



Epidemiology of Diarrhea among under-five Children in a Village in Sunderbans, South 24 Parganas, West Bengal, India

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Abstract

Background: Though various studies have been carried out on the problem of diarrheal disease in under-five children in various parts of India, no comprehensive study has so far been done on this problem in deltaic region of West Bengal, the Sunderbans.

Objectives: A study was undertaken in a prototype village, in Sunderban area to assess the prevalence of diarrheal disease in under-five children and to assess various factors which influence its occurrence.

Methods: Information was collected from all households from village Hogolduri, in Sunderban area, South 24 Parganas regarding socioeconomic characteristics, water source, and sanitation status of the population. Frequency of occurrence of Diarrhea during last three months in each child under-five years of age was recorded and maternal characteristics and child's nutrition were also noted.

Results: Among the 5264 people residing in 1231 households in Hogolduri village, majority of the people were Muslims (79%). Majority (80.7%) of the families belonged to below-poverty-line (BPL). Out of 486 children living in the village, from which all the data were available, diarrhea occurred during last three months in 45.68% of children. Important contributing factors for such morbidity of children were found to be absence of toilets in households, non-use of soap for hand washing after defecation and after child's stool cleaning by mothers, absence of vaccination against measles and low nutritional status of children.

Conclusions: Multiple factors are responsible for high incidence of diarrheal disease in children in a prototype village in Sunderban area.

Keywords: Diarrhea, Under-five populations, Personal hygiene, Sanitation, Exclusive breast feeding, Vaccination.

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Introduction

Diarrhea continues to be an important cause of morbidity and mortality among young children in developing countries.¹ Report from NFHS-3 study² carried out in 29 states in India shows that about 9% of under-five children suffered from diarrhea in the two weeks preceding the survey. Diarrhea appears to be an important contributor to childhood deaths in India. The Sample Registration Survey (SRS) report suggests that diarrhea is among the top 10 causes of death among infants and children 0-4 years of age. About 10% of infants and 14% of 0-4-year children die due to diarrhea in India every year.³

Poor sanitation, lack of access to clean water supply and inadequate personal hygiene are responsible for 90% of diarrheal disease occurrence; this can be easily improved by health promotion and education.⁴ Some of the important measures for diarrhea control as highlighted by UNICEF and WHO are measles vaccinations, promotion of early and exclusive breastfeeding, promotion of hand washing with soap, improved water supply quantity and quality including treatment and safe storage of household water, and community-wide sanitation promotion.⁵

The present paper is based on a study on prevalence of diarrheal disease in under-five children in a village in Sunderbans, one of the areas in West Bengal having much higher general morbidity rate than the state average.⁶ Sunderbans, the largest mangrove belt of the world, is a famous heritage declared by UNESCO in the year 1987.⁷ There are 13 blocks in South 24 Parganas area of Sundarbans. Out of these, the Basanti block, one of the blocks from where the study village has been selected, is one of the main deltaic islands in the Sundarban region bounded by the Matala and Vidyadhari rivers/creeks. It is one of the backward blocks in Sunderban area. The level of literacy and per capita income is much below the state average and most of the people fall below the poverty line. The communication and transport network is very poor and most of the areas are inaccessible. Provision of healthcare is extremely poor and electricity is almost non-existent. Frequent climatic insult is a regular feature - cyclonic storm, inrush of tidal waves and flooding is the cause of recurrent damage of life, crops and property every year.⁶ The study village Hogolduri in Ramchandrakhal GP of Basanti block, a prototype village in Sunderbans, was selected because of its large population size, socioeconomic backwardness and being severely affected by Aila Cyclone during 2007.

The purpose of this study is to estimate the prevalence of diarrhea among under-five children in the whole of the village population studied and to estimate association between quality of drinking water used and sanitation status of the families, education, occupation, hygienic behavior and breast feeding practice of mothers of children, and nutrition and immunization status of children, the important factors which are known to influence the occurrence of diarrhea in children.

Materials and Methods

A cross-sectional study was undertaken in the population residing in all households of Hogolduri village in 2013-14. A total number of 5264 participants residing in 1231 households were surveyed. The survey team consisted of five field workers and one supervisor at Hogolduri village. All field workers employed for the work had completed secondary education. They were selected on the basis of their experience of home visits. Their training lasted for two weeks, including the pilot-testing of the observation schedule in the field. A proforma, incorporating a pretested questionnaire, was prepared for collection of information from head of the family/ senior family member who was interviewed for data collection during house to house visit in the study village. The questionnaire incorporated information regarding demographic and socioeconomic characteristics, availability and usage pattern of safe water for drinking purpose, hygiene habits and sanitation practice by the family members, the literacy, occupation status, habit of exclusive breast feeding, use of ORS (oral rehydrating solution) and hygiene behavior in relation to hand washing after defecation and before feeding their children by mothers, and of children's nutrition and vaccination status. Exclusive breast feeding data had been obtained using 24-hour recall method. Body weight of each child studied was recorded during house visit. Nutrition of children was assessed by determining under-nutrition as $<2SD$ (standard deviation) in the Z-score which was determined according to the standard WHO table on body weight in relation to specific age and sex.⁸ Frequency of occurrence of diarrhea during last three months in each child less than five years of age was recorded from every family. The passage of loose, liquid or watery stools more than three times a day was taken as diarrhea case.⁹

In regard to drinking water, drinking water source of each household was recorded. For sanitation, questions regarding whether the households possess toilet or practice open defecation was noted. Hygienic habits in

regard to materials (soap, water or soil) used for washing hands were noted. Each participant mother of children was asked whether they washed their hands before taking food, after visiting toilet, and after cleaning child's stool and what material they used for this purpose. The interviewers were also trained to demonstrate the steps of hand washing with soap. Whether mothers know use of ORS for treatment of their children during diarrhea was also noted.

A total of 533 children aged under-five years, were found in 1231 households born of 526 mothers. Data regarding occurrence of diarrhea in children under-five during previous three months was collected from their mothers. Further various data related to their breast feeding habit, immunization inclusive of measles vaccine, data regarding mother's education, occupation hygienic behavior and assessment of nutrition status by recording Z-score in relation to age and sex of child were acquired from family members having children.

Approval of the study protocol was obtained from the Ethical Committee of the DNGM Research Foundation, fulfilling the Helsinki criteria and recommendation of the Indian Council of Medical Research, Government of India. Informed consent was taken from each participant before carrying out an interview.

Statistical Analysis

Out of the data obtained on diarrheal disease from families of 533 children, all the data on education and occupation of mothers and their knowledge about use of ORS for treatment of diarrhea, hand washing habits with soap, Z-score in relation to age and sex of child, history of immunization and breast feeding were available for 486 children born of 411 mothers residing in 411 households. While analyzing the data, initially a descriptive analysis was done to understand the distribution of baseline data on 486 children and 411 mothers. History of exclusive breast feeding for six months by mothers was available for 437 children (excluding children less than six months) and vaccination status including measles and DPT was available for 399 children aged more than 11 months. On difference of occurrence of diarrhea in these children having history of exclusive breast feeding and full vaccination inclusive of measles vaccine, Chi-square test was applied to understand significance of difference of proportions. The simultaneous effects of other confounders were determined using Poisson regression analysis with occurrence of diarrhea as the dependent variable and other confounding factors as independent variables. The analysis was performed using statistical software R.¹⁰

Results

Among the 5264 people residing in 1231 households in Hogolduri village, 52.2% were males. Majority of the people were Muslims (79%). Forty-seven percent of heads of families were either illiterate or just literate. In regard to occupation, 27.5% of these people were laborers or farmers. Majority (80.7%) of the families belonged to below-poverty-line (BPL)

Out of 486 children living in the village from which all the data were available, diarrhea occurred during last three months in 45.68% of children of which 44.95% were boys and 46.73% were girls. Diarrhea occurred in highest (64.52%) among children of age between the age of 12 months and 35 months. Body weight was <2SD compared to standard body weight in relation to age and sex in 52.24% of children studied. Diarrhea occurred in more number of children having low body weight compared to children with normal body weight (Table 1).

Baseline characteristics of mothers (n=411) of study children and occurrence of diarrhea during last three months have been tabulated in Table 2. Only 27.49% of mothers had education above primary level. Majority of (69.83%) mothers were housewives. Diarrhea occurred in more (59.46%) number of their children compared to those (40.54%) of working mothers. Knowledge of use of ORS for the treatment of diarrhea was found to be present in 34.79% of mothers. Hand washing practice with soap after cleaning child's stool and following defecation was practiced by a small number (28.71% and 27.01% respectively) of mothers. Diarrhea occurred in less number of their children. Soil was mostly used for cleaning hands after cleaning child's stool and after defecation by majority (68.86% and 72.02% respectively) of mothers. Diarrhea was found to occur in more number of their children. In regard to sanitation, 33.09% of households of the children studied had toilets; people residing in rest of the households in their families were practicing open defecation. Diarrhea occurred in more number of children who did not have toilets (Table 2). All residents were getting safe drinking water from tube wells or roadside tap points.

Exclusive breast feeding for six months was found to be received by 65.67% of 437 children aged more than six months. There was no significant difference in occurrence of diarrhea in children (49.8%) who received exclusive breast feeding for six months compared to those (45.3%) children who did not ($p>0.05$). Full immunization with polio, DPT, measles and Hepatitis B vaccine was given to 41.35% of 399 children aged above 11 months of age. Diarrhea occurred in less number

(77.5%) of children who were fully vaccinated compared to those (92.7%) who were not ($p < 0.001$) (Table 3).

Poisson regression analysis for these children showed that child's age was significantly related to occurrence of diarrhea. Of various other factors studied, working status of mothers, good nutritional status of child (Z-

score median, normal), presence of home toilet in the family, practice of hand washing with soap after defecation and after cleaning child's stool by mothers were found to be significantly associated with lower occurrence of diarrhea in the children. However, mother's education did not show any significant influence in occurrence of diarrhea in children (Table 4).

Table 1. Distribution of under-5 Children according to Their Age and Nutrition Status and Occurrence of Diarrhea

Child Related Characteristics	No. of Children (n=486)		Diarrhea in 3 months (n=222)		
	N		N	Freq	%
Gender					
Male	287		129	244	44.95
Female	199		93	167	46.73
Age in months					
0.0-11	87		35	66	40.23
12-23	93		60	108	64.52
24-35	104		50	99	48.08
36-47	112		45	87	40.18
48-59	90		32	51	35.56
Nutrition Score:					
(Age-specific weight Z-score)					
<2SD	201		105	179	52.24
Median (Normal)	285		117	232	41.05

Table 2. Baseline Characteristics of Mothers (N=411) of Study Children and Occurrence of Diarrhea in 486 Children during Last Three Months

Mother of study children Characteristics	No. of Mothers (n=411) N(%)		No. of Children with diarrhea (n=222) N(%)	
Education				
Illiterate	102	(24.82)	47	(21.17)
Just literate	65	(15.82)	37	(16.67)
Primary	131	(31.87)	72	(32.43)
Secondary and above	113	(27.49)	66	(29.73)
Occupation				
Housewife	287	(69.83)	132	(59.46)
Working	124	(30.17)	90	(40.54)
Knowledge of use of ORS				
Yes	286	(34.79)	158	(71.17)
No	125	(65.21)	64	(28.83)
Hand washing after child's stool cleaning:				
Soap	118	(28.71)	62	(27.93)
Water	10	(2.43)	9	(4.05)
Soil	283	(68.86)	151	(68.02)
Home toilet present				
Yes	136	(33.09)	60	(27.03)
No	275	(66.91)	162	(72.97)
Hand washing after defecation				
Soap	111	(27.01)	48	(21.62)
Water	4	(0.97)	3	(1.35)
Soil	296	(72.02)	171	(77.03)

Table 3. Exclusive Breast Feeding for Six months (Total No. of Children over Six Months=437) and Complete Vaccination including Measles and DPT (No. of Children >11 Months=399) and Occurrence of Diarrhea

Exclusive Breast Feeding for 6 months (n=437, >6 months age)	No. of Children	Diarrhea Occurrence in 3 Months	P Value
Yes	287 (65.67%)	143 (49.8%)	0.409
No	150 (34.33%)	68 (45.3%)	
Complete vaccination including measles and DPT (n=399) (>11months age)			
Yes	165 (41.35%)	128 (77.5%)	0.000
No	234 (58.65%)	217 (92.7%)	

Table 4. Poisson Regression Analysis with Occurrence of Diarrhea as the Dependent Variable and Other Confounding Factors as Independent Variables (n=411 for Mother, n=486 for Children)

	Estimate	p Value	95% CI	
			Upper	Lower
Intercept	-1.318	0.000	-2.008	-0.734
Mother's education	0.026	0.547	-0.059	0.111
Mother's occupation	0.180	0.037*	0.011	0.348
Child's age	-0.083	0.036*	-0.161	-0.005
Z-score, child's nutrition (<2SD vs. median, normal)	0.084	0.015*	-0.172	0.228
Home toilet present in family (0=Yes,1=No)	0.245	0.016*	0.045	0.446
Hand washing practice by mothers after defecation	0.229	0.006**	0.046	0.372
Hand washing by mothers after child's stool cleaning	0.179	0.008**	0.028	0.323

*significant at 0.05, **significant at 0.01.

Discussion

This report highlighted high prevalence of diarrheal disease in under-five children in a prototype village in Sunderban region of West Bengal. Out of 486 children studied, diarrhea occurred in 45% of children during a period of previous three months without significant difference in sex distribution. Overall prevalence of diarrhea was reported to be 22.36%¹¹ in a recent population-based cross-sectional study conducted on 152 children under five years of age in the urban slums of Bankura, West Bengal. Another study carried out in 2004 in West Bengal reported that overall prevalence of diarrhea among under-five children varied from 26.4% to 37.0%.¹² Prevalence of diarrhea in the two weeks prior to the survey was found to be 19.8% of children aged 2-59 months (range: 4.4-30%) in a study carried out by UNICEF in all over India, in one district in each of 10 states. Diarrhea was also found to occur in 19.1% of children in Purulia district of West Bengal.¹³ Though we observed high prevalence of diarrhea during three months prior to the study, the data could not be compared with data available from literature as we considered a longer study period for collection of diarrhea data. However, we considered three months period as study period because we wanted to obtain larger data set to ascertain influence of various confounding factors, which are likely to have their effect

on occurrence of diarrhea. Three-month period is not considered to be long enough a period to vitiate data collection for recall bias.

In our study, child's age was significantly related with prevalence of diarrhea ($p < 0.05$), the prevalence was highest in the age group of 12th -23rd month. The prevalence progressively decreased with increasing age. Similar observation was made from a study carried out in under-five children in Kashmir (India) where it was reported that prevalence of diarrhea was highest in the age group of 6-11 months and was lowest among children aged 48-59 months.¹⁴

It was interesting that children of working mothers were found to have significantly less prevalence of diarrhea compared to those of housewives ($p < 0.05$). Maybe working mothers are more enlightened and take more care of their children. In regard to the hygienic behavior of mothers, hand washing with soap after defecation and hand washing after child's stool cleaning were found to have significantly less prevalence of diarrhea in their children ($p < 0.01$). Presence of home toilet in the family was found to be significantly associated with less prevalence of diarrhea compared to those who did not have toilets in their houses. District Level Household Survey to quantify the impact of access to improved sanitation on diarrheal morbidity for children under five

years of age in India found that access to improved sanitation reduced the risk of contracting diarrhea by 2.2 percentage points.¹⁵ In a study conducted near Kolkata, it was found that non-diarrheal families were more likely to have a sanitary latrine and have soap for ablution.¹⁶ Systematic reviews of the impact of sanitation on health have estimated a mean reduction of 32-36% in diarrheal incidences.¹⁷⁻¹⁹ Further systematic review also showed that washing hands with soap can reduce the risk of diarrheal diseases by 42-47%.^{20,21}

Several studies have shown the beneficial effects of breast-feeding in preventing morbidity and mortality from diarrhea in infants.²²⁻²⁵ However, in the present study exclusive breast feeding for six months by mothers was not found to be associated with decreased occurrence of diarrhea in the children. The reasons may be that other factors like poor personal hygiene along with adverse environmental and sanitary conditions played more important role in causing occurrence of diarrhea.

It is evident from the study that malnutrition (whether assessed by impaired weight or height for age) leads to increased frequency and duration of diarrheal illnesses, (with a 37% increase in frequency and a 73% increase in duration) accounting for a doubling of the diarrhea burden (days of diarrhea) in malnourished children.²⁶⁻²⁸ In the present study, under-nutrition (Z-score <2SD) was found to be present in 41.28% of under-five children and the incidence of diarrhea was significantly higher in these compared to others (p<0.05).

Measles and diarrhea appear to interact synergistically to increase mortality and result in irreversible effect of nutritional deprivation.²⁹ At the end of two rounds of immunization with measles at the end of two years, significant reduction was observed in mortality due to diarrhea and malnutrition in children (1-4 year old) in the study area in contrast to control area in a two-year longitudinal study in India.³⁰ In this study, more (92.7%) children had occurrence of diarrhea who were not fully vaccinated, while diarrhea occurred in less number (77.5%) of children who were fully vaccinated (p<0.001).

There are reports that the prevalence of diarrhea varies according to education of mothers, diarrhea being relatively high among children whose mothers are illiterate.³¹ In other studies, the findings suggest that the protective effect of maternal education on infant diarrhea varies according to the socioeconomic environment in which the mother lives: maternal education protects against infant diarrhea in the more economically and socially advantaged communities but

has no effect in the more disadvantaged communities.³² However we did not find any influence of education on occurrence of diarrhea in our study population.

Recent study done in Maharashtra showed that majority (90.7%) of women studied had knowledge of use of ORS for treatment of diarrhea.³³ Significant number of mothers (69.58%) in the current study also was found to have knowledge of use of ORS.

Conclusion

This paper is based on a study on diarrheal disease in children in a village in Sunderbans of South 24 Parganas District in West Bengal, a backward area which epitomizes abject poverty, deprivation, and acute struggle against geographical challenges. Majority of residents of the village were Muslims, with low income and poor education. The prevalence of diarrheal disease was found to be high in children below five years of age. Important contributing factors for such morbidity of children were found to be absence of toilets in households, non-use of soap for hand washing after defecation and after child's stool cleaning, absence of complete vaccination against measles and low nutritional status of children.

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Conflict of Interest: None

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