

Factors associated with sanitation practices among household-level in Mogadishu, SomaliaAbdirizak Mohamud Yusuf^{1*}, Nittaya Pasukphun², Yanasinee Suma³¹⁻²Faculty of Public Health, Thammasat University (Rangsit campus), Pathumthani, Thailand,³Faculty of Public Health, Thammasat University (Lampang campus), Lampang, Thailand*Corresponding author: Abdirizak Mohamud Yusuf, abdirizak.moh20@gmail.com

ABSTRACT

Background: Poor sanitation is responsible for 4% of mortalities and 5.7% of morbidity worldwide, particularly among under five children. In 2015, the WHO estimated that 2.39 billion children under five had diarrhea. Diarrhea is accountable for 18% of all child deaths from water contamination, improper sanitation, or hygienic practices.

Objectives: This present study aimed to identify factors associated with sanitation practices among household-level in Mogadishu, Somalia

Methods: A cross-sectional study was conducted in the Hodan district of Mogadishu, Somalia, from December 2021 to February 2022. The study subjects were randomly selected from 241 households. Descriptive statistics were processed, and logistic regression analysis was used. A confidence interval of 95% and a p-value less than 0.05 were considered statistically significant.

Results: Among 29% of households had poor sanitation conditions. More than 60.6% of the participants lived in multi-family homes, and 81.3% of households lacked access to hand-washing facilities. There was an association between residences with multiple families and diarrhea in children under five years [AOR= 0.001 - 95% CI 0.001-0.002]. While families without toilets had [AOR= 0.577 - 95% CI 0.673- 0.623], and children in households using pit latrines were statistically significant [AOR= 9.393 - 95% CI 2.377-37.115]. Similarly, family income had a nearly increased risk of diarrhea occurrence in children [AOR= 0.125 - 95% CI 0.041-0.381].

Conclusion: Provide adequate water, hygiene and sanitation services in the Hodan district is vital for diarrheal prevention. Awareness-raising at a household level and improved sanitation facilities, and sanitation practices and encouraging, should be scaled up accordingly. Further in-depth studies should also be conducting.

Keywords: Diarrhea, Hygiene, Household, Sanitation Practices, Water.

1. Introduction

Poor sanitation is responsible for 4% of mortalities and 5.7% of morbidity worldwide, particularly among under five children [1]. In 2015, the WHO estimated that 2.39 billion children under five had diarrhea. Diarrhea is accountable for 18% of all child deaths from water contamination, improper sanitation, or hygienic practices. Hygiene improvement becomes less investigated than sanitation services and water quality, [2]. A lack of safe drinking water, inadequate sanitation, poor hygiene, and overcrowding continue to be major contributors of diarrhea in children in low- and middle-income countries, [3].

These diarrheal infection determinants are related to poverty and sanitation aspects [4]. According to comparable research, more than 94% of diarrhea episodes can be prevented by improving sanitation and promoting hygiene [5]. Although, poor sanitation practices are also responsible for diseases such as trachoma and parasitic intestinal infections that contribute to an additional burden of diseases, affecting public health, [6].

Indeed, 90% of diarrhea-related deaths occur in South Asia and Sub-Saharan African countries including Somalia. More than half of all diarrhea deaths in children under five years old

occur in just 15 African and Asian nations. Somalia is one of many African countries with high diarrhea rates. In 2011, 50% of deaths from diarrhea occurred in Sub-Saharan Africa, demonstrating that the most severe consequences are concentrated in the most afflicted areas. [7]. On the other hand, healthy child, a single incidence of diarrhea is typically self-limiting and has no long-term sequel. Besides, several episodes per year can lead to nutritional deficits and long-term consequences, [8]. Sanitation is the maintenance of sanitary conditions through safe faeces disposal, wastewater disposal to separate human excreta from human touch at all sanitation facilities sequence, and wastewater disposal [9].

The risks associated with poor household sanitation practices predominantly affect vulnerable people suffering from diarrhea caused by polluted water sources. Due to insufficient water storage containers, shortage of latrines, living in a house with few rooms, and not exclusively breastfeeding for the first six months of life, diarrhea remained a significant public health issue for under five children in Somalia [4]. Increased demand for inadequate systems and services puts cities in danger of large-scale illness outbreaks linked to poor sanitation, since, there have been few

long-term interventions in this sector, and the ability for new changes is limited, due to limited resources [10].

The availability of latrines, household sanitation facilities, water handling, type of water supply, and infant feces disposal were all factors that contributed to the risk of acute childhood diarrhea. This result can potentially increase the frequency of diarrheal disease in Mogadishu, particularly in informal settlement sites [11].

In Mogadishu, Somalia, inadequate sanitation services at the household's cause reoccurrence acute watery diarrhea in under five children [12]. A few studies in the Hodan district research site highlighted the importance of residential sanitation practices with regard to diarrhea incidence. Infections triggered by water are caused by poor hygiene, sanitation, and overpopulation [13].

2. Methods

2.1 Study design

A cross-sectional study design was utilized. The study population involved all households with children aged less than five years. This study was carried out in the Hodan district of Mogadishu, Somalia, between 15th December 2021 and 28th February 2022.

2.2 Sample size and sampling procedure

Kish Leslie's (1965) formula for cross-sectional studies was calculated using sample size calculation with a level of confidence of 1.96, a margin of error of 0.05 and the baseline indicator level was = 0.17 [14]. The number of households was 3,210 households. The calculated sample size was 217. With 10% added for none response rate, a final total of 241 respondents were collected in case of incomplete data from the required quota. These households were based on the estimated population proportion size from the district plan. A systematic sampling technique was used to select households in the Hodan district, including internally displaced people (IDP) section, particularly homes with under five children who have lived in the study site, for more than five years. Participants who met the inclusion criteria were interviewed to obtain information about access sanitation factors, and risk factors of diarrhea among households having under five year's children.

The trained enumerators then were approached and explained the purpose of the study to the selected caregivers; allowing them to ask questions on areas that were not clear to ensure that they understood the purpose and the procedure to be followed before signing a consent form concurrence were recruited into

the study. Each household was selected as one caregiver.

2.3 Inclusion and exclusion criteria

The study included households with children under five years' old who lived in the Hodan district for at least five years. All households without children under five were excluded from the study.

2.4 Ethical considerations

The Ministry of Health and Human Services Ethical and Research Committee approved the study in Somalia with reference no. MOH&HS/DGO/1947/DEC/2021. The Hodan District Commissionaire also permission was obtained. Informed written consent was obtained from all respondents before interviewing and house-to-house observation.

2.5 Research instruments Data collection

The researcher recruited four enumerators experienced in human research ethics. Then, instruments were pre-tested for interviewed before data collection to check the appropriateness of the questionnaires. Some amendment was made after the pre-test. Data were gathered using the interview techniques with observation checklist. In selected households, trained data collectors interviewed each respondent. A structured questionnaire

was developed to gather data on families with children under five years old at the study site. The questionnaire is divided into two sections; the first part; assesses the socio-demographics of households, comprising age, gender, marital status, education, occupation, and home ownership. The second aspect; collected household predictor variables for diarrhea in the Hodan district, Mogadishu, Somalia. The dependent variable for the study was diarrhea under five years.

2.6 Data analysis

SPSS version 26 was used to enter, code, clean, and analyze the data. Accordingly, the descriptive level was analyzed and presented using tables, frequencies, and percentages. Binary and logistic regressions were used to assess the association of various sanitation factors of childhood diarrhea using an unadjusted odds ratio and adjusted odds ratio with a corresponding 95% confidence interval, to determine any statistically significant relationship between sanitation practices and diarrhea. A p-value of 0.05 was considered statistically significant.

3. Results

3.1 Socio-demographic characteristics of the study participants

In this study, 241 participants were interviewed. Of these, 195 (80.9%) were female, while only

46 (19.1%) were males. The majority of participants were between the age of 26-35 (46.1%) and those between the age of 36-45 was 23.7%. Only 5.4% of them were older than 50 years. In terms of their education, employment, and income, the majority of participants were illiterate, 106 of 241 (44.0%), while only 8 (3.3%) had university level, as also 169 (70.1%) of them were unemployed. The family income per month varied as 37.3% had approximately 200 dollars, whereas 25.7% had less than USD 100 income per month. More than 146 (60.6%) respondents were resident multi-family homes, which means more than one family living in one house, and

36.5% were in single-family homes. Only 7 out of the 241 participants (2.9%) had apartments. The number of family members per household varied as most of them lived in a home of 5-10 persons 140 (58.1%), and 20.3% were less than 1-5 persons, followed by over ten persons (21.6%) in the household. Most participants lived in rental houses in 124 out of 241 (51.9%), as 24% lived in government-owned houses. All of the study households were available toilet facilities. Among 19.5% were aged 12–23 months, and 3.7% were aged 24–35 months. While most participants believed diarrhoea was a health risk, and 1.7% were unaware of its consequences.

Table 1. Socio-demographic characteristics of the study participants (n=241)

Variables	Category	Frequency	Percentage
Gender	Male	46	19.1
	Female	195	80.9
Age of mothers	18-25	37	15.4
	26-35	111	46.1
	36-45	57	23.7
	46-55	23	9.5
	56-65	13	5.4
Educational status	Primary	53	22.0
	Secondary	74	30.7
	University	8	3.3
	Illiterate	106	44.0
Marital status	Married	199	82.6
	Unmarried (single, widowed, divorced)	42	17.4
Occupational status	Employed	72	29.9
	Unemployed	169	70.1
Family income per month	Less than \$ 100 US	62	25.7
	Between \$ 100 to 200 US	89	36.9
	More than \$ 200 US	90	37.3
Kind of house	Single-family homes	88	36.5
	Multi-family homes	146	60.6
	Apartments	7	2.9
Family members	1-5 persons	49	20.3
	5-10 persons	140	58.1
	Over 10 persons	52	21.6

Variables	Category	Frequency	Percentage
House ownership	Owner	58	24.1
	Rented from private	125	51.9
	Government home	58	24.1
Number of under five years old	Less than 3 children	103	42.7
	More than 4 children	138	57.3
Child experienced diarrhea	Yes	74	30.7
	No	167	69.3
If yes what was child in months	0 – 11 months	18	7.5
	12 – 23 months	47	19.5
	24 – 35 months	9	3.7

3.2 WASH risk factors of diarrhea among households having under five year's children

The water, sanitation, and hygiene risk factors where around 78 (32.4%) of the households practiced pit latrines without slabs, whereas 77 (32.0%) had squat toilets with water flush latrines, but 172 (71.4%) of the respondents used clean restrooms, and 69 (28.6%) used unclean baths. Among 98 (40.7%), participants refused to practice the garbage disposal

methods, and 58 (24.1%) reported they discarded in an open area. The adequate sanitation facilities where 171 (71.0%) had good household sanitation conditions. Most of the participants, 238 (98.8%), had used pipe water supply regarding the water sources. And 129 (53.5%) respondents used buckets with a lid for water storage at the household's level, whereas as 18 (7.5%) had Jerri cans. Almost 45.2% of participants practiced chlorination for water treatment, while only 4.6% used filtration.

Table 2 WASH risk factors of diarrhea among households having under five year's children

Variables	Category	Frequency	Percentage
Type of latrine	Sit-down toilet with water flush	47	19.5
	Squat toilet with water flush	77	32.0
	Pit latrine without slab/open pit	78	32.4
	Dry toilet	39	16.1
Cleanliness of the latrine	Clean	172	71.4
	Unclean	69	28.6
Garbage disposal	Refuse disposal method	98	40.7
	Disposed into open pit	85	35.3
	Discarded in open area	58	24.1
Household sanitation condition	Good	171	71.0
	Poor	70	29.0
Source of water	Pipe	238	98.8
	Borehole	3	1.2
Water storage at household	Bucket with a lid	129	53.5
	Bucket without a lid	38	15.8
	Jerry cans	18	7.5
Water treatment	Boiling	26	10.8

Variables	Category	Frequency	Percentage
	Chlorination	109	45.2
	Filtration	11	4.6
	I don't use any method	68	28.2
	Others	26	10.8
Do you use soap	Yes	223	92.5
	No	18	7.5
Hygiene status among children	Good	168	69.7
	Poor	73	30.3
Food preparation	Fair	150	62.2
	Good	91	37.8

3.3 association between socio-demographic and access sanitation facilities at household-level

Being unmarried and low family income increases the risk of diarrhea in children by 0.363 [95% CI: 0.184-0.718]. Meanwhile, families earning \$200 or more had nearly 29 times more likely to get diarrhea from their children. With regards to children's diarrhea is attributed to living in government-owned buildings due to old and inadequate of sanitation facilities. Multi-family apartments have 0.037 greater odds of diarrhea in children under five than single-family homes;

results are statistically significant. Zone K, Ahmed Gurey, Horsed, and October are the main sub-areas of Hodan district. In the Hodan the IDP settlements are the most vulnerable areas. Compared to Zona-K, the Hodan district's sections and sub-areas significantly increased diarrhea among children. However, the neighboring section in October has 16 odds more than their counterparts. While odds ratio 16.944 (95% CI: 4.824-59.514), and the Ahmed Gurey area has an odd ratio of 6.389 (95% CI: 1.746-23.373) for developing diarrhea children in Kacan

Table 3. Association between socio-demographic and access sanitation facilities at household-level

Variables		Model 1		Model 2	
		Unadjusted OR	CI (95%) (Lower-upper limit)	Adjusted OR	CI (95%) (Lower-upper limit)
Gender	Male	Ref	Ref	Ref	Ref
	Female	0.865	0.426-1.759	0.719	0.310-1.667
Age of mother/ caretaker years	18-25	Ref	Ref	Ref	Ref
	26-35	1.571	0.718-3.438	1.289	0.561-2.959
	36-45	1.870	0.762-4.586	1.460	0.566-3.771
	46-55	1.141	0.386-3.378	1.014	0.305-3.371
	56-65	0.522	0.146-1.871	0.405	0.097-1.701
Marital Status	Married	Ref	Ref	Ref	Ref
	Unmarried	0.363	0.184-0.718	0.416	0.201-0.861
Education	University	Ref	Ref	Ref	Ref
	Secondary	0.222	0.026-1.897	0.160	0.016-1.644

		Model 1		Model 2	
Variables		Unadjusted	CI (95%)	Adjusted	CI (95%)
		OR	(Lower-upper limit)	OR	(Lower-upper limit)
Family income	Primary	0.939	0.100-8.828	0.697	0.063-7.744
	Illiterate	0.266	0.001-2.249	0.248	0.041-0.381
	Less than \$ 100	Ref	Ref	Ref	Ref
	Between \$ 100-200	7.014	3.397-14.486	0.125	0.041-0.381
	More than \$ 200	28.984	11.249-74.680	0.478	0.175-1.307
House ownership	Owner	Ref		Ref	Ref
	Rented from private	1.839	0.891-3.793	2.815	1.050-7.546
	Government home	0.293	0.136-0.632	3.838	1.539-9.573
Area of residence	Zona-K IDP area	Ref	Ref	Ref	Ref
	Kacan	6.667	2.337-19.020	0.037	0.011-0.127
	Ahmed Gurey	6.389	1.746-23.373	6.389	1.746-23.373
	Horseed	0.177	0.068-0.456	0.177	0.068-0.456
	October	17.944	4.824-59.514	16.944	4.824-59.514
Kind of house	Single-family homes	Ref	Ref	Ref	Ref
	Multi-family homes	0.037	0.010-0.022	0.001	0.001-0.002
	Apartments	0.57.1	0.001-0.013	0.000	0.000-0.000
Number of family members	1-5 persons	Ref	Ref	Ref	Ref
	5-10 persons	0.462	0.212-1.003	0.682	0.245-1.897
	Over 10 persons	0.696	0.276-1.758	1.085	0.326-3.615
Occupational status	Employed	Ref	Ref	Ref	Ref
	Unemployed	0.673	0.361-1.253	0.681	0.361-1.284
Number of under five years children	Less than 3 children	Ref	Ref	Ref	Ref
	More than 4 children	1.306	0.128-2.145	1.311	0.653-2.632

Significant variables considered at 0.05 level. OR: Odd ratio. CI: Confidence Interval of 95% level.

3.4 Association between WASH risk factors in diarrhea at households in children

The type of latrine was found to have an association with childhood diarrhea, with a 0.139 odds ratio [95% CI: 0.053-0.365]. Households who do not utilize any water treatment were 11.400 odds [95% CI: 1.777-11.213] more likely to have diarrhea in their

children. Regarding the households dumped their waste in open areas, are higher risk for childhood diarrhea with a 10.400 odds ratio [95% CI: 1.699-37.672].

Children with diarrhea was statistically associated with a 2.093 odds ratio [95 % CI: 1.092-4.010]. Similarly, families who do not practice well their food preparation in terms of

food safety and covering immediately after cooking had 14.652 [95% CI 0.5.626-38.156] more diarrhea than adequately prepared homes. The children that utilized pit latrines with a slab showed significant association with childhood diarrheal, where the odds ratio was 0.340 [95% CI 0.162-1.717] compared to those who practiced EcoSan toilet facilities. Toilets, latrine type, water treatment, children hygiene levels, food preparation, and sanitation facility type were also adjusted and identified statistically significant. This suggests that families who use pit latrines with slabs have a 0.340 odds ratio [95% CI: 0.162-1.717], which means they are less likely to get diarrhea.

Table 4. Association between WASH risk factors in diarrhea with children at households

Variables		Unadjusted OR	CI (95%) (lower-upper limit)	Adjusted OR	CI (95%) (lower-upper limit)
Type of latrine	Toilet with water flush	Ref	Ref	Ref	Ref
	Toilet with water flush	0.447	0.164-1.216	6.569	2.165-186.650
	Pit latrine without slab	0.139	0.053-0.365	4.393	2.377-37.115
	Dry toilet	0.488	0.157-1.518	2.321	0.663-8.127
Cleanliness of the latrine	Clean	Ref	Ref	Ref	Ref
	Unclean	1.121	0.608-2.067	1.1502	0.701-3.220
Household sanitation condition	Good	Ref	Ref	Ref	Ref
	Poor	1.732	0.912-3.290	0.782	0.362-1.689
The main source of water supply	Pipe	Ref	Ref	Ref	Ref
	Borehole	0.885	0.079-9.913	3.319	0.039-281.717
	Boiling	Ref	Ref	Ref	Ref
Drinking water treatment	Chlorination	4.875	0.186 -8.116	5.690	2.532-119.301
	Filtration	11.00	0.174-70.675	57.988	4.304-781.267
	I don't use any method	11.400	1.777-11.213	8.995	2.473-153.614
Do you use soap	Yes	Ref	ref	Ref	Ref
	No	2.336	0.655-8.326	1.203	0.216-6.701
Hygiene status among children	Good	Ref	Ref	Ref	Ref
	Poor	2.093	1.092-4.010	3.910	1.802-8.484
Food preparation	Fair	Ref	Ref	Ref	Ref
	Poor	14.652	0.5.626-38.156	20.714	7.732-55.489
Caregiver wash hands with soap	Yes	Ref	Ref	Ref	Ref
	No	1.772	0.202-1.574	0.953	0.229-3.966
Type of sanitation facility	Ecosan toilet	Ref	Ref	Ref	Ref
	Pit latrine with a slab	0.340	0.162-1.717	0.329	0.155-0.701
	Pit latrine without a slap	1.560	0.612-3.974	1.589	0.622-4.059
	VIP-latrine	4.855	0.000-1.125	457.7	0.000-000

Significant variables considered at 0.05 level. OR: Odd ratio. CI: Confidence Interval of 95% level.

4. Discussion

The study found that 29% of the households had poor sanitation status, associated with diarrhea in children under five years old. The majority of

participants resided in an overcrowded neighborhood with IDPs families, making them more prone to parasites in diarrheal diseases. This aligns with earlier research reported by

[15]. Both IDPs and host communities in the study site had poor sanitation practices and unclean sanitation facilities. Diarrhea was 73 times more likely to occur in children living in households that did not consider it was a health risk.

Although this study conducted in Mogadishu it is presented, disposal of waste, household water handling, water source, handwashing behaviors, and improper infant faeces disposal were risk factors for sanitation practices in Somalia. Adults from IDPs sometimes practiced open defecation [11].

The study also found that 84.2% of homes had private latrines whereas 15.8% had public latrines. The status of IDPs is characterized by high population density, poor sanitation facilities, shortage of water supply, in adequate of sanitation and hygiene services, and insufficient health awareness campaigns owing to the emergency, [13]. A study conducted in Ethiopia revealed a disparity in the use of communal and privately-owned toilets, allowing the assessment of improved and unimproved sanitation facilities, [16].

In this study, 71.4% of respondents used clean restrooms, whereas 28.6 percent utilized dirty latrines, this is high risk of diarrhea outbreak. However, another study found that proper

sanitation facilities such as clean latrines are key preventive approaches for diarrheal infections [15]. This study shows that households without toilets had a statistically significant difference in diarrhea, compared to those with latrines. According to a recent survey in North Ethiopia, 94% know the importance of latrines for health, however 48.3% believe latrines are primarily for the wealthy people, [5].

This study revealed that the families who did not clean their latrines were more likely to have diarrhea, than those who clean their toilets regularly. Because we observed sanitation facilities in each household to determine the sanitation status at household-level and 87.6% households were seen flies in the food preparation area, followed by 81.5% households lacked access to handwashing facilities. Approximately, 83.4% cleaned their kitchen, swept, and tidied to avoid food contamination. This result is also lower than the findings of similarity study that presented 92% households cleaned their kitchen and swept, in Kersa Woreda, Eastern Ethiopia [17].

Moreover, 66.8% of respondents prioritized waste around their homes, but only 33.2% had adequately managed it. Comparing this study's findings to those from South Ethiopia, where

only 18.5% of families had children managing solid waste, [16]. Concerning waste disposal, around 40.7% of participants declined to utilize it, while 24.1 percent dumped it in an open place. Also, 57.7% of participants collect trash outside their homes, causing diarrhea, whereas 42.3% correctly dispose of their waste. Another research highlighted that 95.6% of households correctly disposed of waste, which can reduce diarrheal prevalence, [8].

5. Conclusion

This study revealed an association between sanitation practices and diarrhea in children under five years old in both IDP and host communities in the Hodan district. Those with diarrhea had been under 35 months the results revealed poor sanitation facilities. Those sanitation factors associated with diarrhea include open-pit latrines with no slabs, water treatment, government housing, hygiene, and flies seen in the kitchens.

The majority of people lived in overcrowded neighborhoods with a high number of IDP families, rendering them more vulnerable to parasites and diarrhea due to poor sanitation condition. Each household need adequate latrines, safe drinking water, waste disposal and improved hygiene practices. Multiple-family

buildings had less sanitary facilities than single-family apartments, which require appropriate WASH services.

Our study findings recommend raising awareness among children under 35 months in the Hodan district, providing adequate water, sanitation, and hygiene services, and promoting proper handwashing practices among caregivers, children, and residents of the Zona-K IDPs area and the host community at the study site. Educate caregivers and children under the age of five about the effects of diarrhea and the importance of the availability of adequate sanitary facilities is recommended.

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References

- [1] Rah JH, Cronin AA, Badgaiyan B, Aguayo V, Coates S, Ahmed S. Household sanitation and personal hygiene practices are associated with child stunting in rural India: A cross-sectional analysis of surveys. *BMJ Open*. 2015;5(2).
- [2] Mustaf A, Isack, Juma J, Nyamai, Atei Kerochi. Analysis of risk factors associated with diarrhea prevalence among under-five children in Galkayo, Somalia, 2022].
- [3] Agustina R, Sari TP, Satroamidjojo S, Bovee-Oudenhoven IM, Feskens EJ, Kok FJ. Association of food-hygiene practices and diarrhea prevalence among Indonesian young children from low socioeconomic urban areas. *BMC Public Health*. 2013;13(1).
- [4] Berhe AA, Aregay AD, Abreha AA, Aregay AB, Gebretsadik AW, Negash DZ, et al. Knowledge, Attitude, and Practices on Water, Sanitation, and Hygiene among Rural Residents in Tigray Region, Northern Ethiopia. 2020.
- [5] Kumar A. Households' Toilet Facility in Rural India: Socio-spatial Analysis. 2017;
- [6] Mihrete TS, Alemie GA, Tefera AS. Determinants of childhood diarrhea among under-five children in Benishangul Gumuz Regional State, North West Ethiopia. 2014;
- [7] Dagnew AB, Tewabe T, Miskir Y, Eshetu T, Kefelegn W, Zerihun K, et al. Prevalence of diarrhea and associated factors among under-five children in Bahir Dar city, Northwest Ethiopia, 2016: A cross-sectional study. *BMC Infectious Diseases*. 2019 May 14;19(1).
- [8] Sahiledengle B, Alemseged F, Belachew T. Sanitation practice and associated factors among slum dwellers residing in urban slums of Addis Ababa, Ethiopia: A community based cross-sectional study. 2018.
- [9] Id SY, Hudani A, Udenigwe O, Shah V. Improving Water, Sanitation and Hygiene Practices, and Housing Quality to Prevent Diarrhea among Under-Five Children in Nigeria.
- [10] Yusuf AM, Sheikh A, Omer M, Yasin S omer, Had HJ. Prevalence and Factors Associated with Diarrhoea Among Children Aged 0-59 Months In Badbaado Camp In Mogadishu, 2018.
- [11] Alasow A, Yusuf Abdirizak. Knowledge, Attitudes and Practices on Sanitation Among Women of Reproductive Age at Badbado Camp, Dharkenley District, Mogadishu-Somalia. *CAJPH*. 2020;6(4):220.
- [12] Mohamed H. Prevalance of Diarrhea and Associated Factors Among Children Under Five Years in Internally Displaced Populations of Hodan District, Somalia. 2019;
- [13] Dahir O, Boonshuyar C. Environmental determinants of reported diarrhea among under 5-year-old children in Mogadishu, Somalia. 2020.
- [14] Biniyam S, Fessahaye A, Tefera B. Sanitation practice and associated factors among slum dwellers residing in urban slums of Addis Ababa, Ethiopia: A community based cross-sectional study. *Journal of Public Health and Epidemiology*. 2018;10(10):370–9.
- [15] Eshete Soboksa N, Nenke Yimam G. Assessment of Household Level Sanitation Practice of Mothers' and Associated Factors in Gedeo Zone, South Ethiopia. *American Journal of Public Health Research*. 2017;5(2):43–9.
- [16] Bizatu M, Negga Baraki. Community based assessment on household management of waste and hygiene practices in Kersa Woreda, Eastern Ethiopia. 2010.