

Original Research Article

Analysis of risk-factors associated with diarrhea prevalence among underfive children in Galkayo District Puntland State, Somalia

Mustaf A. Isack^{1*}, Juma J. Nyamai², Atei Kerochi³

¹Department of Public Health, ²Department of Epidemiology and Biostatistics, ³Department of Community Health, School of Public Health. Mount Kenya University, Kenya

Received: 27 October 2021

Revised: 02 November 2021

Accepted: 03 November 2021

*Correspondence:

Dr. Mustaf A. Isack,

E-mail: musdhafey@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The study analysed risk factors associated with diarrhea prevalence among underfive children in Galkayo District Puntland State, Somalia.

Methods: The study used analytical cross-sectional survey conducted in Galkayo, from February to March 2020. The inclusion criteria were caregivers with underfive children, and exclusion criteria were children over five years, caregivers who have no underfive children and children with chronic diarrhea. Sample of 385 was calculated using Yamane formula. Caregivers were randomly selected using simple random sampling after cluster sampling. The researcher administered structured questionnaires, collected data from eligible caregivers using interview guide and elicited on diarrhea perceptions. Quantitative data was analysed using SPSS, qualitative data was identified common and sub-themes.

Results: The study found diarrhea was affecting 30% of underfive children. The presence of two under-fives in the household was associated with high diarrhea prevalence [OR=1.93, 95% CI= (1.21, 3.08)]. Low educational level of underfive caregivers were associated with high diarrhea occurrence [OR=1.36, 95% CI= (0.68, 2.66)]. Households headed by non-biological mothers, diarrhea prevalence was high [OR=0.06, 95% CI= (0.00, 0.50) and OR=0.17, 95% CI= (0.03, 0.79)] respectively. Those children under the care of employed caregivers, diarrhea occurrence was high [OR=2.41 (0.99, 5.80)]. Poor personal hygiene (32%), sanitation (28%), and water quality (28%) were attributed to the cause of diarrhea among children.

Conclusions: The study recommends, practice of child spacing, improve caregivers' basic education to better understand risk factors and seek treatment, establish routine water quality surveillance at source and at household level, conduct awareness behaviour change by promotion of handwashing.

Keywords: Diarrhea prevalence, Galkayo district, Risk factors, Under-five children

INTRODUCTION

World Health Organization (WHO) describes diarrhea as passing three or more loose or watery excrement in a day. In 2015, the global burden of diseases (GBD) estimated that there were 2.39 billion episodes of diarrhea of which 957.5 million of these were children under five years of age.¹ Diarrhea is the second leading cause of death among underfive children worldwide. Globally, diarrhea

contributes to 18% of underfive child mortality, most of which (78%) occur in Africa and Southeast Asia continents.² Most affected are children under two years of age where diarrhea incidence peaks at age 6-11 months and up to 72% of the deaths occur.³ Demonstrably, considerable improvement has been made in the control of diarrheal mortality. Between 2005 and 2015, the death rate of diarrhea reduced significantly by 34.3%, the fastest decrease ever recorded in sub-Saharan African

countries where the death rate reduced by more than 100 deaths per 100000 in western (from 445 to 277 deaths per 100000), eastern (from 243 to 131 deaths per 100000), and southern (from 214 to 113 deaths per 100000), in East Africa, mortality rate of diarrhea decreased from 243 to 131, which translates a reduction of 46.1%.⁴ Despite this substantial progress made in the past one and half decades, still diarrhea continues with considerable and preventable burden of morbidity and mortality in Africa.⁵ Diarrhea has a harmful effect on child's growth and intellectual development. The main factors contributing to estimated 88% of diarrhea deaths include drinking unprotected water, poor hygiene practices and poor environmental sanitation.⁶ The rotavirus is the leading cause of acute diarrhea and causes about forty percent (40%) of sicknesses of underfive children. Mostly, the microorganisms spread from the stool of an infected individual to the mouth of another susceptible individual through contaminated water, food, or other objects.⁷ Lack of clean drinking water, unavailable hygiene amenities and deprived cleanliness can cause a huge number of the world's low-income persons to perish from avoidable diarrheal illness. Expanding access to better-quality drinking water sources, and enhanced cleanliness can cut down diarrhea's illness in five-year kids. Furthermore, water quality control and treatment appear to reduce up to forty-five percent (45%) of diarrhea death among under-five kids in country populace where the fecal matter is high.⁸ Currently the rotavirus vaccine, in addition to access to clean drinking water, acceptable hygiene and sanitation are ways of preventing diarrhea.⁹ Over a five-year period (2012 to 2017) in East Africa, prevalence of diarrhea amongst children of under-five was reported as follows; 11% in Somalia, 16% in Kenya, and 54% in Ethiopia.¹⁰ In 2016, children below five years in Somalia who died due to diarrhea was 10,224.23, (16/1000 live births), which was 13% of child mortality.¹¹ Some reports indicate that 7,632 and 8,183 cases of all types of diarrhea occurred in Bosaso-Puntland it constituted eighty seven percent (87%) and eighty-eight percent (88%) for the years 2013 and 2014 respectively.¹² This study investigated the reasons for the high prevalence of diarrhea in the underfive year children residing in Galkayo, Somalia.

METHODS

The study used analytical cross-sectional study design that was conducted in Galkayo District Puntland State, Somalia, from February to March 2020.

Inclusion criteria

Caregivers with underfive children and had lived in Galkayo for at least three months.

Exclusion criteria

Caregivers with children underfive years old and had lived in Galkayo for less than three months.

The sample size was 385 calculated using Yamane formula of 1986. Two-stage cluster random sampling procedure was used to select the research participants. First stage clusters were selected and then households were selected through simple random sampling technique as a second stage. The researcher administered structured questionnaires to the caretakers of children underfive years of age in each of the selected household. Qualitative data was collected using interview guides to conduct focus group discussion with underfive caretakers and key informant interviews for staff at ministry of health, water, and sanitation as well as civil society.

Quantitative data was analysed using statistical packages for the social sciences (SPSS) version 20, while qualitative data was analysed by identifying common themes and sub-themes. Descriptive and inferential statistical findings was analyzed and presented in tables, charts, and graphs. Chi-square test displayed the association between dependent and independent variables. Logistic regression was done to identify associations between the independent and dependent variables.

Ethical consideration was observed throughout the research. An ethics certificate was issued by Mount Kenya University ethics research committee as well as research permission received from Somali Research Council and an approved letter from Galkayo local administration. An informed written consent was obtained by signing/thumbprint on the consent form before the start of collecting of data from each research participant.

RESULTS

Socio-demographic factors and diarrhea prevalence among underfive children

Thirty percent of the households (HHs) reported diarrhea among the under-five children during the two weeks prior to the survey. The prevalence of diarrhea among the under-five children was highest in the households where the caregiver of the child was an aunt (42.9%), followed by housemaid (33.3%), then by father (31.9%) and lowest where the mother was in-charge (23.4%). The prevalence of diarrhea was highest in the households where the mother of the under-five child was employed (41%), followed by where the mother was housewife (33%), then by student mothers (27%) and lowest where the mother was running a business (23%). The number of the under-five children in the HHs and the diarrhea occurrence, the findings indicate that the prevalence of diarrhea among HHs with one child younger than five years was 51.3%, those with two underfive children was 40.2% and those with 3 or more children it was 8.5%. Logistic regression analysis indicates that the HHs with two or less under-five children were almost two times more likely to develop diarrhea than those with more than two children [OR=1.93, 95% CI= (1.21, 3.08)].

Table 1: Socio-demographic factors and diarrhea prevalence.

Variables	Diarrhea (N=385)		Crude OR (95% CI)
	Yes (%)	No (%)	
Membership in household (HH)			
1-3 persons	8 (11.9)	34 (88.1)	0.56 (0.23, 1.21)
4-7 persons	37 (7.2)	60 (92.8)	1.4 (0.85, 2.29)
>7 persons	72 (9.8)	174 (90.2)	1.0
HH head			
Aunt	3 (42.9)	4 (57.1)	1.0
Father	95 (31.9)	203 (68.1)	0.62 (0.14, 3.22)
Housemaid	1 (33.3)	2 (66.7)	0.67 (0.02, 10.86)
Mother	18 (23.4)	59 (76.6)	0.41 (0.08, 2.22)
Occupation of caregiver			
Business	22 (22.7)	75 (77.3)	1.0
Employed	12 (41.4)	17 (58.6)	2.41 (0.99, 5.80)
Housewife	75 (32.6)	158 (67.4)	1.65 (0.97, 2.90)
Student	8 (26.9)	18 (73.1)	1.26 (0.44, 3.28)
No. of under-five in HH			
One child	60 (51.3)	172 (64.2)	1.0
Two children	47 (40.2)	74 (27.6)	1.93 (1.21, 3.08) *
Three children	10 (8.5)	22 (8.2)	1.33 (0.57, 2.91)
Child's sex			
Male	48 (28.4)	121 (71.6)	0.85 (0.54, 1.31)
Female	69 (31.9)	147 (68.1)	1.0
Child's age			
<6 months	9 (32.1)	19 (67.9)	1.0
6-24 months	69 (29.5)	165 (70.5)	0.88 (0.39, 2.14)
>24 months	39 (31.7)	84 (68.3)	0.98 (0.42, 2.45)
Age of care givers (respondents)			
<18 years	1 (33.3)	2 (66.7)	1.0
18-35 years	74 (32.0)	157 (68.0)	0.94 (0.09, 20.47)
>35 years	42 (27.8)	109 (72.2)	0.77 (0.07, 16.84)
Marital status (respondents)			
Married	104 (31.0)	232 (69.0)	1.15 (0.53, 2.69)
Single	0 (0.0)	2 (100)	NA
Divorced	9 (28.1)	23 (71.9)	1.0
Widowed	4 (36.4)	7 (63.6)	1.46 (0.32, 6.16)
No comment	0 (0.0)	4 (100)	NA
Level of education (respondent)			
Never attended any school	42 (31.1)	93 (68.9)	1.0
Primary completed	19 (38.0)	31 (62.0)	11
Primary incomplete	18 (36.7)	31 (63.3)	1.29 (0.64, 2.54)
Secondary completed	26 (26.8)	71 (73.2)	0.81 (0.45, 1.44)
Secondary incomplete	6 (20.0)	24 (80.0)	0.55 (0.19, 1.38)
Tertiary/university completed	6 (26.1)	17 (73.9)	0.78 (0.27, 2.03)
Tertiary/university incomplete	0 (0.0)	1 (100)	NA
Relation to child (respondent)			
Mother	81 (34.0)	157 (66.0)	0.43 (0.12, 1.47)
Father	25 (25.5)	73 (74.5)	0.29 (0.08, 1.02)
Aunt	6 (54.5)	5 (45.5)	1.0
Grandmother	1 (7.1)	13 (92.9)	0.06 (0.00, 0.50) *
Sister	4 (16.7)	20 (83.3)	0.17 (0.03, 0.79) *

*P value less than 0.05

The increasing age of a caregiver has an inverse relationship with the prevalence of diarrhea among the under-five children. The prevalence of diarrhea was 0.85% among children whose caregivers were 18 years and below as compared to those of 18-35 years and above 35 years of age where it was 63.24% and 35.89% respectively. The frequency of diarrhea was slightly low among the under-fives living in the HHs where the caregiver is married (31%) compared to 36% for the HHs of widowed caregivers but higher than in the HHs where the caregiver is divorced (28%). The prevalence of diarrhea of under-fives children of caregivers who have attained education level equivalent to primary and below was 67.52% while among children whose caregivers' education level is secondary and above was 32.47%. The under-fives of caregivers with primary education were almost 1.3 times more likely to develop diarrhea compared with their counterparts [OR=1.29, 95% CI= (0.64, 2.54)] (Table 1).

Socio-economic factors and diarrhea prevalence

The source of household income and its association with prevalence of diarrhea was revealed as follows; The HHs whose main source was remittances experienced prevalence of diarrhea of 40%, those from private

employer had prevalence of 35.3%, income from agriculture was 33.3%, those with own businesses it was 30.2%, and those with income from civil service employment it was 24.3%. The research assessed the relationship of diarrhea occurrence and amount on expenditure on healthcare. The analysis revealed that the HHs who had expenditure of \$26-\$50 had prevalence of 35%, those who had expenditure of \$5-\$25, prevalence of diarrhea was 32% and diarrhea prevalence of 14% for HHs who had expenditure of \$51-\$100 and those who spent above \$100 the prevalence was 26%. On bivariate analysis, children from households whose health expenditure was \$51-100 were less likely to develop diarrhea than their counterparts [OR=0.3, 95% CI= (0.12, 0.69)]. Ninety percent of caregivers of the under-five children who suffered diarrhea spent money treating diarrhea compared to only 10% of caregivers who did not report occurrence of diarrhea (Table 2).

Level of awareness of diarrhea among caregivers

Just thirty-two percent of under-five children who got diarrhea were treated at home with ORS purchased from shops, 26% were treated with ORS provided from health facilities and 2% were just observed and 40% sought other medication (such like traditional healers).

Table 2: Socio-economic factors and diarrhea prevalence.

Variables	Diarrhea (N=385)		Crude OR (95% CI)
	Yes (%)	No (%)	
Family source of income			
Salary from civil service employment	17 (24.3)	53 (75.7)	0.64 (0.23, 1.93)
Salary from private employer	24 (35.3)	44 (64.7)	1.09 (0.40, 3.21)
Own business	51 (30.2)	118 (69.8)	0.86 (0.34, 2.40)
Agriculture	7 (33.3)	14 (66.7)	1.0
No income	16 (30.8)	36 (69.2)	0.89 (0.31, 2.73)
(Remittance amount of money sent to family members for support, by member(s) who is somewhere in abroad)	2 (40.0)	3 (60.0)	1.33 (0.15, 9.99)
Family health expenditure			
\$ 5-25	54 (32.3)	113 (67.7)	0.87 (0.53, 1.42)
\$ 26-50	45 (35.4)	82 (64.6)	1.0
\$51-100	7 (14.3)	42 (85.7)	0.3 (0.12, 0.69) *
Above \$100	11 (26.2)	31 (73.8)	0.65 (0.29, 1.38)
Did the family spend on treating <5 children suffering diarrhea?			
Yes	105 (90)	31 (11)	16.94 (2.61, 331.00)
No	11 (9)	232 (87)	0.24 (0.03, 4.74)
Do not know	1 (1)	5 (2)	1.0

*P value less than 0.05

Environmental factors and diarrhea prevalence

The prevalence of diarrhea in the HHs who own toilets was 33% while it was 14% among those HHs who do not own toilets. On bivariate analysis, children from households with a toilet were almost three times to develop diarrhea than their counterparts with no toilet

[OR=2.92, 95% CI= (1.35, 7.30)]. The prevalence of diarrhea in the HHs who own clean toilets was 30% while it was 37% among those HHs who own dirt toilets. On bivariate analysis, children from households with a clean toilet were less likely to develop diarrhea than their equals who own dirt toilets [OR=0.78, 95% CI= (0.49, 1.23)].

Table 3: Environmental factors and diarrhea prevalence.

Variables	Diarrhea (N=385)		Crude OR (95% CI)
	Yes (%)	No (%)	
Toilet ownership			
Yes	110 (32.7)	226 (67.3)	2.92 (1.35, 7.30) *
No	7 (14.3)	42 (85.7)	1.0
If yes, sanitary state of toilet (N=336)			
Clean	57 (29.7)	135 (70.35)	0.78 (0.49, 1.23)
Dirty	53 (36.8)	91 (63.2)	1.0
If No, where members go for call of nature (N=49)			
Bush	1 (14.3)	8 (85.7)	0.17 (0.00, 6.53)
Neighbours' toilet	3 (13.0)	20 (87.0)	0.15 (0.00, 4.46)
Open defecation	1 (20.0)	4 (80.0)	0.25 (0.00, 10.21)
Public toilet	2 (8.3)	10 (91.7)	0.09 (0.00, 3.43)
None	1 (50.0)	1 (50.0)	1.0
Disposal of child's faeces (N=274)			
Disposed of at the toilet	35 (24.8)	106 (75.2)	0.67 (0.37, 1.24)
Bury in the trenches	4 (19.0)	17 (81.0)	0.48 (0.13, 1.45)
Collect and throw away into washed wastes	14 (42.4)	19 (57.6)	1.5 (0.65, 3.46)
Other	26 (32.9)	53 (67.1)	1.0
Sources of water			
PSAWEN (puntland state authority for water, energy and natural resources)	25 (29.8)	59 (70.2)	1.21 (0.57, 2.66)
Rainwater collection points	11 (28.9)	27 (71.1)	1.16 (0.45, 2.94)
Water vendor	23 (31.1)	51 (68.9)	1.29 (0.59, 2.87)
Tap water	44 (32.6)	91 (67.4)	1.38 (0.69, 2.87)
Borehole	14 (25.9)	40 (74.1)	1.0
Amount of water consumption of HH per day			
<40 liters	20 (22.5)	69 (77.5)	1.0
40-80 liters	49 (33.6)	97 (66.4)	1.74 (0.96, 3.24)
>80 liters	48 (32.0)	102 (68.0)	1.62 (0.90, 3.02)
Is there a water storage container?			
Yes	112 (30.3)	258 (69.7)	0.87 (0.30, 2.84)
No	5 (33.3)	10 (66.7)	1.0
Types of water storage container (N=370)			
Metal	28 (41.2)	40 (58.8)	NA
Plastic	82 (27.3)	218 (72.7)	NA
Other (Water pot)	2 (100)	0 (0.0)	NA
Status (cleanness) of storage container (N=370)			
Clean	65 (27.1)	175 (72.9)	0.66 (0.42, 1.04)
Dirty	47 (36.2)	83 (63.8)	1.0
Methods of drinking water from container (N=370)			
Dip cup into the container	56 (31.8)	120 (68.2)	0.95 (0.54, 1.72)
Through tap of container	32 (26.4)	89 (73.6)	0.73 (0.39, 1.39)
Pour the water	24 (32.9)	49 (67.1)	1.0
Sanitary state of cup for drawing water (N=176)			
Clean	29 (29.0)	71 (71.0)	0.74(0.39, 1.41)
Dirty	27 (35.5)	49 (64.5)	1.0
Water container with lid (N=370)			
Yes	91 (29.3)	220 (70.7)	0.75 (0.42, 1.36)
No	21 (35.6)	38 (64.4)	1.0

*P value less than 0.05

The prevalence of diarrhea in the HHs who have no toilets and use open defecation was 20% while it was 14.3% among those HHs who have no toilets but used

neighbour's toilets. The prevalence of diarrhea among under-fives from HHs whose child's faeces collected and threw away into washed wastes was 42.4%, while 25% of

those whose faeces were disposed of at the toilets. The children from the HHs who threw away child's faeces were 1.5 times likely to develop diarrhea than their counterpart [OR=1.5, 95% CI= (0.65, 3.46)]. The prevalence of diarrhea in the HHs whose water sources was from water vendors was 33%, while it was 31.1% among those whose source is the tap water. On the bivariate analysis, children from those HHs whose source of water was water vendors were almost 1.4 times likely to report diarrhea than their counterparts [OR=1.38, 95% CI= (0.69, 2.87)]. The prevalence of diarrhea in the HHs whose amount of water consumption per day between 40-80 litres was 34% while those used more than 80 litres/day was 32%. The children from those HHs who consume between 40-80 liters of water per day were 1.7 times more likely to report diarrhea than their counterparts [OR=1.74, 95% CI= (0.96, 3.24)]. The prevalence of diarrhea in the HHs who have water storage container was 30.3% while it was 33.3% among those who do not have water storage container in their houses [OR=0.87, 95% CI= (0.30, 2.84)]. The prevalence of diarrhea in the HHs whose water storage status was assessed as clean was 27.1%, while it was 36.2% in the HHs where the water storage was assessed as dirty [OR=0.66, 95% CI= (0.42, 1.04)]. The prevalence of diarrhea in the HHs whose method of water drinking was to pour from the water container was 33%, while it was 32% in the HHs who dip cups in the container [OR=0.95, 95% CI= (0.54, 1.72)]. The prevalence of diarrhea in the HHs whose drawing cup's sanitary was assessed as clean was 29%, while it was 36% where the cup was assessed as dirty [OR=0.74, 95% CI= (0.39, 1.41)]. The prevalence of diarrhea in the HHs whose water container with lid was 29.3%, while it was 36% without lids of their water container [OR=0.75, 95% CI= (0.42, 1.36)] (Table 3).

DISCUSSION

The study found 30% of under-five children who participated in the survey experienced at least an episode of diarrhea during the past two weeks prior to the survey. The high prevalence of diarrhea in the area was well collaborated during the time of FGD and KII discussion. Diarrhea was described by the participants in the FGDs and KII as one of the commonest causes of morbidity and mortality in the under-fives in the area of study. The prevalence was greater than the country's approximation of nineteen percent.¹³ And the estimate for Jigjiga District, in Ethiopia at 27.3%, 95% CI (26.9%, 27.4%).¹⁴ The Ethiopian region where the study was done is similar to the region where the current study has been done as residents in both areas are from Somali ethnic group. One of the common characteristics the residents from both areas share, is the practice of pastoralism. The prevalence of diarrhea in this study is also much higher than the findings from a study done among under five children of IDPs' in Northwest Somalia (Bosasso, Puntland) which revealed a diarrhea prevalence of 11%.¹⁵ But it is much lower than the findings of another study done among under five children of an IDP living in the Somali capital,

Mogadishu which found a diarrhea prevalence of 47.9%.¹⁶ The main logical explanation for the differences observed between the various surveys could be the seasonal variations of the diarrhea incidence. The data of this survey was collected in February-March 2020; the driest season of the year (Jilaal season). During the dry season, water scarcity is severe which is a barrier to adequate hygiene practices such as regular washing of hands. Respondents during the FGD and KII attribute the high diarrhea prevalence to early weaning, poor child feeding practices which is hygienically inadequate, inadequate child spacing leading to early cessation of breastfeeding and low socio-economic status. This suggests there is need for more attention in reducing prevalence of diarrhea in Galkayo by intensifying efforts to improve access to clean and safe water. This study reveals that age, childbirth order, number of under five children in the household and HH health expenditure were major factors associated with diarrhea occurrence. The households with two under-five children were almost two times likely to report diarrhea as compared to the households having more than two under-five children [OR=1.93, 95% CI= (1.21, 3.08)]. This finding is close to that in a study done in Kersa district, located in Eastern Ethiopia. [OR=1.74, 95% CI= (1.33, 2.28)].¹⁷ A research done in Benishangul Gumuz regional state, northwest Ethiopia, having more than two under-fives in the household [AOR=1.73, 95% CI (1.03, 2.93)] was established as a risk factor of childhood diarrhea.¹⁸ Age of the child is connected to the occurrence of diarrhea as a study done in Kersa district, in Eastern Ethiopia indicates that child's age in under five (OR=2.25, 95% CI; (1.5, 3.36) was the chief aspect contributing to diarrhea occurrence.¹⁹ A study done in Benishangul Gumuz regional state, northwest Ethiopia, child's age [AOR=1.9, 95% CI (1.2, 3.6)] was discovered to be the risk-factor for childhood diarrhea.²⁰ In this study, childbirth order was substantially associated with occurrence of diarrhea. The first-born and second born children had higher prevalence of 31.5% and 30.8% respectively and third born had significantly lower prevalence of 18.5%. A study done in Benishangul Gumuz regional state, northwest Ethiopia higher childbirth order [AOR=6.1, 95% CI (3.1, 12.2)] was found to be a risk factor for childhood diarrhea.²¹ The households whose family health expenditure was \$51-100 were more likely to develop diarrhea than those whose expense was below \$50 and above \$100 [OR=0.3, 95% CI= (0.12, 0.69)]. According to Memirie et al, 0.3% of households were pushed into an extreme poverty due to diarrhea episodes' payments. The figures were much higher for inpatient care, where 6% and 7% of the households with severe diarrhea cases were pushed below the extreme poverty level.²² This study declared over two-third (68%) of the caregivers who participated in the study have some level of awareness on diarrhea affecting their under-five children. The main source of information (31%) was health facility, (27.2%) community health workers, (18.8%) listening radios on programmes, (17.2%) friends while small portion (5.7%) have no awareness. A study done in Kashan, Iran, knowledge of

mothers managing diarrhea in under five children indicated that health centers, educational programmes and individual reading were the main sources of knowledge about diarrhea treatment. Twenty nine percent (28.8%) of mothers had a good knowledge of diarrhea, while 46.5% had medium and 24.7% had low knowledge in diarrhea.²³ This study indicated the prevalence of diarrhea was high among under five children in the households without toilets with 14% while it was 33% among those households who own toilets. Children from households with a toilet were almost 3 times more likely to experience diarrhea than those living in HHs with no toilet facilities [OR=2.92, 95% CI= (1.35, 7.30)]. This study contradicts a study done in the IDP's in Bosasso, Somalia whose finding indicated that the under-fives children living in HHs with no latrines had more diarrhea cases with a risk of having diarrhea 1.0369 times more compared to those having latrines.²⁴ Having access to toilets does not necessarily mean the households are appropriately practicing proper disposal of human waste and practicing good hygiene. HHs with toilets may not be using them because they may not be well maintained.

There was a limitation of the study. The study was only conducted in one district in Galkayo town (urban and semi-urban.) It may not be generalized for the rural population.

CONCLUSION

The study concluded diarrhea was affecting 30% of underfive children in Galkayo district. In the households present two underfive children diarrhea prevalence high. The primary or below educational level of caregivers of underfive children was associated with high occurrence of diarrhea. The households headed by non-biological mothers, the diarrhea prevalence was high. Those underfive children under the care of employed caregivers, the occurrence of diarrhea was the high. Poor personal hygiene practices, poor sanitation, and poor water quality were attributed to the cause of diarrhea among underfive children. Diarrhea is caused by bacteria transmitted by insects and flies through the consumption of contaminated water or food. Households lacking a toilet facility who go to bush for defecation or use open defecation contaminate the environment and increases diarrhea transmission and high prevalence of diarrhea. Disposal of child's faeces by collecting and throwing away into washed wastes or burying into the trenches spoils the surface water that many people consume.

Recommendations

The study recommended child spacing practice by families and discourage frequent and too many close pregnancies. To improve the education of caregivers and basic knowledge to help them understand risk factors of diarrhea and seek prompt treatment. The study suggests that biological mothers should care underfive children to reduce the occurrence of diarrhea and create a child and a

mother bond. Employers to grant special leave to employed mothers during breastfeeding, care at this crucial time for child growth. Government to establish water quality surveillance both at the source and at the households to determine points of causes of contamination and address the problems. Organize awareness and behaviour change campaigns to promote handwashing, appropriate use of latrines, right methods of water storage and end user of water treatment. Galkayo local municipality to develop ambitious plan of communities' sensitization for better prevention methods of wastes. To allocate sites for disposal of domestic wastes. Galkayo local municipality to collaborate with individual HHs lacking a toilet and help construct of one in the interest of the public health. Faeces burial is recommended and reduces contamination of surface water, drinking water and domestic use, this also averts transmission of diarrhea. Train the communities for proper disposal of faeces. Galkayo local municipality, health workforce and other stakeholders to improve the living condition of under five children in preventing from diarrheal disease by intensifying provision of awareness using any mode of delivering messages.

ACKNOWLEDGEMENTS

Authors would like to express appreciations to Mount Kenya University, Mudug Regional Health Officer, and other bodies provided permission at State and Federal level, the respondents who voluntarily allowed for the participation of the study. Mr. Peterson Kariuki, School of Public Health, Mount Kenya University and Dr. Dominic Mogere, the Head of Department, Epidemiology and Biostatistics, School of Public Health, Mount Kenya University for their tireless assistance and guidance in the entire process. Authors would like to thank all participants (KIIs, FGDs and individual respondents), and those who directly and indirectly contributed to the process.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: This study was approved by Mount Kenya University Ethical Review Committee, then a clearance permit was attained from the Research & Ethics Review Committee of Ministry of Health and Human Services and Ministry of Education, Culture & Higher Education of Somali Federal Republic. Finally, an approval of Research Authorization Letter was gained from Mudug Regional Health Officer, Ministry of Health, Puntland, Somalia

REFERENCES

1. Troeger C, Forouzanfar M, Rao PC, Khalil I, Brown A, Reiner Jr RC, et al. Estimates of global, regional, and national morbidity, mortality, and aetiologies of diarrhoeal diseases: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet Infect Dis*. 2017;17(9), 909-48.

2. Farthing M, Salam MA, Lindberg G, Dite P, Khalif I, Salazar-Lindo E, et al. Acute diarrhea in adults and children: a global perspective. *J Clin Gastroenterol*. 2013;47(1):12-20.
3. Walker CLF, Rudan I, Liu L, Nair H, Theodoratou E, Bhutta ZA, et al. Global burden of childhood pneumonia and diarrhoea. *Lancet*. 2013;381(9875):1405-16.
4. Khalil IA, Troeger C, Blacker BF, Rao PC, Brown A, Atherly DE, et al. Morbidity, and mortality due to shigella and enterotoxigenic *Escherichia coli* diarrhoea: The Global Burden of Disease Study 1990–2016. *Lancet Infect Dis*. 2018;18(11):1229-40.
5. Troeger C, Blacker BF, Khalil IA, Rao PC, Cao S, Zimsen SR, et al. Estimates of the global, regional, and national morbidity, mortality, and aetiologies of diarrhoea in 195 countries: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Infect Dis*. 2018;18(11):1211-28.
6. Bowen A, Agboatwalla M, Luby S, Tobery T, Ayers T, Hoekstra RM. Association between intensive handwashing promotion and child development in Karachi, Pakistan: a cluster randomized controlled trial. *Arch Pediatr Adolesc Med*. 2012;166(11):1037-44.
7. Gedamu G, Kumie A, Haftu D. Magnitude and associated factors of diarrhea among under five children in Farta wereda, North West Ethiopia. *Qual Prim Care*. 2017;25(4):199-207.
8. Mengistie BB. Prevalence of diarrhea and associated risk factors among children under-five years of age in Eastern Ethiopia: A cross-sectional study. *Open J Prevent Med*. 2013;3(07):446.
9. WHO Fact sheet: rotavirus commonest cause of diarrhea in children worldwide, 2013. Available from: <https://www.paho.org/en/topics/rotavirus>. Accessed on 25 July 2021.
10. Elmi OE, Dioso RIP. Prevalence of diarrhoeal diseases among children under five years in east African Countries from 2012-2017. *ASEAN J Sci Technol Develop*. 2017;34(1):51-5.
11. UNICEF. Situation analysis of children in Somalia, 2016. Available at: <https://www.unicef.org/somalia/media/981/file/Somalia-situation-analysis-of-children-in-Somalia-2016-full.pdf>. Accessed on 20 August 2021.
12. Kalid M, Omar E, Ibrahim A, Said S, Farah DA. Factors related to the occurrence of diarrheal disease in under-five children of IDP's in Bosaso, Puntland-Somalia. *World J Med Sci*. 2016;13(1):54-9.
13. Warsame HA. Morbidity of diarrheal disease among children aged under five years living in internally displaced population camps of Hodan District, Mogadishu-Somalia. 2016.
14. Hashi A, Kumie A, Gasana J. Prevalence of diarrhoea and associated factors among under-five children in Jigjiga District, Somali Region, Eastern Ethiopia. *Open J Prevent Med*. 2016;6(10):233-46.
15. Turyare MD, Mativo JN, Kerich M, Ndiritu AK. Prevalence and socio-demographic determinants of diarrhea among children below 5 years in Bondhere district Somalia. *The Pan African Med J*. 2021:38.
16. Alebel A, Tesema C, Temesgen B, Gebrie A, Petrucka P, Kibret GD. Prevalence and determinants of diarrhea among under-five children in Ethiopia: a systematic review and meta-analysis. *PloS one*. 2018;13(6):e0199684.
17. Mengistie B, Berhane Y Worku A. Household water chlorination reduces incidence of diarrhea among under-five children in rural Ethiopia: a cluster randomized controlled trial. *PloS one*. 2013;8(10):e77887.
18. Mihrete TS, Alemie GA, Teferra AS. Determinants of childhood diarrhea among underfive children in Benishangul Gumuz regional state, north West Ethiopia. *BMC Pediatr*. 2014;14(1):1-9.
19. Godana W, Mengistie B. Determinants of acute diarrhoea among children under five years of age in Derashe District, Southern Ethiopia, 2013.
20. Asfaha KF, Tesfamichael FA, Fisseha GK, Misgina KH, Weldu MG, Welehaweria NB, et al. Determinants of childhood diarrhea in Medebay Zana District, Northwest Tigray, Ethiopia: a community based unmatched case-control study. *BMC Pediatr*. 2018;18(1):1-9.
21. Natnael T, Lingerew M, Adane M. Prevalence of acute diarrhea and associated factors among children under five in semi-urban areas of northeastern Ethiopia. *BMC Pediatr*. 2021;21(1):1-11.
22. Memirie ST, Metaferia ZS, Norheim OF, Levin CE, Verguet S, Johansson KA. Household expenditures on pneumonia and diarrhoea treatment in Ethiopia: a facility-based study. *BMJ Glob Health*. 2017;2(1):e000166.
23. Ghasemi AA, Talebian A, Masoudi Alavi N, Moosavi GA. Knowledge of mothers in management of diarrhea in under-five children, in kashan, iran. *Nurs Midwife Stud*. 2013;1(3):158-62.
24. Getachew A, Tadie A, Hiwot M, Guadu T, Haile D, Cherkos T, et al. Environmental factors of diarrhea prevalence among under five children in rural area of North Gondar zone, Ethiopia. *Italian J Pediatr*. 2018;44(1):1-7.

Cite this article as: Isack MA, Nyamai JJ, Kerochi A. Analysis of risk-factors associated with diarrhea prevalence among underfive children in Galkayo District Puntland State, Somalia. *Int J Community Med Public Health* 2021;8:5660-7.