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Research article

## Contributing Factors to Acute Diarrhea in Children Less than Five Years in Orotta Pediatric National Referral Hospital from 1st May to 30th June 2016

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### Abstract

**Introduction:** Acute gastroenteritis (AGE) is a major cause of morbidity and mortality in children world-wide with the highest incidence in the economically transitioning countries like Eritrea. It kills more children than AIDS, malaria, and measles combined. Therefore, identifying the real and actual contributing factors of acute diarrhea in these population is of a great need. **Objective:** To determine the contributing factors associated with acute gastroenteritis among children less than five years in Orotta Pediatric National Referral Hospital from 1st May to 30th June 2016. **Methodology:** A hospital- based qualitative retrospective case–control study was done with N= 160, 80 cases and 80 controls of children who were admitted in the outpatient department of OPNRH. The data was gathered from the children health records and by interviewing the care givers of the children using objectively structured questionnaire. Collected data was entered in SPSS version 20 and analysis was performed with appropriate statistical tools like Chi-square test and odds ratio to determine the significant associations. **Results:** A total of N= 160 children, 80 cases and 80 controls were enrolled in the study. Significant associations were found with child age, maternal age, washing breast before feeding the child, public latrine utilization, hand washing practice of mothers, storage of cooked food, and buying food from street vendors. **Conclusion and recommendation:** From this study we identified the contributing factors of acute diarrhea to be private or public latrine ownership, hand washing practices of mothers, storage of cooked food and buying food from street vendors. Therefore, this study recommends that more emphasis should be given on sanitation practices (hand washing, food storage, and usage of latrines) and safety of purchased food from street vendors should be reassured.

**Keywords:** acute diarrhea, children, under five, sanitation, safety, socioeconomic

### Introduction

As per the World Health Organization (WHO), diarrhea is generally defined as three or more loose or watery stools within 24-hour and it is termed as acute if it stays for less than 14 days . It can also be defined as an increase in stool frequency to twice the usual number per day in infants, or three or more loose or watery stools per day in older children [1].

Worldwide, 780 million individuals lack safe drinking-water and 2.5 billion had poor sanitation which allowed diarrhea - causing pathogens to spread more easily [1]. In developing countries, children under five

experience on average three episodes of diarrhea every year and in Africa, five episodes of diarrhea per year, with each episode depriving the child from the nutrition necessary for growth, and as a result, it is accountable for causing the majority cases of malnutrition [1,2]. Acute diarrheal diseases are one of the major problems affecting children worldwide, downgrading their overall well-being and bringing about significant requirement for health services [3]. Diarrhea is responsible for causing 4% of all deaths (out of which 7.7% belonging to Africa) and 5% of health loss to disability worldwide. It is related with 2.2

million deaths and accounts to almost 4 billion cases annually in the world, mostly affecting children under five years of age in developing countries [4]. It appears to be the second leading cause of death in children under five being responsible for the death of 760,000 children every year, killing more than malaria, AIDS and measles combined [5]. In the United States, diarrhea in children under five leads to several millions of doctor visits causing 200,000 hospitalizations and approximately 400 deaths where most of the morbidity was due to dehydration associated with acute watery diarrhea [6]. In northern Brazil, child mortality rate exceeds by 14% during the first five years where more than 50% of these recorded deaths were due to diarrhea [7]. In both India and Nigeria the deaths of 386,600 and 151,700 children were attributed to diarrheal diseases [8]. Africa and South Asia harbor more than 80 percent of child deaths due to diarrhea and almost three quarters of all deaths from diarrhea among children under five occurred in just 15 countries [8]. Even though estimates suggested that incidence of diarrhea had remained relatively stable in the past two decades, childhood mortality only decreased by 4% in Africa from 2000 to 2008, owing to inadequate interventions and high poverty rate [9-11]. In South Africa, diarrheal disease is still a major cause of morbidity and mortality in children under-five accounting for over 10% of deaths in 2000 [12]. A study conducted in Kenya showed that 1,146 children less than five years were hospitalized with diarrhea [13]. Another study conducted in central rural Ethiopia revealed that diarrhea to be one of the common causes of under-five mortality, accounting for approximately 24% of all deaths [14]. In comparison to other age groups, prevalence of diarrhea is said to be more prominent among young children aged 6-23 months [15]. In Eritrea, the prevalence of diarrhea varies seasonally and peaks before the rainy season [16]. In addition the data also revealed that the occurrence of diarrhea varies by age, where young children aged 6-23 months were more prone to diarrhea than children in the other age groups and the age group of 12-23 months had the highest prevalence accounting to 17 percent of diarrheal cases [16]. According to the HMIS 2014 report, diarrhea had been the second leading cause of outpatient and inpatient morbidity and the third leading cause of inpatient mortality in hospital and health center for the last ten years. In 2013, it accounted for about 23.9% of OPD morbidity, 10.5% of inpatient morbidity and 8.7 % of inpatient mortality in children under five [17]. A study done in Eritrea in 2002, showed that diarrheal morbidity has important association with age and the number of children particularly with high prevalence of diarrhea at the age of weaning period and household with a large number of children [2]. Also a relationship was established between environmental factors comprising water quantity, access to improved water sources, and availability of toilet facilities, compound hygiene, housing conditions, and refuse disposal with diarrhea occurrence [2]. It is estimated that 88% of

diarrheal deaths globally are ascribed to unsafe water, poor hygiene, and insufficient sanitation, where it's frequency and severity is exasperated with lack of access to adequate clean water and disposal of human waste, lack of proper feeding and hand washing practices, poor housing qualifications, and absence of access to adequate and affordable health care [18-20]. So given the fact that diarrhea continues to be one of the top ten causes of morbidity and mortality in Eritrea from the reports of EPHS and other studies, it is crucial to determine the contributing factors of acute diarrhea to come up with a tangible solution to tackle the continuing burden of this disease especially in children under five. Therefore, the ultimate objective of this study is to determine the contributing factors associated with acute gastroenteritis among children less than five years in Orotta Pediatric National Referral Hospital during the specified period of time.

## Methodology

### Research Design

A qualitative retrospective case control study was used through semi-structured questionnaire by interviewing care givers of the subjects after receiving an informed consent. Collected data was entered in SPSS version 20 and analysis was performed with appropriate statistical tools like Chi-square test and odds ratio to determine the significant associations.

### Study Area and Population:

The study was conducted in the outpatient department of Orotta National Pediatric Referral Hospital which is located in Asmara, capital city of Eritrea. It gives service for about 60 to 80 patients who are less than 14 years of age in the OPD department daily coming from the different corners of the nation. All children under-five years of age who visited the hospital from May 1st- June 30th 2016, where those with diarrhea were selected as cases and those without as controls. During the study period all children under five years of age admitted to OPD from 1st of May to June 30th 2016 due to acute diarrhea were included in the study.

## Results

### Background Characteristics of Children

From the total population selected N= 160 subjects, 80 cases consisted 67.5% males and 32.5% females, while from the 80 controls 53.8% were males. The mean age of the children was 16.69 ( $\pm$ 13.9) (Table 1). A total of 81.3% of the cases were from urban areas, and 76.3% of the controls were from urban and 23.8% were from rural areas. This implies that the majority of the participants were from urban areas. Majority of the cases and controls (81.3%) and (47.5%) respectively were between the ages of 6-24 months. As described in Table 2, there was a significant association between child's age and development of acute diarrhea as evidenced with p-value <0.05.

**Table 1.** Mean values of Child and Maternal age, Maternal Education, Number of rooms and Number of People living in the house hold.

Variables	Mean value of the cases	Mean value of the controls	Sum of means
Childs age in Months	15.03±9.66	18.36±16.95	16.69±13.85
Maternal age in years	27.96±6.23	30.41±7.05	29.19±6.74
Maternal Education	7.70±3.083	7.79±3.532	7.74±3.305
Rooms	1.56±0.809	1.7±1.06	1.64±0.94
People	4.8±1.82	5.11±1.99	4.96±1.904

**Table 2.** Background Characteristics of Children.

Variables	N	Cases n (%)	Controls n (%)	X <sup>2</sup>	OR (95% CI)	p-value
<b>Age of child (months)</b>						
< 6m	27	7 (8.8)	20(25)3	11.97	0.28(0.13-0.62)	0.001
6m-24m	103	65(81.2)	38(47.5)		1.38(1.13-1.69)	
< 6m	27	7 (8.8)	20(25)3	0.004	0.98(0.52-1.84)	0.95
>24m-60m	30	8 (10)	22(27.5)		1.02(0.59-1.77)	
6m-24m	103	65(81.2)	38(47.5)	12.46	1.41(1.14-1.73)	0.000
>24m-60m	30	8 (10)	22(27.5)		0.299(0.14-0.62)	
<b>Sex of child</b>						
Male	97	54(67.5)	43(53.8)	3.168	1.256(0.97-1.62)	0.075
Female	63	26(32.5)	37(46.2)		0.703(0.47-1.04)	

**Table 3.** Socio demographic status of Mothers of the Cases

Variables	N	Cases	Controls	X <sup>2</sup>	OR 95%CI	P Value
		n(%)	n(%)			
<b>Maternal Age</b>						
18-25	49	27(33.8)	22(27.5)	0.018	0.97(0.63-1.49)	0.89
26-34	71	40( 50)	31( 38.8)		1.02(0.76-1.38)	
26-34	71	40( 50)	31( 38.8)	5.83	1.41(1.06-1.88)	0.016
>35	40	13(16.2)	27( 33.8)		0.53(0.31-0.91)	
18-25	49	27(33.8)	22(27.5)	4.55	1.503(1.03-2.19)	0.033
>35	40	13(16.2)	27( 33.8)		0.59(0.35-0.96)	
<b>Marital Status</b>						
Single	9	6(7.5)	3(3.8)	1.060	2 (0.59-7.7)	0.303
Married	151	74(92.5)	77(96.2)		0.97(0.91-1.03)	
<b>Maternal Education</b>						
<7	49	25(31.2)	24(30)	0.409	1.04(0.65-1.7)	0.522
≥7	111	55(68.8)	56(70)		0.98(0.8-1.20)	
<b>Maternal Employment</b>						
Employed	22	8(10)	14(17.5)	1.897	0.6(0.25-1.3)	0.168
Unemployed	138	72(90)	66(82.5)		1.1(0.96-1.24)	

Hence those at the age group of 6-24 months were 1.38 and 1.41 times more likely to be affected with acute diarrhea than those at the age group of <6 months and >24-60months respectively.

Most of the caregivers were unemployed 90% and 82.5% respectively for cases and controls while 10% of cases and 17.5% controls were employed, and majority of the mothers were married. There was no statistically significant association between marital status, maternal education and maternal employment with the development of acute diarrhea. However, there was a significant association between maternal age and occurrence of acute diarrhea as evidenced with p-value <0.05. Children of mothers who were above 35 were 0.53 and 0.59 times less likely to have acute diarrhea than the children of mothers between the age of 26-34 and 18-25 respectively (Table 3).

The study found no significant association between family size, number of rooms they lived in, their knowledge about prevention and communicability with the occurrence of acute diarrhea.

Out of the 105 participants who had latrine, 62.7% of the cases and 83.3% of the controls used private latrine and the remaining used public latrine. This study found statistical significant association with the utilization of public latrine and occurrence of acute diarrhea with p value = 0.025; those who used public latrine were 2.24 times more likely to be affected by acute diarrhea than those who used private latrine, but there was no association with latrine ownership, garbage disposal, waste water disposal, frequency and time of cleansing the child and care given to the child after defecation (p >0.05) (Table 4).

As explained in Table 5, there was no statistical significant association between hygiene practice of the child

and development of acute diarrhea p-value>0.05 but, there was a significant association between hygienic practice of the mother and occurrence of acute diarrhea as the p-value hits the cut point p<0.05. Mothers who always washed their hands after visiting the toilet were 0.67 times less likely to have child with acute diarrhea than those who sometimes washed their hands. Those who sometimes washed their hands after helping the child defecate were 1.77 times more likely to have child with acute diarrhea than those who always washed their hands. Mothers who always washed their hands before preparing food were 0.59 times less likely to have children with acute diarrhea. And those who sometimes washed their hands before feeding the child were 1.24 times more likely to have children with acute diarrhea than those who always washed their hands. Mothers who never washed their breast before feeding their child were 2.52 times more likely to have child with acute diarrhea than those who sometimes cleaned their breast.

Children whose mothers stored cooked food for later use were 1.27 times more likely to develop acute diarrhea than those whose mothers didn't store cooked food for later use. And diarrhea was 1.74 more likely to occur in children whose mothers purchased food from street vendors than those whose mothers did not purchase food from street vendors, while method of storage, water source and water treatment had no statistical significant association (Table 6)

A total 68.8% mothers of cases used different method of water treatment while 31.3% mothers of cases used no water treatment. While 80% of the controls treated their water and the remaining 20% did not treat their water. There was no statistically significant association found with breast feeding practice, exclusive breast feeding and co-morbid illness as evidenced by p value >0.05.

**Table 4.** Sanitation and Waste Disposal of the Cases.

Variables	N	Cases	Controls	X <sup>2</sup>	OR	95%CI	P-VALUE
		N (%)	N (%)				
<b>Latrine ownership</b>							
YES	105	51(63.8)	54(67.5)	0.381	0.94	(0.75-1.18)	0.537
NO	55	29(36.2)	26(32.5)		1.12	(0.73-1.71)	
<b>Private or public latrine</b>							
PRIVATE	77	32(62.7)	45(83.3)	5.048	0.75	(0.59-0.96)	0.025
PUBLIC	28	19(37.3)	9(16.7)		2.24	(1.12-4.48)	
<b>Frequency of cleaning</b>							
EVERYDAY	55	23(45.1)	32(59.3)	1.832	0.776	(0.535-1.127 )	0.176
1-2 TIMES A DAY	43	23(45.1)	20(37)		1.325	(0.879-1.999)	
NOT CLEANED	7	5(9.8)	2(3.7)				

**Table 5.** Hand Washing practice of the Mothers of Cases.

Variables	N	Cases	Controls	X <sup>2</sup>	OR	95%CI	P-VALUE
		N (%)	N (%)				
<b>Hand washing After Visiting Toilet</b>							
Sometimes	49	31(56.4)	18(35.3)	4.726	1.59	(1.03-2.48)	0.036
Always	57	24(43.6)	33(64.7)		0.67	(0.47-0.97)	
<b>After Helping the Child Defecate</b>							
sometimes	54	35 (64.8)	19(36.5)	8.475	1.77	(1.18-2.67)	0.004
Always	52	19 (35.2)	33(63.5)		0.54	(0.37-0.84)	
<b>Hand washing Before Preparing Food</b>							
Sometimes	64	38 (70.4)	26(50)	4.595	1.41	(1.02-1.94)	0.032
Always	42	16(29.6)	26(50)		0.593	(0.362-0.97)	
<b>Hand washing Before Feeding the Child</b>							
Sometimes.	106	57 (77)	49(62)	4.04	1.24	(1.00-1.54)	0.044
Always	47	17 (23)	30(38)		0.61	(0.37-1.00)	
<b>Wash Breast Before Feeding the Child</b>							
Never	54	39 (60.9)	15(24.2)	17.36	2.52	(1.55-4.08)	0.000
Sometimes	72	25(39.1)	47(75.8)		0.52	(0.37-0.72)	

**Table 6.** Food storage and purchasing from street vendors by Mothers of Cases.

Variables	N	Cases	Controls	X <sup>2</sup>	OR	95%CI	P-VALUE
		N (%)	N (%)				
<b>Food Storage more than 24hrs.</b>							
Yes	112	62(77.5)	50(61.2)	4.97	1.27	(1.03-1.56)	0.026
no	58	18(22.5)	30(38.8)		0.58	(0.36-0.95)	
refrigerator	36	16(25.8)	20(40)	2.56	0.65	(0.38-1.11)	0.11
Disk cover	76	46(74.2)	30(60)		1.24	(0.94-1.62)	
<b>Food purchasing from Street vendors.</b>							
yes		40(50)	23(28.8)	7.57	1.74	(1.16-2.62)	0.006
no		40(50)	57(71.2)		0.7	(0.54-0.91)	

## Discussion

The objective of this study was to determine the contributing factors associated with acute diarrhea among under five children in OPNRH. And the study found significant associations with child age, maternal age, washing breast before feeding the child, public latrine usage, hand washing practice of mothers, storage of cooked food for later use, and buying food from street vendors. Studies done in Kenya, Uganda, Egypt and India stated that there was an association of having diarrhea with age, where the highest being among children aged 12-23 months [21-24]. Similarly, the study result showed

that the risk of having diarrhea was highest between the age of 6 - 24 months compared to the other age groups that are <6 month and >24-60 month. This pattern resembles to the result found in Indonesia in which the p value was 0.014 [7]. Moreover, high rate of diarrhea had been observed in boys which were almost twice than girls, however there was no significant association as evidenced with p value of 0.075. Similar study done in Iraq showed that the rate of diarrhea was twice in boys than girls [25]. And another study done in Brazil stated that male children had higher risk of presenting with diarrhea than female children [26]. This study also revealed that majority of the

mothers whose children had diarrhea were between the age group of 18-25 and 26-34 years and there was a significant association with p value of 0.033 and 0.016 respectively. Corroborating studies conducted in Kenya, showed that mothers of young age had a high record of diarrheal rates among children under five [21,28]. Another study showed that prevalence of acute diarrhea was highest in children whose mothers were above the age of 25 [29]. A study done in Indonesia revealed that shared utilization of latrine had risk of infection transmission (OR=1.61(1.26-2.08), P=0.001) [7]. Another finding in relation to this, revealed that sharing toilet with more than four households and occurrence of diarrhea had statistical significance with a p value of 0.01 [29]. Similarly this study showed significant association with the utilization of public latrine with a p value of 0.025. In this study, mothers' hand washing behavior had a significant association with the occurrence of acute diarrhea as it is evidenced by  $p < 0.05$ . Another study in line with this stated that children whose mothers practiced more hand washing were 0.8 times less likely to develop diarrhea with a p value of 0.001 [7]. In accordance to this study, studies done in Ethiopia, Nigeria and Ghana also showed that mother hand washing practices and overall poor handling of food are the main causes of diarrhea occurrence and other infectious disease [30-32]. In addition, similar studies conducted elsewhere stated that lack of hand washing with soap after house work and toilet use by mothers was found to cause diarrhea in children [33,34]. Mothers who always washed their hands after visiting the toilet were 0.67 times less likely to have a child with acute diarrhea than those who sometimes washed their hands. A study done in Ghana showed that there was significant association with hand washing behavior, mothers who did not wash their hand after defecation and before cooking food had a significant association with a p value of 0.02 [29]. Children whose mothers stored cooked food for later use were 1.27 times more likely to develop acute diarrhea than those who didn't store cooked food for later use. In this study there was a significant association with buying food from street vendors and acute diarrhea with a p value of 0.006. Similar study in Nigeria found that food bought from street vendors had been associated with diarrhea [35]. In addition, a research conducted in Indonesia also stated that buying prepared food from street vendors had statistically significant association with diarrhea p value of 0.04 [29].

### Conclusion and Recommendation

The results of the study showed that factors like child age, maternal age, latrine-sharing among more than one family, hand washing practice of mothers, breast washing before feeding the child, storing food for more than 24 hours, buying food from street vendors were found to be associated with the occurrence of diarrhea among children less than five of age admitted to OPD in OPNRH. Therefore, this study suggests that more empha-

sis should be given on sanitation practices like hand washing, breast washing, food storage, and usage of latrines, and safety of purchased food from street vendors should be reassured.

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### Authors Contribution

All authors took part in the conception, extraction of data, statistical analysis, reading and approval of the final manuscript prior to submissions.

### Conflict of Interest

The authors declare no conflict of interest.

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