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## RISK FACTORS ASSOCIATED WITH PREVALENCE OF DIARRHEA AMONG UNDER 5 YEARS CHILDREN IN LOW SOCIOECONOMIC AREA OF URBAN BANGLADESH

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### ABSTRACT

*Diarrheal illness remains one of the major causes of child morbidity and mortality in the world. It kills an estimated 2.5 million people each year, with about 60-70% of them being children under five years of age. The study was aimed to find out risk factors associated with prevalence of diarrhea among under 5 years' children in low socioeconomic area of urban Bangladesh. A cross-sectional study was conducted to assess the incidence and risk factors associated with diarrheal illness. A semi-structured questionnaire was used in this study to collect the data on incidence and risk factors associated with prevalence diarrheal illness. Data was analysed using SPSS 19 version. The majority of diarrheal diseases incidence were found among the children that their mothers/caretaker had below secondary level of education (63.2%). Most of the incidence were found among younger age group ( $\leq 3$  years), almost all diarrheal incidence occurred among the children that did not completed their vaccination as scheduled, It has been seen that the diarrheal incidence also occurred among the children that were not exclusively breastfed. The prevalence of diarrheal illness was found to be 38 percent. The findings of this study revealed, the household storage of food, sources of drinking water,*

*type of latrine used in the household, lack of maternal education, exclusive breastfeeding practices and vaccination schedule as risk factors of diarrhea among under 5 years old children.*

**Keywords:** Diarrhea, Risk-factors, Food, Children, Bangladesh.

## **INTRODUCTION**

Food hygiene is the set of basic principles employed in the systematic control of the environmental conditions during production, packaging, delivery/transportation, storage, processing, preparation, selling and serving of food in such a manner as to ensure that food is safe to consume and is of good keeping quality (Schlundt et al., 2004). However, food itself can pose a health threat, a problem that is serious in urban areas due to difficulties in securing optimal hygienic food handling practices (Okojie et al., 2005). According to Okojie et al. public health objective of food hygiene and safety is the prevention of illness attributable to consumption of food. This is because of adequate supply of safe, wholesome and healthy food is essential for the health and well-being of humans (Okojie et al., 2005).

Gordon-Davis (2011) interprets hygiene as the preservation of health and it involves all measures that ensure the safety and quality of food during its handling. These measures are correct storage of both raw and cooked foods, as well as correct preparation and cooking methods. Unhygienic preparation of food provides plenty of opportunity for transfer of bacteria as well as growth or survivals of bacteria and other pathogens (Gordon-Davis, 2011).

Davis (2011) have found that in most countries, street food stands simple structures where running water, toilets and washing facilities are seldom available (Gordon-Davis, 2011). The washing of hands, utensils and dishes are often done in bowls or pots of water. Menasha *et al.* (2002) also reported that, disinfection is seldom carried out and pests may be attracted to vending sites if there is inadequate sewage disposal (Menasha et al., 2002).

Many factors ranging from ignorance (Walker et al., 2003) uncaring and poor attitude to personal hygiene (Okojie et al., 2005) lack of basic hygiene infrastructure and sanitary facilities such as water, soap and toilets and lack of food storage and preservation facilities, all contribute to poor attitude toward food hygiene (FH) practices among food handlers. In addition, lacks of time and staff have been identified as some of the barriers to practice of food hygiene. Many

food handlers also believed that their products were of relatively low risk to the consumers (Clayton et al., 2002).

The consumption of contaminated or unsafe foods may result in illness, also referred to as food borne disease (Plaut, 2000). Food borne diseases remain a major public health problem across the globe. Even in developed countries, an estimated one-third of the populations are affected by microbiological food borne diseases each year (Schludt et al., 2004). Kaferstein and Abdussalam reported that up to 10% of the population of industrialized countries might suffer annually from food-borne diseases (WHO, 1987). An estimated 70% of cases of diarrheal diseases are associated with the consumption of contaminated food (Schludt et al., 2004; Kaferstein and Abdussalam, 1999). Diarrheal diseases, mostly caused by food-borne or water-borne microbial pathogens, remain the leading causes of illness and deaths in these countries, killing an estimated 1.9 million people annually worldwide. Yet, it is expected that a large number of illnesses remain under-reported as only the most serious cases are usually investigated. In most developing countries, reliable statistics on food-borne diseases are not available due to poor or non-existent reporting systems (Kaferstein and Abdussalam, 1999).

Food hygiene rests directly on the state of personal hygiene and habits of the personnel working in the establishments. In developing countries such as Nigeria, the normal atmospheric temperature is ideal for the multiplication of micro-organisms which cause food poisoning (Obionu, 2007). Sometimes the food may look attractive and may be normal in smell and taste, and yet cause acute illness almost immediately after consumption or after a period of time due to toxins produced by bacteria. Globally food-borne illness affects an estimated 30% of individuals annually (Chapman et al., 2010). Meals prepared outside the home have been implicated in up to 70% of traced outbreaks. And with urbanization, industrialization and development, people tend to increasingly patronize public food vendors. Thus proper handling of foods, utensils and dishes together with emphasis on the necessity for good personal hygiene are all of great importance. This study was to find out the risk factors associated with prevalence of diarrhea among under 5 years' children in low socioeconomic area of urban Bangladesh.

## **METHODOLOGY**

### **Study Design**

An observational, cross-sectional study design was carried out in this study to collect the data from the mothers of under five years' children in selected low socio-economic urban areas (Kamrangirchar and Hazaribagh) of Dhaka, Bangladesh. Data were collected between December 2016 to March 2017. A total of 150 mothers of under five years children were selected by using convenient sampling technique.

### **Data Collection Tools**

In this study data was collected in two phase; Interview for the socio demographic factors and Observations. A semi-structured questionnaire, was used for conducting an interviews and observation which consisted three different sections;

- a. Socio Demographic factors
- b. Environment factors
- c. Proximal factors

### **Data Management & Analysis Plan**

After collection of data, all interviewed questionnaires was checked for completeness, correctness and internal consistency to exclude missing or inconsistent data and those were discarded. Corrected data were entered into Statistical Package for Social Sciences (SPSS) statistical software version 19 for the analysis.

### **Quality Control & Quality Assurance**

For quality control and assurance measures follows below guidelines:

- Regular help and guidance from the supervisor was taken before conducting interview.
- Data collection and analyses was done by the researcher himself with the help of interpreters that translated the English questionnaire into Bengali.
- Data were checked and rechecked for reliability.
- For data collection pretested questionnaire was used.

## RESULTS

### Socio-demographic distribution of the respondents

Table 1 showed that slightly above seven-tenth (71.3%) of the respondents were in the age group 25-35 years, followed by age group 36-46 (24.7%). The mean age of the respondents was 31.6 years. In this study two-third (66.7%) of the respondents were Muslims and the rest were non-muslims. Based on marital status, majority (76%) of the respondents were married. Regarding educational level, little above two-fifth (46%) of the mother's had below secondary educational level, followed by 26.7% those that had above secondary educational level. More than half (50.7%) of them were housewives, followed by 29.3% service holders and only 7.3% were unemployed. According to family monthly income, close to half (48%) of the respondents family's income was <10,000 taka and the rest were earning >10000 taka. Majority (85.3%) of the participants had two and above children. Little above half (50.7%) of the children were male. More than three-fifths (66%) of these children were between 2 and above years old. Concerning their nutritional status, 46% of the children had medium level of nutrition, followed by adequate level of nutrition (27.3%) and the rest had poor level of nutrition. The prevalence of diarrhea among the children was 38%.

### Demographic and Socio-economic characteristics of mothers/caretakers in relation to childhood diarrhea among under-five children

Table 2 demonstrated that there was no significant association between age of the mothers/caretaker and the incidence of the childhood diarrhea ( $P=0.970$ ), majority of the cases were found among the children that their mothers/caretaker aged 25-35 years. Marital status was also found not associated with incidence of diarrhea ( $P=0.081$ ). The diarrheal incidence among under 5 years children was found to be significantly associated with mother's education level, mother's occupation and family monthly income ( $P<0.001$ ), however majority of diarrheal diseases incidence were found among the children that their mothers/caretaker had below secondary level of education. The findings revealed that the diarrheal incidence was not associated with number of children in the household ( $p=0.572$ ). Majority of the children were male (50.7%) and sex was not significantly associated with diarrheal incidence among the under 5 years children ( $p=0.706$ ). The majority of the cases were found among younger age group ( $\leq 3$

years). Nevertheless age of the child was not significantly associated with occurrence of diarrhea and nutritional status of the child was significantly associated with diarrheal incidence.

### **Proximal characteristics of mothers/caretakers in relation to childhood diarrhea among under-five children**

Table 3 showed that the majority of the respondents 60(40%) understood that their child has diarrhea when he/she passes a watery stool twice a day. There was significant association between understanding that the child has diarrhea and diarrheal incidence ( $P<0.001$ ). More than half of respondents after recognizing that the child has diarrhea they sought treatment from hospital. There was significant association between diarrheal incidence and the place of seeking treatment ( $P<0.001$ ). The majority of the diarrheal incidence occurred among the children that sought their treatment from patent medicine store. In this study it has been observed that there was significant association between completing vaccination and diarrheal incidence among under 5 years old children ( $P<0.001$ ). Almost all diarrheal incidence occurred among the children that did not completed their vaccination as scheduled. It has been seen that the diarrheal incidence also occurred among the children that were not exclusively breastfed, there was significant association between exclusively breastfeeding and occurrence of diarrheal cases among under 5 years children. The majority of the diarrheal incidence occurred on the children that were not taken for medical attention when ill. There was significant association between seeking medical attention when the child was ill and diarrheal incidence.

### **Environmental characteristics of mothers/caretakers in relation to childhood diarrhea among under-five children**

Table 4 Showed that there was significant association between the type of latrine use in the household and diarrheal incidence among under 5 years children ( $P<0.001$ ) and majority of the incidence occurred in the household that were using hanging type of latrine. It has been seen that there was significant association ( $P<0.001$ ) between knowledge on diarrhea is preventable and it's incidence among under 5 years children, majority of this incidence occurred among the children that their parents has no knowledge regarding prevention of diarrheal disease. There was also significant association between knowledge on the 5 steps of hand washing and incidence of diarrheal diseases among the children ( $P<0.001$ ), majority of the cases were found among the children that their mothers/caregivers has no knowledge on 5 steps of hand washing. There was

significant association between diarrheal incidence and source of drinking water for the household, storing place for drinking water in the household ( $P < 0.001$ ). The findings also revealed that there was significant association between storing place for raw or cooked food for the use of the household and diarrheal incidence among under 5 years children, however majority of the incidence occurred among those that left their raw or cooked food on the kitchen flow. There was no significant association between diarrheal incidence and allowing children to defecate any how around the house ( $P = 0.218$ ), travelling distance to where they sourced water ( $P = 0.784$ ), and duration of standing in the queue before fetching the water ( $P = 0.799$ ).

**Table 1: Socio-demographic distribution of the respondents (n=150)**

Characteristics	Frequency	Percentage
<b>Age of the respondents (years)</b>		
≤24	6	4.0
25-35	107	71.3
>35	37	24.7
Mean ±SD	31.6 ±5.6 years	
<b>Religion</b>		
Muslim	100	66.7
Non-Muslim	50	33.3
<b>Marital status</b>		
Married	114	76.0
Single	6	4.0
Divorced	12	8.0
Separated	11	7.3
Widowed	7	4.7
<b>Mother's educational level</b>		
No formal education	24	16.0
Below secondary education	69	46.0
Secondary and above	40	26.7
Others	17	11.3
<b>Mother's occupation</b>		
Housewife	76	50.7

Service holder	44	29.3
Business	12	8.0
Unemployed	11	7.3
Others	7	4.7
<b>Family monthly income (taka)</b>		
<10000	72	48.0
≥10000	78	52.0
<b>Number of children in the household</b>		
One	22	14.7
Two and above	128	85.3
<b>Sex of the child</b>		
Male	76	50.7
Female	74	49.3
<b>Age of the child</b>		
≤1	51	34.0
≥2	99	66.0
<b>Nutritional status of the child</b>		
Adequate	41	27.3
Medium	69	46.0
Poor	40	26.7
<b>Diarrhea (recently)</b>		
Yes	57	38
No	93	62

**Table 2: Demographic and Socio-economic characteristics of mothers/caretakers in relation to childhood diarrhea among under-five children (n=150)**

Variables	N (%)	Diarrhea		Chi-square and P-value
		Yes(n)	No(n)	
<b>Age of the mothers/caretakers</b>				
≤24	6(4.0)	2	4	X <sup>2</sup> =0.060
25-35	107(71.3)	41	66	P=0.970
36-46	37(24.7)	14	23	
<b>Marital status</b>				
Married	114(76.0)	50	64	X <sup>2</sup> =8.297
Single	6(4.0)	2	4	P=0.081
Divorced	12(8.0)	1	11	
Separated	11(7.3)	2	9	
Widowed	7(4.7)	2	5	
<b>Mothers educational level</b>				
No formal education	24(16.0)	13	11	X <sup>2</sup> =30.015
Below secondary education	69(46.0)	36	33	P<0.001
Secondary education and above	40(26.7)	1	39	
Others	17(11.3)	7	10	
<b>Mothers occupation</b>				
Housewife	76(50.7)	40	36	X <sup>2</sup> =23.330
Service holder	44(29.3)	4	40	P<0.001
Business	12(8.0)	6	6	
Unemployed	11(7.3)	4	7	
Others	7(4.7)	3	4	
<b>Family monthly income</b>				
<10,000	72(48.0)	40	32	X <sup>2</sup> =25.081
>10,000	78(52.0)	17	61	P<0.001
<b>Number of children in the household</b>				
One	22(14.7)	8	14	X <sup>2</sup> =1.116
Two and above	128(85.3)	49	79	P=0.572

<b>Sex of the child</b>				
Male	76(50.7)	30	46	$X^2=0.142$
Female	74(49.3)	27	47	$P=0.706$
<b>Age of the child</b>				
≤1	51(34.0)	17	34	$X^2=3.215$
≥2	99(66.0)	40	59	$P=0.360$
<b>Nutritional status of the child</b>				
Adequate	41(27.3)	0	41	$X^2=34.778$
Medium	69(46.0)	35	34	$P<0.001$
Poor	40(26.7)	22	18	

**Table 3: Proximal characteristics of mothers/caretakers in relation to childhood diarrhea among under-five children (n=150)**

Variables	N (%)	Diarrhea		Chi-square and P-value
		Yes(n)	No(n)	
<b>How do you know your child has diarrhoea? When he/she passes watery stool</b>				
Once a day	41(27.3)	1	40	$X^2=30.480$
Twice a day	60(40.0)	31	29	$P<0.001$
Thrice a day	44(29.3)	22	22	
Don't know	5(3.3)	3	2	
<b>After recognizing that the child is passing watery stool, I sought treatment from!</b>				
Hospital	58(38.7)	0	58	$X^2=58.403$
Patent medicine store	35(23.3)	22	13	$P<0.001$
Herbalist	28(18.7)	16	12	
Home treatment with ORS + zinc	29(19.3)	19	10	
<b>After recognizing that the child is passing watery stool, I promptly sought medical attention!</b>				
Immediately	62(41.3)	1	61	$X^2=62.557$
After one day	14(9.3)	6	8	$P<0.001$
After two days	33(22.0)	23	10	
After three days	41(27.3)	27	14	

<b>The child completed all his/her vaccination schedule</b>				
Yes	43(28.7)	0	43	$X^2=36.946$
No	107(71.3)	57	50	$P<0.001$
<b>The child exclusively breastfed</b>				
Yes	38(25.3)	0	38	$X^2=31.192$
No	112(74.7)	57	55	$P<0.001$
<b>You promptly sought for medical attention when the child is ill</b>				
Yes	80(55.3)	9	71	$X^2=52.066$
No	70(46.7)	48	22	$P<0.001$
<b>Your child or children experienced diarrhoea</b>				
Very rarely	53(35.3)	1	52	$X^2=63.337$
Very often	19(12.7)	3	16	$P<0.001$
2 to 4 times a year	43(28.7)	28	15	
More than 5 times a year	35(23.3)	25	10	

**Table 4: Environmental characteristics of mothers/caretakers in relation to childhood diarrhoea among under-five children (n=150)**

Variables	N (%)	Diarrhea		Chi-square and P-value
		Yes(n)	No(n)	
<b>Type of latrine in the household</b>				
Hanging type	52(34.7)	33	19	$X^2=38.391$
Pit latrine	59(39.3)	24	35	$P<0.001$
Modern type	39(26.0)	0	39	
<b>The diarrhoea is preventable</b>				
Yes	70(46.7)	3	67	$X^2=63.322$
No	80(53.3)	54	26	$P<0.001$
<b>Knew the 5 steps of hand washing</b>				
Yes	69(46.0)	3	66	$X^2=61.420$
No	81(54.0)	54	27	$P<0.001$
<b>Source of drinking water for the household</b>				
Tap water	48(32.0)	4	44	$X^2=26.369$

Water from bore hole	102(68.0)	53	49	P<0.001
<b>Storing place for drinking water in the household</b>				
Drum with a cover	50(33.3)	3	47	$X^2=46.644$
Drum without a cover	79(52.7)	49	30	P<0.001
Local earthen pot with cover	13(8.7)	1	12	
Local earthen pot without a cover	8(5.3)	4	4	
<b>Storing place for raw or cooked food for the use of the household</b>				
Refrigerator	34(22.7)	0	34	$X^2=45.332$
Store at ambient temperature	32(21.3)	12	20	P<0.001
Left on the kitchen floor or bench	84(55.9)	45	39	
<b>Ensure food is properly cooked before serving it to family members</b>				
Yes	70(46.7)	4	66	$X^2=58.069$
No	80(53.3)	53	27	P<0.001
<b>Food utensils left scattered all over the house for hours before being washed</b>				
Yes	72(48.0)	46	26	$X^2=39.390$
No	78(52.0)	11	67	P<0.001
<b>Children allowed to defecate any how around the house and left for hours before being cleared</b>				
Yes	16(10.7)	8	8	$X^2=1.095$
No	134(89.3)	49	85	P=0.218
<b>The travelling distance between your house and place of water supply</b>				
Less than 5 minutes	25(16.7)	8	17	$X^2=1.738$
5 to 10 minutes	53(35.3)	19	34	P=0.784
10-30 minutes	43(28.7)	18	25	
One hour or more	29(19.4)	12	17	
<b>Duration of standing in the queue before fetching water from the nearest water source</b>				
Less than 5 minutes	23(15.3)	10	13	$X^2=1.655$
5 to 10 minutes	46(30.7)	20	26	P=0.799
10-30 minutes	38(25.3)	13	25	
One hour or more	43(28.7)	14	29	

## DISSCUSSION

In this study the prevalence of diarrheal illness among under five children was found to be 38%. The prevalence of diarrheal illness among children under-five years of age differ from that obtained in some countries; 22.5% in Nepal (Muluken et al., 2011) 28.9% in Ethiopia (FMOH, 2005) 23.6% in Dakahlia / Egypt (Mitike, 2001) and 18% in Ghana (Girma et al., 2008). These variations may be due to difference in knowledge, attitude and practices about diarrheal illness and associated risk factors among mothers/caretakers of children of this study and previous studies.

In this study it has been seen that there was no significant association between age of the mothers/caretaker and the incidence of the childhood diarrhea ( $p=0.970$ ), majority of the cases were found among the children that their mothers/caretaker aged 25-35 years. Our finding is similar to another finding in Nepal which found that there was no significant association between the mothers/caregiver ages and diarrheal diseases occurrence among under five children (Girma et al., 2008). Marital status was also found not significantly associated with incidence of diarrhea (Table 2). The diarrheal incidence among under 5 years children was found to be significantly associated with mother's education level ( $P<0.001$ ). The observation that the incidence of diarrhea was higher in children whose mothers/guardians had no formal education is in agreement with the reports of Ekanem et al. from Nigeria (Ekanem et al., 1991). Mother's occupation and family monthly income were found to be associated with diarrheal incidence ( $P<0.001$ ) among under 5 years children (Table 2). However majority of diarrheal diseases incidence were found among the children that their mothers/caretaker had below secondary level of education. The findings of this study substantiate earlier reports that education is important to change healthcare seeking behavior and practice of mothers/guardians (Muluken et al., 2011; Mitike, 2001; Karki et al., 2010; El-Gilaniy and Hammad, 2005). Majority of the cases were found among younger age group ( $\leq 3$  years). Nevertheless in this study age of the child was not significantly associated with occurrence of diarrheal illness ( $P=0.360$ ). This differ to the findings of a study in Nepal which found that ages of children between 3 to 5 are significantly associated with diarrhea than lower age groups (Girma et al., 2008). This could be related to their more environmental exposure and unsafe child feces disposal methods (poor hygienic practices) associated with increased risk of diarrhea and nutritional status of the child was significantly associated with diarrheal incidence.

In this study it has been observed that there was significant association ( $P < 0.001$ ) between completing vaccination and diarrheal incidence among under 5 years old children (Table 3). Almost all diarrheal incidence occurred among the children that did not completed their vaccination as scheduled. It has been seen that the diarrheal incidence also occurred among the children that were not exclusively breastfed, there was significant association between exclusively breastfeeding and occurrence of diarrheal cases among under 5 years children. Our study findings is consistent with other study which showed that there is association between mode of feeding and diarrhea morbidity in children (Mihirshahi et al., 2007; Perera et al., 1999). Promotion of exclusive breast feeding in the first 4 to 6 months of life could reduce both the incidence of diarrhea and related deaths and are likely to be beneficial for infant survival. This is consistent with earlier estimates of potential reductions in diarrhea mortality after increased breast feeding (Yoon et al., 1997; Knight et al., 1992; Arifeen et al., 2001).

There was significant association between the type of latrine use in the household and diarrheal incidence among under 5 years children ( $P < 0.001$ ) and majority of the incidence occurred in the household that were using hanging type of latrine. This has been revealed by study in Egypt, where there was a strong association between the presence of feces in the yard and non-flush toilets with under-five childhood diarrheal morbidity (Girma et al., 2008).

There was also significant association between knowledge on the 5 steps of hand washing and incidence of diarrheal diseases among the children ( $P < 0.001$ ), majority of the cases were found among the children that their mothers/caregivers has no knowledge on 5 steps of hand washing. It is clear that hand washing reduces the transmission of pathogens causing diarrhea. However, monitoring correct hand washing behavior at critical times is challenging. With this regard, hygiene behavior related observational studies showed wide discrepancy between what people said and did and suggested that the availability of water and soap in places of hand washing may reveal as indicators of hand washing behavior (Dikassa et al., 1993; Regassa et al., 2008). There was significant association between diarrheal incidence and source of drinking water for the household, storing place for drinking water in the household ( $P < 0.001$ ). This is similar to the findings of a study in Ethiopia, which found that there was significant association between household water storage and prevalence of diarrhea (Alelign et al., 2016). It has been found that there was significant association between storing place for raw or cooked food for the use of the household and diarrheal incidence among under 5 years children, however majority of the

incidence occurred among those that left their raw or cooked food on the kitchen flow (Table 4). Poor hygiene practices, especially in food preparation and feeding practices, may increase the risk of having diarrhea, up to 70% of diarrhea episodes are actually caused by water and food contaminated with pathogens (Motarjemi et al., 1993).

## **CONCLUSION**

The findings of this study revealed, the household storage of food, sources of drinking water, type of latrine used in the household, lack of maternal education, exclusive breastfeeding practices and vaccination schedule as risk factors of diarrhea among under 5 years old children. Therefore, this highlights the need for promoting environmental sanitation and hygienic child care practices.

## **RECOMMENDATIONS**

Based on the findings of this research we recommended that;

- Interventions through effective health education of the community, paying special attention to maternal education is recommended to reduce the incidence of diarrhea in the study area.
- Health education should be provided on the importance of treating water by boiling and storing them in covered containers. Also it is better to construct improved water source so as to provide safe water and increase their daily water consumption in the community.
- The advocacy on hand hygiene with detergent (soap) to children care takers should be emphasized as it protects the children against diarrhoea.
- Executing of these recommendations will be expected to improve under-five diarrheal morbidity in the community.

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## **Conflict of Interest**

The authors declare that they have no competing interests.

## **Ethical Considerations**

Ethical approval for the study from the North South University Research Review and ethical committees was obtained. Informed consent was also taken from the participants in the selected area. Confidentiality of the respondents was maintained. Respondents were given rights to refuse and withdraw from the study, any time they wish.

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