Factors associated with diarrhea among infants seeking healthcare services at Homa Bay County Referral Hospital, Kenya

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Abstract

More than 90% of infant deaths in Kenya is due to conditions like pneumonia, diarrhea, malaria, neonatal problems, malnutrition and HIV/AIDS, and often a combination of these conditions. Diarrhea among infants is both preventable and treatable if only mothers of these infants are educated on ways of preventing

The main objective of this study is to investigate factors associated with diarrhea among infants seeking healthcare services at Homa Bay County referral hospital.

A descriptive cross-sectional study was conducted to explore the factors associated with diarrhea among infants.

Results showed majority of respondents were aged between 18-25 years, resided in rural areas. Majority (95.2%) were daily laborers with 42% having household average monthly income of < Ksh.5000.On education status of the respondents,43.3% had only attained primary education. Diarrhea prevalence was more (73.3 %) among those who were residing rural areas .In regression analysis between different variables mother/caretaker's education also showed a great significance with prevalence of diarrhea as infants of mothers/caretakers who were unable to read had higher diarrhea prevalence (p – value 0.002)than among those who had attained college education.

In conclusion, residence, type of water storage container, methods of complementary feeding, mother/caretaker education status and cleansing materials to wash the hands were the most important variables that affected the occurrence and severity of diarrhea in children.

1. BACKGROUND

Infant mortality and morbidity are a global health problem requiring strategic policy, programming and investments. Recently, reports indicate 75% of all under-fives deaths occurred during their first year of life[1]. Indeed, the leading medical cause of infant and child deaths is the acute childhood illnesses which include acute respiratory infections, diarrhea, malaria, and meningitis. Diarrhea is the second-largest cause of childhood mortality in the world, while malaria causes 11% of childhood deaths. Measles is the fifth-largest cause of childhood mortality[2,3].

In 20 – 22 June 2012, the United Nation conducted a conference in Rio to agree on new set of global SDG to take over the tracking of sustainable development in the world after the MDG's of 2015[2,3]. Goal number 3 which is ensuring health lives and promoting well-being for all at all ages was a primary concern to most developing countries as things like limited resource and poor access to quality health services within the developing countries brought a major challenge in achieving this goal[4]

In 2015, over 4.5 million under five deaths occurred, 75% of theseoccurred in the first year of life (infancy stage), most of this deaths occurred due to treatable and preventable diseases like pneumonia, diarrhea, and other neonatal conditions which require simple interventions[5]. Among these diseases, Diarrhea remains the second leading cause of under – five mortality worldwide. Each year it's estimated that 2.5 million cases of diarrhea occurs worldwide; out of these 46% occurs in Africa, 38% in South Asia, 9% in East Asia and Pacific while the remaining percentage occurs in the rest of the world[1]. According to Kenya Demographic Health Survey and Kenya National Bureau of Statistics, severe diarrhea is a major cause of morbidity and mortality among infants [6,7]. Most of the diarrhea cases peaks at 6 – 11 months of age hence infants at this age range are at a higher risk for diarrheal diseases. There is a big gap of between deaths caused by diarrhea and other conditions pulling the Country behind preventing it from reaching the set target for instance diarrhea kills 19%, pneumonia kill 15% and other smaller causes taking 5% [8].

As Kenya strives towards reducing infant morbidity and mortality to lower than 12 per 1000 live births and under-five mortality to lower than 25 deaths per 1000 live births, high infant morbidity and mortality still remains an alarming problem to the Kenyan health sector[9].This rate though has been declining steadily since the year 2008/09 where it was 52 deaths per 1000 up to 39 deaths per 1000 live births in 2014 which according to the sustainable development goal number 3 target 3 it is still very high and also considering that there are only a few years to the year 2030 which is the deadline for the targeted SDG's[10]. Most of the MDGs for maternal and child health could not be achieved as many challenges in health service coverage still remain a problem and disparities between regions continue to exist in delivery of this health service. This is attributed by some factors which predispose infants to morbidity in certain regions more than others hence high morbidity and mortality of infants in those particular regions, examples of these factors include: socio - demographic factors such as Mother's age, mother's education, family size, sex of the child and area of

residence, Environmental factors e.g. Latrine availability, Hand washing facility and source of water and finally Behavioral Variable e.g. Latrine utilization, Hand washing practice, Exclusive breastfeeding, complimentary feeding practices. These factors predispose infants to morbidity hence leading to mortality[11].

This study explored the prevalence and factors associated with severity diarrhea among infant seeking healthcare services at HomaBay County referral hospital hence apply the results in coming up with proper interventions that will help reduce infant mortality.

2. METHODS

2.1 Study design

A descriptive cross-sectional study was carried out at Homa Bay county referral hospital to explore the factors associated with diarrhea among infants seeking healthcare services.

Homa Bay County Teaching and Referral Hospital is a Ministry of Health County hospital located in Homa Bay Township Sub location, Homa-Bay Location in Rangwe Constituency, Homa Bay County.It offers both preventative and curative services for a variety of illnesses to patients from Homa Bay county and surrounding counties. It attends to approximately 200 to 250 infants from within the surrounding community per day.

2.2 Sample size

The study participants consisted infants with diarrhea and their mothers who gave consent. A sample size of 255 participants was selected from the infants with diarrhea attended to in the pediatrics, newborn, maternity and outpatient departments during the study period. The sample size was calculated using the modified formula of Fishers et al. (1998):$n = \frac{z^2 p(q)}{d\text{^}2}$.

Whereby z = is the Z value for the corresponding confidence level (i.e., 1.96 for 95% confidence);

d = is the margin of error (i.e., 0.05 = ± 5%) and p = is the estimated value for the proportion of a sample that have the condition of interest. Then use the percentage. The estimate that was used in the resent research done in Nigeria (Magbagbeola, Tosin & Adetokunbo, 2017) is 21.1, percentage is 0.211. Hence 0.211 will be used as the p value.

Therefore;$n = \underline{1.96^2 p\ (1\text{-}p)} / d^2$

$n = \underline{1.96 \times 1.96 \times 0.211\ (1\text{-}\ 0.211)} = 255$

0.0025

2.3 Sampling technique

A total of 255 participants were included into the study. The inclusion criteria involved infants whose parents consented to participate in the study.Infants whose parents declined to consent were excluded from the study.Systematic sampling method was used in which every alternative participant was selected for inclusion into the study. The first study participant was selected by simple random sampling among infants presenting with diarrhea and their parents who accompanied them. The parents were allowed to pick a folded numbered paper from a basket. The participant who picked the paper numbered 001 was the first respondent. Thereafter every alternate child whose parent gave consent was included in the study sample.

2.4 Data collection

Data collection was conducted within one month period in November 2018.A pretested semi structured questionnaire was used to collect information on the participants socio demographic, environmental and behavioral factors.

2.5 Data analysis

Data collected was analyzed through descriptive and inferential statistics. This was used to establish relationship between variables tested using chi – square and Pearson's correlation. Inferential analysis through use of t-test and Analysis of Variance (ANOVA) tested the relationship between the factors and infant morbidity (diarrhea). The report was presented in form of percentages, ratios, charts and graphs.

2.6 Ethical Considerations

Study approval was sought from DedanKimathiUniversity of Technology Ethical Review Committee and Homa Bay County Referral Hospital. Written informed consent was sought from all study participants after they were given participant information and before they were interviewed. Participation was purely on voluntary basis. Privacy and confidentiality were maintained while handling participants' information.

3.0 RESULTS

3.1 Socio – demographic factors

Majority (86.67%) of the mothers /caretakers were in the age range of between 18 – 25years. Out of all the mothers/caretakers included in the study, 73.33% were residing in the rural areas.Regarding the number of family members within the respondents' households, 76.8% of the respondents had more than three siblings in their households and among these households 80% reported having one child being below five years.

Majority(95.2%)of the respondents, are daily laborers with 42% having household average monthly income of < Ksh.5000.On education status of the respondents,43.33% had only attained primary education. 96% of the respondents were married**. (Table 1)**

Table 1: Summary of socio – demographic factors

Variable	Response category	Response
Mother's/caretakers age	18 – 25	36.67
	26 – 30	36.67
	30 – 45	13.33
	Above 45	13.33
Residence	Rural	73.33
	Urban	26.67
Mother/caretaker's education	Unable to read and write	16.67
	Can read and write	16.67
	Primary	43.33
	Secondary	13.33
	College and above	10.00
Religion	Orthodox	50
	Protestants	36.67
	Muslim	10
	Others	3.33
Number of under five infants	One	70
	Two and above	30
Age of the infant	1 – 3 months	23.33
	4 – 6 months	40.00
	7 – 9 months	36.67
Sex of the infant	Male	53.33
	Female	46.67
Spouse Education status	Unable to read and write	15.00
	Can read and write	35.00
	Primary	25.00
	Secondary	10.00
	College and above	15.00
Spouse Occupation	Farmer	10.00
	Daily laborer	75.00
	Government employee	15.00
Monthly income	Below 5000	80
	5000 – 10,000	10
	10,000 – 15,000	6.67
	Above 15,000	3.33

3.2 Prevalence of diarrhea

According to the findings of this study the prevalence of diarrhea among infants in Homa Bay County referral hospital and its environs was 26.67% as shown at **Figure 1**

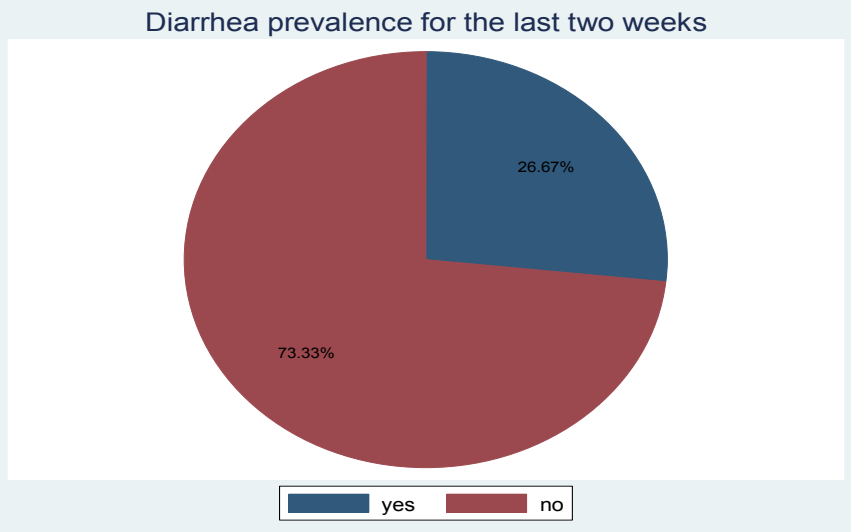

Figure1: diarrhea occurrence in the last two weeks

3.3 Association between socio-demographic factors and diarrhea prevalence

In regression analysis between different variables and the prevalence of diarrheal disease in the

previous 2 weeks, there was a greater association betweenarea of residence and the diarrhea prevalence among those who resided in rural areas(p – value 0.001), compared to those residing in the urban area. In addition mother/caretaker's education also showed a great significance with prevalence of diarrhea as infants of mothers/caretakers who were unable to read had higher diarrhea prevalence (p – value 0.002)than among those who had attained college education. In relation to socio – economic factors, monthly income showed a significance to diarrhea prevalence as we a higher percentage of infants of mothers/caretakers with a monthly income of less than 5000 having a higher diarrhea prevalence(p – 0.004) than the those whose household had a monthly income of 15,000.(**Table 2)**.

Table 2: Association between socio-demographic factors and diarrhea prevalence

Variable	**Response category**	**Response**	**Had diarrhea episode in the last two weeks?**		**P - value**
			yes	no	
Mother's/caretakers age	18 – 25	36.67	2.9	8.1	0.006
	26 – 30	36.67	2.9	8.1	
	30 – 45	13.33	1.1	2.9	
	Above 45	13.33	1.1	2.9	
Residence	**Rural**	**73.33**	**56.67**	**16.67**	**0.001**
	urban	26.67	10	16.67	
Mother/caretaker's education	**Unable to read and write**	**16.67**	**13.33**	**3.33**	**0.002**
	Can read and write	16.67	6.67	10.00	
	Primary	43.33	16.67	26.67	
	Secondary	13.33	0.00	13.33	
	College and above	10.00	0.00	10.00	
Religion	Orthodox	50	13.33	36.67	0.009
	Protestants	36.67	10.00	26.67	
	Muslim	10	3.33	6.67	
	Others	3.33	0.00	3.33	
Number of under five infants	One	70	13.33	56.67	**0.001**
	Two and above	**30**	**26.42**	**3.58**	
Age of the infant	1 – 3 months	23.33	3.33	20.00	0.005
	4 – 6 months	40.00	10.00	30.00	
	7 – 9 months	36.67	13.33	23.33	
Sex of the infant	Male	53.33	13.33	40.00	0.008
	Female	46.67	13.33	33.33	
Spouse Education status	Unable to read and write	15.00	10.00	5.00	0.006
	Can read and write	35.00	10.00	25.00	
	Primary	25.00	10.00	25.00	
	Secondary	10.00	0.00	10.00	
	College and above	15.00	0.00	15.00	
Spouse Occupation	Farmer	10.00	5.00	5.00	0.007
	Daily laborer	75.00	20.00	55.00	
	Government employee	15.00	0.00	15.00	
Monthly income	**Below 5000**	**80**	**56.67**	**23.33**	**0.004**
	5000 – 10,000	10	3.33	6.67	
	10,000 – 15,000	6.67	0.00	6.67	
	Above 15,000	3.33	0.00	3.33	

3.4 Environmental characteristics of the participants

Findings of this study indicates that majority (63.7%) of the participants were using water from the unprotected wells/springs .Most of the respondents (62%) used a Jerrican to store both household and drinking water .

Most of the respondents (98.2%) had traditional pit latrines. Among the respondents,majority(70%)of them reported having a hand washing facility near there latrines. 40.5% of the respondents reported presence of feces around holes of the latrines. In addition regarding the solid and water waste disposal methods of the respondents(49.6%) disposed solid wastes in the open field while 56.8% disposed water wastes in the field as summarized in the **Table 3** below.

Table 3: Environmental factors

Variable	Response category	percentage
Main source of water	Protected well/spring	5.63
	Unprotected well/spring	63.7
	River water	20
	Piped water	6.67
	others	0
Time needed to collect water (min)	< 15	36.67
	15 – 30	34.43
	>30	28.9
Container used for water storage	Pot/clay pot	1.26
	Bucket	34.04
	Jerrican	62.03
	Guard	2.67
	Others	0
Separate container for drinking water Storage.	Yes	42
	No	58
Presence or of a scooper	Present	52.67
	Absent	47.7
Type of scooper used	Any	20.67
	Separate	79.33
Latrine present	Yes	98.1
	No	1.9
Type of latrine	Traditional pit latrine	98.2
	VIP latrine	0.8
	Communal latrine	1.0
	others	0
Presence of washing facility on the toilet	yes	29.6
	no	70.04
Distance of hand washing facility	Next to latrine	68.87
	Within walking distance	31.13
Feces around the toilet hole	Yes	40.05
	No	59.3
Keeping domestic animals?	Yes	65
	no	35
Disposal of solid waste	Open field	49.6
	Burning	16.4
	Properly constructed pit	4.9
	Composite	29.3
	others	0
Disposal of liquid waste	In the field	86.8
	Properly constructed site	13.2
	Others	0

3.5 Association between environmental factors and diarrhea prevalence

Significant association was shown between diarrhea prevalence and source of water (p – value 0.002) as infants who were being given water from unprotected sources had a higher prevalence of diarrhea than those who were being given water from the piped water .Having separate storage container for drinking water had a higher significance to diarrhea prevalence as infants in the families who used a separate container for storage of drinking water had a lower diarrhea (p – value 0.001)as compared to those who didn't.The type of scooper used by the families of the infants also showed some association to the diarrhea prevalence as infants of the families who used any type of scooper in drawing water had a higher prevalence of diarrhea(p – value 0.003), than those who used separate scooper .Latrine presence in the family showed association to the diarrhea prevalence (p – value 0.003), presence of hand washing facility on the toilet near showed significant association to diarrhea prevalence (p – value 0.002).Method of solid wastehad a significant association (p – value 0.001) as households that disposed their solid in the open air reported about their infants having diarrhea in the two previous weeks .Liquid waste disposal also had a significant association to diarrhea prevalence (p – value 0.003).(**table 4)**.

Table 4: Association between environmental factors and diarrhea prevalence

Variable	Response category	percentage	Had diarrhea episode in the last two weeks?		P - value
			Yes (%)	No (%)	
Main source of water	Protected well/spring	5.63	1.00	4.63	
	Unprotected well/spring	**67.7**	**55.2**	**12.5**	**0.002**
	River water	20	15.2	4.8	
	Piped water	6.67	1.27	5.4	
	others	0	0	0	
Time needed to collect water (min)	< 15	36.67	10.00	26.67	**0.002**
	15 – 30	34.43	14.98	19.45	
	>30	**28.9**	**20.02**	**8.88**	
Container used for water storage	Pot/clay pot	1.26	0.8	0.46	0.899
	Bucket	34.04	19.87	14.87	
	Jerrican	62.03	30.85	31.15	
	Guard	2.67	2.67	0	
	Others	0	0	0	
Separate container for drinking water Storage.	Yes	42	10.34	31.66	**0.001**
	No	**58**	**42**	**16**	
Presence or of a scooper	Present	52.67	12.67	40	0.005
	Absent	47.7	28.05	19.65	
Type of scooper used	**Any**	**20.67**	**15.78**	**4.89**	**0.003**
	Separate	79.33	23.43	55.9	
Latrine present	**Yes**	**98.1**	**16.32**	**81.78**	**0.003**
	No	1.9	1.9	0	
Type of latrine	Traditional pit latrine	98.2	62.42	35.78	0.006
	VIP latrine	0.8	0	0.8	
	Communal latrine	1.0	1.0	0	
	others	0	0	0	
Presence of washing facility on the toilet	yes	70.04	22.0	48.04	**0.004**
	No	29.9	26.72	3.24	
Distance of hand washing facility	Next to latrine	68.87	32.75	36.12	0.007
	Within walking distance	31.13	21.73	9.4	
Feces around the toilet hole	Yes	40.05	26.26	13.79	0.006
	No	59.3	21.76	37.54	
Keeping domestic animals?	Yes	65	12.93	52.07	0.009
	no	35	13.23	21.77	
Disposal of solid waste	**Open field**	**49.6**	**30.6**	**19**	**0.001**
	Burning	16.4	2.10	14.3	
	Properly constructed pit	4.9	0	4.9	
	Composite	29.3	1.22	28.08	
	others	0	0	0	
Disposal of liquid waste	**In the field**	**86.8**	**62.2**	**24.6**	**0.003**
	Properly constructed site	13.2	1.00	12.2	
	Others	0	0	0	

3.6 Behavioral and child care practice characteristics of the participants

Majority (72.7) of the respondents initiated breastfeeding within one hour after childbirth. In addition most respondents (59.9%)of introduced complementary feeds before end of six months of age. The study further showed that majority (62.2%) of the mothers provided complementary feeds by bottle feeding while 25.7% provided by cup feeding.

Considering the time the participants wash their hands, 27.4% of the mothers reported washing their hands before preparing food for the infants, 37% wash their hands after visiting the toilet and 12.9% washed their hands before feeding the infants. In regards to what they used for washing their hands, majority (78.9%) washed their hands with water only while 19.3% used water and soap when washing their hands. Among the participants, most (96.9%) of their infants had been vaccinated for Rota virus and 78.3% had received vitamin A supplementation **(table 5 below).**

Table 5: Behavioral and child care practices factors of the participants

Variable	Response category	Percentage
Time breastfeeding stated	Within one hour after birth	72.7
	After one hour	27.3
Colostrums fed	Yes	98.8
	No	1.2
Complementary feeds started before 6 mnths	Yes	59.9
	No	40.1
Method of complimentary feeding	Bottle feeding	62.2
	Cup feeding	25.3
	spoon feeding	12.5
	Others	0
When hands are washed	Before preparing food	15.7
	After visiting toilet	37.0
	Before eating food	27.4
	After eating food	7.0
	Before feeding the child	12.9
What is used when washing hands	Soap and water	21.1
	Ash and water	0
	water only	78.9
	Others	0
Rotavirus vaccine administered	Yes	96.9
	No	3.1
Infant supplemented with vit A	Yes	78.3
	No	21.7

3.7 Association between behavioral factors and diarrhea prevalence

Findings showed that there was a greater significance on time breastfeeding was initiated and diarrhea prevalence,as infants whose mothers initiated breastfeeding after one had a higherprevalence of diarrhea (p – value 0.004)than those whose mothers initiated breastfeeding within one hour .Time of complementary feeding initiation showed a significance to diarrhea as infants who were started on complementary feeds before end of six months of age had a higher diarrhea prevalence (p – Value 0.002)compared to those infants who were started on complementary feeds after 6 months .In addition,the method of complementary feeding also had a major significance to the diarrhea prevalence as infants who were fed complementary feeds using bottle feeding had a higher prevalence of diarrhea (p – value 0.003) compared to those were fed using a spoon .Vaccination of infants with rotavirus vaccine had a greater association as those infants who had been vaccinated showed a lower diarrhea prevalence (p – value 0.003) (**Table 6below)**.

Table6: Association between behavioral factors and diarrhea prevalence

Variable	Response category	Percentage	Had diarrhea episode in the last two weeks?		P - value
			yes	no	
Time breastfeeding stated	Within 0ne hr after birth	72.7	19.1	53.6	
	After one hour	**27.3**	**19.4**	**7.9**	**0.004**
Colostrums fed	Yes	98.8	18.2	80.6	**0.003**
	No	1.2	1.0	0.2	
Complementary feeds started before 6 mnths	**Yes**	**59.9**	**41.5**	**18.4**	**0.002**
	No	40.1	12.2	27.9	
Method of complimentary feeding	**Bottle feeding**	**62.2**	**47.9**	**14.3**	**0.003**
	Cup feeding	25.3	9.6	15.7	
	spoon feeding	12.5	3.6	8.9	
	Others	0	0	0	
When hands are washed	Before preparing food	15.7	3.7	12.0	0.001
	After visiting toilet	37.0	4.2	32.8	
	Before feeding the infant	40.3	2.6	37.7	
	After feeding the infant	7.0	6.4	0.6	
What is used when washing hands	Soap and water	21.1	11.4	9.7	0.007
	Ash and water	0	0	0	
	water only	78.9	32.1	46.8	
	Others	0	0	0	
Rotavirus vaccine administered	Yes	96.9	12.8	84.1	**0.001**
	No	3.1	2.8	0.3	
Infant supplemented with vit A	Yes	78.3	38.6	39.7	0.007
	No	21.7	10.0	11.7	

4. DISCUSSION

Prevalence of diarrhea was high (73.3%) among infants residing in rural areas than those residing in urban areas.The findings of this study concurswith another study that was done in Sheko district, Southwest Ethiopia and DebreBirehan Town, North East Ethiopia , where infants of families residing in rural residences were mostly affected by diarrhea than those in urban areas[12,13]. The above findings could be attributed to a number of factors, including lack access to a safe and adequate drinking and household water supply where most of the families use water from the unprotected wells and springs, method of water storage, the literacy status of the people, knowledge of hygienic activities and communicable disease prevention and control practices, and poor utilization of latrine for instance most families in rural residences reported not having hand washing facility on their latrines .

Most of those infants that were affected by diarrhea were between 4 – 6 months compared to those infants that were above below 4months, hence the study concluded that there was a significant association between diarrhea prevalence and age of the infant. The findings of this study were in acquiescent with another study done in Eastern Ethiopia [14]. High diarrhea prevalence among this age group may be attributed to introduction of complementary feeds that are contaminated and also poor method of complementary feeding as most of the respondents were using bottle feeding which is associated with high incidences of poor hygiene as most of them are not washed thoroughly before feeding [15]. In addition to that, this age group is where crawling starts and this crawling is associated with risk of ingesting contaminated materials within their environment as this stage also is where according to psychology of development is the oral stage hence everything is directed to the mouth, and the ingestion of unhygienic materials may lead to diarrhea. But as the age increases to 12 months and above, the risk of diarrhea decreased subsequently; this might be associated with development of immunity to diarrhea-causing pathogens after repeated exposure [16].

This study also noted that the mother/caretakers education status had a significant statistical association to prevalence of diarrhea among infants. Infants whose mothers/caretakers had no education or primary education only were 3.7 times and 2.9 times respectively more likely to have diarrheal diseases compared to their counterparts who had attended secondary and tertiary level of education. The findings of this study corresponds with findings of other studies conducted across the globe[17]. The findings were also supported by statistical data from 2014 – 2015 KDHS that stated that the prevalence of diarrhea is higher among infants whose mothers/caretakers hadno education (14%) and 12% for mothers/caretakers who had

primary education. While their counterparts with secondary and tertiary education had a prevalence of 9% and 4% respectively[10]. This may be associated with the fact that education is likely to promote household health, good feeding practices and proper hygiene and sanitation practices. In addition education can increase knowledge and awareness of the transmission and prevention of diarrhea. Hence educated mothers will apply more hygienic practices in taking care of the infant hence decreasing the incidences of diarrhea among their infants.

Rotavirus vaccination was also a major determinant of high prevalence of diarrhea among infants as those who had not been vaccinated were less likely to develop diarrheal diseases than those who were not vaccinated. The findings of this study are in consistence with findings of a study conducted in Uganda which concluded that most of the diarrhea cases among children under five years results from Rotaviruses[18].Rotavirus is the major cause of intense childhood gastroenteritis in the whole globe [19]. According the research done in 2011 on rotavirus vaccination, rotavirus vaccine results in a decline in diarrhea mortality and hence the research concluded that vaccinating infants with rotavirus was the best way to prevent severe rotavirus disease that results in a deadly dehydrating diarrhea[18].

Moreover, infants of mothers/caretakers who used water only when washing their hands reported diarrhea more often, compared to the infants whose mothers/caretakers washed hands using water and soap. This findings concur with other similar studies conducted in Bangladesh ,Jigjiga District Somali Region , Eastern Ethiopia, and in Sheko district, Southwest Ethiopia, where mothers/caretakers' hand washing practices and habits affected the incidences of diarrheal disease among their infants [12,20,21&22].

Storage container also affect the prevalence of diarrhea among infants, households using broad-necked containers for water storage had a greater risk of diarrhea compared to households storing their water using jerry cans (narrow-necked water container). These findings were in line with other different studies done in Nepal and Ethiopia[13,23&24]. The findings might have been due to contamination of water during transportation following collection or storage as the storage containers are not covered and broad necked, hence they can be easily contaminated by pets, dirt, or other debris especially if the household does not have a separate scooper to use when drawing water[24]. These findings were in line with the findings by the Centers for Disease Control and Prevention report that conclude that microbial contamination of water was usually associated with storage containers having wide

openings, for example buckets and pots, which are vulnerable to the introduction of dirty hands, as well as cups and dippers, which can easily carry contamination to the water[25].

Basing on the method of complementary feeding, findings of this particular study concluded that diarrheal disease were much higher among infants who received their complementary feeds via bottle feeding, compared to those who were fed complementary feeds via cup feeding method. This finding concurs with other studies in Ethiopia,where feeding the infants using bottle feeding method was more likely to cause diarrheal diseases than cup feeding[26&28]. This finding might be associated with poor hygiene as the bottles are not properly cleaned before using them to feed the infants hence ending up causing diarrhea.

5. CONCLUSION

The findings of this study concluded some factors independently determined the prevalence of diarrheal diseases among infants, examples of these factors included; mothers/caretakers education, method of complementary feeding, rotavirus vaccination, hand washing practices i.e. like either using soap and water or water only, water storage containers used i.e. broad-necked or narrow necked and area of residence that's either rural or urban residence.

The regional health bureaus and nongovernmental organizationsshould address the availability of safe drinking water and the sanitation of rural communities, which is the major contributing factor for the occurrence of diarrheal disease among infants living in this area.

According to the findings of this study, mothers/caregivers education, behavioral factor and poor environmental conditions are major determinants of the occurrence of diarrheal diseases in infants. These problems may be alleviated in the long run, by integrated efforts of individuals themselves, governmental and non – governmental sectors. However, there are some short term solutions that can be achieved before long-term solutions are obtained to minimize the risks of diarrheal diseases. The local government should focus on improving the accessibility of safe drinking water for the community. In addition, regional and local health officials must work to create awareness about the type of water storage containersthat the community should use. In addition to that, all mothers should be informed that the cup method of complementary feeding is better than bottle feeding to prevent diarrhea, and concerned bodies must work to createawareness about how mothers use and access hand washing detergents during critical times.

6. RECOMMENDATIONS

The study recommends thecounty government to focus on improving the accessibility of safe drinking water for the community. Parental /caregivers education on use of clean water and proper sanitation practices. Thus reduce prevalence of diarrhea morbidity among the infants.

7. ABBREVIATIONS

ANC	-	Antenatal care
FP	-	Family planning
IMCI	-	Integrated management of childhood illnesses
KDHS	-	Kenya demographic health survey
LBW	-	Low birth weight
MCH	-	Mother Child health
ORS	-	Oral rehydration salt
SDG	-	Millennium development goals
TT	-	Tetanus toxoid
UN	-	United Nations
WHO	-	World health organization
UNFP	-	United Nations food program
UNICEF	-	United nation children's fund

8. COMPETING INTERESTS

The authors declare that they have no competing interests.

9. FUNDING

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