7% no water available in the water container, 6.7% and 21.5% seen stool in the toilet and home surrounding.

Flies in the kitchen and food preparation area, garbage in the household surrounding and animal e.g. donkey, sheep, chicken around the house were observed

in more than half of the households. Since U5 diarrhea most often results from the ingestion of pathogens from lack of environmental and latrine hygiene.

The result of this study showed no association between household environment and latrine sanitation and U5 diarrhea. It can be explained that the immunity of U5 will be better to fight against diarrhea. This may be an explanation of unable to identify the association between environmental surrounding and U5 diarrhea in this study. Overall hygiene practices of caregivers, majority was at fair level. It was observed that almost all caregivers' hand washing practices was very poor, but food and water container hygiene practices of caregivers were better. Children whose caregivers always wash their hands were less likely to develop diarrhea compared to those whose caregivers wash their hands.

This study showed that only hygiene practices of caregivers was significantly associated with family with U5 diarrhea, but food preparation and feeding practices and latrine practices. This is in agreement with the findings from Bangladesh [22]. This could be explained that they are the main caregivers of the child and hand washing with soap/ash clears microorganisms in their hand highly compared to hand washing with water only. About 70.8% informed that always cleanse dishes and cutting board and 28.2% of them sometimes cleanse.

Only 47.2% reported that they always washing hands before cooking food and 33.3% always washing hands with soap before child feeding. In regards to keeping the leftover food away from flies, 70.3% always keep it from flies. Children whose caregivers were at good food hygiene practice were less likely to develop diarrhea compared to children whose caregivers at fair food hygiene practice. These findings agree with the study from Bangladesh [23-27]. The risk of diarrhea among U5 whose caregivers were at poor food hygiene practice was 3.11 times more than those at fair level when control for knowledge on diarrhea, drinking water, total U5 in the family, length of stay in Mogadishu, and age, main occupation of father.

However, knowledge on U5 diarrhea of caregivers in this group of population is still very poor, and it is lower than the study in the Tonle Sap Lake, Cambodia and knowledge was significantly related to diarrhea preventive behaviors of caregivers [28]. The less knowledge on diarrhea may be because of the less educational attainment and ability to read and write of the caregivers. Enhancing caregivers' knowledge may be resulted in improving hygiene, food preparation and feeding practices as well as latrine and environmental sanitation inside and surrounding the residence.

Conclusion

Total of 195 families with U5, 17.4% had their U5 diarrhea. Mother as the main caregiver, her knowledge of U5 diarrhea is still rather poor. Poor hygiene practices, the more number of U5 in the family, and the longer duration of resided in Mogadishu elevated the risk of diarrhea of their U5 in the family.

Recommendation

Promote national policies and regulation that regards the private wells to support management of diarrhea as well as build capacity in implementing preventive interventions, including sanitation, source water improvements, and household water treatment and safe storage. Providing continuous and regular supervision/information to the community focusing on environmental hygiene, food hygiene and general sanitation and water treatment method is recommended. Water-purification tablets should be provided to family households, in particular to households with under 5-year children. Possibilities should be explored for increased water chlorination at community and household levels. Health education

regarding food hygiene practices should provide to mother under 5- year children in Mogadishu and to advocacy on hand washing with soap before feeding child and after going toilet. Knowledge or information for parents and caregivers on how to prevention of diarrhea among their children is suggested.

Acknowledgment

I would like to express my profound gratitude to Thammasat University for fully financial support of my study in Thailand.

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