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Original Research Article

Environmental and Behavioral Factors Associated With Diarrhea Disease among Children Under Five Years Old in Mayo in Khartoum State

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ABSTRACT

Background: It is a fact that diarrheal diseases caused major public health problem in children under-five years of age, especially in camps in developing countries like Sudan. The objective of this study was to investigate the association of environmental and behavioural factors with under five diarrhoea in Mayo in Khartoum state.
Methodology: Community based cross-sectional study (descriptive study) was carried out to study the prevalence of diarrhoea among under five children in Mayo Camp-Khartoum State, Sudan. The chi-square test was used to determine the association between having diarrhoea in the last two weeks and sociodemographic variables.
Results: Diarrhoeal cases occurring within the 2 weeks preceding the interview were giving an overall prevalence of 35.0%% (n = 311). Prevalence was higher among boys than girls were (25% and 10%, respectively).Our study showed that environmental factors such as state of water containers, place of defecation, and presence of flies in the kitchen was significantly associated with diarrhea, in addition to several behavioral factors that were found to affect diarrheal disease among children in Mayo Camp.
Conclusion: We found a high prevalence of diarrhoea in children under the age of five in Mayo camp, with a higher prevalence among male children than female children. In addition, our study showed high significant association between a mother's educational level, income levels, and diarrhoeal disease. These findings highlight the need for public health interventions to relieve the burden of diarrhoea among children under the age of five.

Keywords: Diarrhoea, Environmental, Behavioral, children, under five years

INTRODUCTION

Diarrhea remains the leading cause of morbidity and mortality in children under 5 years old worldwide. Children in developing countries are disproportionately affected by preventable and treatable diseases with simple and affordable interventions. Consequently, children in these countries are 10 times more likely to die before the age of 5 years old than children in industrialized countries. [(1, 2)]

People in the economically poorest regions of the world and the least developed countries continue to bear the heaviest burden of child deaths. More than four-fifths of all deaths among children younger than 5 years old in 2011 occurred in sub-Saharan Africa and South Asia. [(3)]

Worldwide, the majority of deaths related to diarrhea take place in Africa and South Asia. Nearly half of deaths from diarrhea among young children occur in Africa where diarrhea is the largest cause of death among children under 5 years old and a major cause of childhood illness. [(4)]

Diarrhoea is the most important public health problem connected to water and sanitation and can be both "waterborne" and "water-washed". In recent decades, a consensus developed that the key factors for the prevention of diarrhea are sanitation, personal hygiene, availability of water, and good quality drinking water; and that the quantity of water that people have available for hygiene is of equal or greater importance for the prevention of diarrhoea as the bacteriological water quality. [(5)] In developing countries, infectious diarrhoeas are frequently disabling and contribute significantly to malnutrition and mortality in children. [(6)]

Epidemiologic studies show that factors determining the occurrence of diarrhea in children are complex and the relative contribution of each factor varies as a function of interaction between socio-economic, environmental and behavioral variables. [(7)]

In this study, we provide an overview of environmental and behavioral factors associated with diarrhea disease among children under five years of age in Mayo in Khartoum state. Specifically, we determined the prevalence of diarrhoea among under five years old, and identified key risk factors among children in this study area.

METHODOLOGY

Community based cross-sectional study (descriptive study) was carried out to study the prevalence of diarrhoea among under 5 children in Mayo Camp-Khartoum State –Sudan.

The source population is all mothers/ care givers-under-five children living in the camp and study population was mothers with children aged less than five years living in the selected households sampled and from whom data was collected. Mothers with their child aged less than five years willing to participate in the selected households were included and Mothers/ care givers of under-five children who had other health problem, critically ill and those who did not permanently live in the camp was excluded.

The sample size was determined by using the following formula: $N = \frac{Z^2 \times p.q}{d^2}$

Where :(N: is maximum size required, Z= 1.96 @ 95% confidence, P: is expected prevalence rate =28.2% at CI 95˚, q: 1-p , d= is the margin of sample error tolerated (%) =0.05) Apply the formula: $n \frac{(1.96)2 \times p.q}{(0.05)2}$ = 311 So the 311 household was obtained.

Systematic random sampling technique was used for distributing the sample through the study population by following formula: $K=\frac{N}{n}$ where :(K= interval, N=Population, n = sample). Obviously, we cannot select 6.9678 of a house. To compensate for this, we decided to pick every seventh household and continue to rotate this pattern until we have 311 household.

Data Collection:

After a verbal consent from the mother (care giver), a pretested questionnaire containing a related sociodemographic factors and inquiries were made regarding the possible risk factors for diarrhoea (Family size, education level, occupation, income, water source and storage, latrine use, knowledge on diarrhoea causes, prevention, food handling and breast feeding).

Data Analysis:-

Data collected was entered and analysed by using (SPSS) programme version 10.0, a relation between diarrhoea as depending variable and possible risk factor as influencing built by using cross tabulation and Chi-Square Tests. Significance was taken as a $P < 0.05$.

RESULTS

Table 1: Prevalence of diarrhea among under five children in Mayo camp

Child has currently or in the last 2 weeks	Frequency	Percent (%)
Diarrhea		
Male	78	25%
Female	31	10%
Total	109	35.0%
No Diarrhea	202	65.0%
Total	311	100.0%

Prevalence of diarrhoea among children under the age of five

Diarrhoea prevalence among children under the age of five was estimated based on the number of children who reportedly had diarrhoea during the 2 weeks preceding the interview as the numerator and the overall number of children in the sample as the denominator. Diarrheal cases occurring within the 2 weeks preceding the interview were giving an overall prevalence of 35.0%% (n = 311). Prevalence washigher among boys than girls (25% and 10%, respectively).

Table 2: Environmental characteristics of households in Mayo camp, Khartoum state.

Variables	Response category	Frequency	Percent (100%)
Source of water	Water pot	217	69.8
	Barrels	31	10.0
	Jerrycans	63	20.2
State of water containers	Protected	31	10.0
	Unprotected	280	90.0
Place of defecation	Open latrine	124	39.9
	Own latrine	78	25.1
	Shared latrine	109	35.0
Presence of flies in the kitchen	Present	232	74.6
	Not present	79	25.4

Environmental characteristics of the respondents:

According to the findings of our study, about seventy of the households were drinking water from water pot sources. Regarding the State of water containers, the majority of respondents 280(90%) used unprotected water containers, and the few rest 31(10%) used protected one respectively. Regarding place of defecation, one hundred twenty-four (39.9%) of the households used open latrine, seventy-eight (25.1%) have own latrine, and one hundred nine (35%) shared latrine. According to this study, most of respondent 232 (74.6%) revealed that there was presence of flies in the kitchen. (See Table 2).

Table 3 Behavioral and child care practices of mothers in Mayo camp, Khartoum state.

Variables	Response category	Frequency	Percent (100%)
Reaction of mother if child gets diarrhoea.	Continue breast feeding	15	4.8
	Give ORS	157	50.5
	Visit the health facility	108	34.7
	Continue breast-feeding, Give ORS and Visit the health facility.	31	10.0
Hand washing time	Before eating	201	64.6
	After defecation	31	10.0
	Mentioned more than three critical time for hand washing	79	25.4
Ways of hand washing	Use water, soap and ash.	110	35.4
	Use water only	201	64.6
Washing food utensils	Use water and soap	218	70.1
	Use water and ash	93	29.9
Practicing absolute breast-feeding for six months	Practiced	79	25.4
	Not practiced	232	74.6
Complementary feeding starting	Less than six months	63	20.3
	More than six months	248	79.7
Weaning time	Less than one year	31	10.0
	1-2 years	249	80.1
	More than 2years	31	10.0
Way of weaning	Suddenly	32	10.3
	Gradually	279	89.7
Practices of mothers to prevent diarrhoea.	Cover food	155	49.8
	Wash fresh vegetables and fruits before eating	31	10.0
	Hand washing	46	14.8
	Mentioned more than three ways for prevention.	79	25.4

Behavioral and child care practices of mothers

Regarding the reaction of the mother if a child gets diarrhoea, half of mothers 157 (50.5%) said they use ORS for rehydration, 108 (34.7%) visit the health facility and only a few mothers 15 (4.5%) continue breast-feeding.

Concerning the hand washing practices of mothers, 201 (64.6%), wash their hand before eating. Our study showed only 31(10%) of the total mothers reported washing hands after defecation.201 (64.6%) of them washed their hands without any detergent (use water only). Regarding the duration of breast-feeding practices, three quarters of mothers 232 (74.6%) do not practice absolute breast-feeding. Concerning the initiation time of complementary feeding, 248 (79.7%) of the mothers started feeding additional food to their children after six months of age. The study further indicated that 249 (80.1 %) of the mothers wean their children at 1-2years. In addition, the majority of mothers weaning them gradually.

Regarding the practices of mothers to prevent diarrhea, 155(49.8%) cover food, 46(14,8)hand washing, and 31(10%) wash fresh vegetables and fruits respectively.(See Table 3).

Table 4: Environmental exposure variables associated with diarrheal disease among children under five years of age in Mayo camp

Environmental variables	Response category	Prevalence of diarrhea among under five children in Mayo camp		χ^2	P-value
		Diarrhoea N (%)	Healthy N (%)		
Source of water	Water pot	78(35.9)	139(64.1)	22.352	0.307
	Barrels	00(00.0)	31(100.0)		
	Jerry cans	31(49.2)	32(50.8)		
State of water containers	Protected	00(00.0)	31(100.0)	18.580	0.000
	Unprotected	109(38.9)	171(61.1)		
Place of defecation	Open latrine	31(25.0)	93(75.0)	35.562	0.000
	Own latrine	16(20.5)	62(79.5)		
	Shared latrine	62(56.9)	47(43.1)		
Presence of flies in the kitchen	Present	109(100.0)	123(60.9)	57.145	0.000
	Not present	00(00.0)	79(39.1)		

The results from the statistical analyses are presented in Tables 4 and 5. The finding revealed that, diarrhoea among children under the age of five was significantly associated with: (i) State of water containers (χ^2 = 18.580, P-value = 0.000); (ii) Place of defecation (χ^2 = 35.562, P-value = 0.000); (iii) Presence of flies in the kitchen (χ^2 = 35.562, P-value = 0.000). Source of water were negatively associated with the occurrence of diarrhoea.

Table 5: Behavioral related risk factor for diarrhoea among children under five years of age in Mayo camp

Behavioral risk factor	Response category	Prevalence of diarrhea among under five children in Mayo camp		χ^2	P-value
		Diarrhoea N (%)	healthy N (%)		
Ways of hand washing	Use water, soap and ash.	31(28.4)	79(39.1)	3.525	0.039
	Use water only	78(71.6)	123(60.9)		
Practicing absolute breast-feeding for six months	Practiced	00(00.0)	79(39.5)	57.145	0.000
	Not practiced	109(100)	123(60.9)		
Weaning time	Less than one year	31(28.4)	00(00.0)	75.693	0.000
	1-2 years	78(71.6)	171(84.7)		
	More than 2years	00(00.0)	31(15.3)		
Practices of mothers to prevent diarrhoea.	Cover food	47(30.3)	108(69.7)	122.737	0.035
	Wash fresh vegetables and fruits before eating	00(00.0)	31(100)		
	Hand washing	15(32.6)	31(67.4)		
	Mentioned more than three ways for prevention.	00(00.0)	79(100)		

Statistical analyses were carried out to identify the behavioral related risk factor for diarrhea among children under five years of age in Mayo camp was presented in

Tables 5, diarrhea among children under the age of five was significantly associated with ways of hand washing (χ^2 = 3.525, P-value = 0.039). Mothers that were practicing absolute breast-feeding for six months showed high statistically significant (χ^2 = 57.145, P-value = 0.000). Similarly, there was highly significant associations between diarrhea and Weaning time (χ^2=75.693, P-value =0.000). Mothers who practice preventive measures of diarrhea revealed significant associations (χ^2=122.737, P-value =0.035).

DISCUSSION

This study inspected household environmental health and behavior factors associated with the occurrence of childhood diarrhoea of Mayo Camp in Sudan. The results indicated that the overall prevalence of diarrhoea was 35.0% in under-five children in the previous two weeks preceding the interview. This rate was higher than reported by Thiam *et al*. for the same age group (2017), in Mbour, (26%) [(8)] in addition to the study conducted in Northwest Ethiopia, 2014 which stated that the prevalence of diarrheal disease among children younger than 5 years old was (21.5%), [(9)] as well as a study carried out in Eastern Ethiopia 2013, (22.5%). [(10)] Also our rate is very high compared to that reported in the Wolitta Soddo Town, Southern, Ethiopia 2015 survey that reported (11%) for this region. [(11)] Our rate agrees with Touray and colleagues (2012) who reported the same prevalence among children under 5 years in Mauritania (35%), [[12]] and with Ebrahim (2003) who revealed that prevalence rates of diarrhea vary from 17% to 27% in the North and 41% in Southern Sudan among children under 5 years old. [(13)]

In this study of under-five children in Mayowe found that being a boy was positively associated with diarrhoea, the high prevalence recorded in male children (25%) rather than female children under five years old, (10%), this result agrees with a study conducted by Siziya (2013) in Sudan. [(14)] and ATU *et al*, (2015) which report high prevalence of diarrhea among males rather than females. [(15)] This higher prevalence could be attributed to behavioral differences in gender in terms of personal hygiene, sanitation, and recreational activities; as the male children go to play football and end up going to bed without a bath with soap and water.

Over half of the study respondents (69.8%) used water pot as a source of drinking water at home, and the bivariate analysis of the study using Chi-square test indicated that there was a statistical significance in the association between diarrhoea and household based drinking water storage; his finding was absolutely the result of water being contaminated at or following collection during transportation and/or storage since the water storage containers are uncovered and broad necked, so they can be contaminated easily by pets, dirt, or other debris. [(16)] The findings of this study were also supported by a Centers for Disease Control and Prevention report that found that microbial contamination of water was usually associated with storage vessels having wide openings, such as buckets and pots, which are vulnerable to the introduction of hands, as well as cups and dippers, which can easily carry contamination to the water. [(17)]

In this particular study, it was found that the use of open latrine for defecation was significantly associated with the prevalence of diarrhoea. In a study carried out in Ibadan, Nigeria, indiscriminate disposal of solid waste was significantly associated with a high rate of diarrhoea. [(18)] Studies in Ethiopia also revealed that open disposal of waste around the house were a risk factor for diarrhoea. [(19)] We also found that distribution offlies in the kitchens was significantly associated with the risk of diarrhoea. The likely explanation for these results is that inappropriate disposal of solid waste and evacuation of wastewater inpen areas creates breeding sites for insects, which may spread diarrheal pathogens from the open waste to water or food.

Moreover, children of mothers who washed their hands using water only at critical times were more than five times more likely to report diarrhea, compared to children of mothers who washed their hand using water and soap. This finding showed statistical significance with prevalence of diarrhea. The finding was supported by similar studies conducted in Bangladesh, [20] which prove that washing hands with ash is a prevalent behavior in Mirzapur and may help diminish transmission of diarrheal pathogens to children, and was also supported by similar studies performed Jigjiga District, Somali Region, Eastern Ethiopia, and in Sheko district, Southwest Ethiopia, where mothers' hand washing habits affected the occurrence of diarrheal disease among their children. [21]

Regarding to absolute breastfeeding, the study showed that 232 (74.6%) of the mothers of children do not practice absolute breastfeeding and this can weaken the immunity of children, which showed a high statistical significant with the prevalence of diarrhea, in addition breastfeeding may reduce the incidence of fever after infant immunization, this finding supported by study conducted by Hari Cheryl Sachs 2013. [22]

CONCLUSION

The findings of this study exposed that, diarrheal cases occurring within the 2 weeks preceding the interview were giving an overall prevalence of 35.0%%. Prevalence was higher among boys than girlsat25% and 10%, respectively in Mayo camp, and several environmental and behavioral factors were found to affect diarrheal disease among children in the district. Therefore, the government, families and nongovernmental organizations working with children and mothers must cooperate regarding interventions to minimize the risks of the disease.

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