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MAGNITUDE, SPECTRUM AND PREDICTORS OF DIARRHOEA: EVIDENCE FROM RURAL NORTH INDIA

Community Medicine

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ABSTRACT

Child survival and their optimum growth and development have been major concerns in both developed and developing countries. Diarrhoea is the most common preventable cause of morbidity and mortality in under-five children. The study aimed to find the magnitude, spectrum and predictors of diarrhoea in under-five children. This community-based cross-sectional study was conducted in the community development block of rural area of Varanasi, India. This study was conducted on 217 under-five children meeting sample size requirements, selected through a multistage sampling procedure. Prevalence of diarrhea in the previous two weeks in under-five children was 35.9%. The number of episode per child was 1.08. Diarrhoea was watery in 69.4%, and blood and mucous were present in 22.4% cases. The logistic model identified higher adjusted odd's ratio for subjects without vitaminA supplementation (15.86;95%CI,4.22-59.66), from other caste categories (4.91; 95%CI,0.96-25.14), uncovered water storage (5.00;95%CI,1.69-14.82), unsatisfactory class of drinking water (16.89;95%CI 2.59-109.92) and in subjects with delayed complementary feeding (4.61 95%CI,1.20-17.65). One-third of the subjects had diarrhoea. Predictors of diarrhoea identified in this study call for focused attention for prevention of diarrhea.

KEYWORDS

Diarrhoea, Under-five children, Rural area, Immunization, VitaminA

INTRODUCTION

Child survival and their optimum growth and development have been major concerns in both developed and developing countries. Based on lessons learnt through the Millennium Development Goal(MDG's), the United Nations initiated Sustainable Development Goals to improve global child health. Sustainable Development Goal targets to end the epidemics of water-borne diseases and other infectious diseases by 2030 to achieve the SDG target 3.2 of ending preventable deaths of children under-five and of reducing under-five mortality to below 25 per 1,000 live births (WHO, 2015). World Health Organization(WHO) targets to decrease diarrhoea to less than 1 in 1000 by 2025 (GAPPD WHO,2013). Diarrhoeal disease is the second leading cause of deaths in children underfive years old and is responsible for killing around 525,000 children every year in the world (UNICEF,2009).

Although the disease burden observed is significantly high in low-income populations with poor access to safe water, sanitation, and urgent medical care. The acute infectious diarrhoea is also a common cause of outpatient visits and hospital admissions in high-income regions and is a significant health problem globally. Prevention and treatment of diarrhoea are challenging task because of pervasive infrastructural, political, and socioeconomic barriers, including access to safe water and sanitation, education, nutrition, and access to health care (Waznyet al.2013). An estimated 1.7 billion episodes of diarrhoea created health systems costs of about 7 billion US dollars. If the total bouts of diarrhea are translated into the number of events per child per year, it approximates to 2.9 episodes per child per year (Hutton G et al.,2004). In India, more than 2·3 million children die every year, and diarrhoeal diseases contribute about 334 000 of these deaths. Diarrhoea leading to 13% deaths,is the third most prevalent cause of death in under-five children, killing an estimated 300,000 children in India each year (Jayalakshmi et al, 2011).

National Family and Health Survey was done in 2015-16 shows the prevalence of diarrhoea of 9% in India as a whole whereas it is 15% in the state of Uttar Pradesh of India (IIPHS, 2017). Even though the mortality and morbidity among children under-5 years have declined, its proportion due to diarrheal diseases remains high.

Diarrhoea refers to an increase in frequency, fluidity or volume of the stool than the normal. It is the passage of three or more loose or watery stools within 24 hours or a decrease in the consistency of the stool from that which is typical for the patient (Degebasa et al., 2018). Based on clinical syndromediarrhoea can be classified as, acute watery diarrhea, dysentery, persistent or prolonged diarrhea and chronic diarrhea.

METHODS

This is observational, community-based cross-sectional study. Participants of the study were 0-59 months children. Taking the prevalence of diarrhoea as 15 % in Varanasi (District fact sheet Varanasi Uttar Pradesh NFHS 4) and the permissible level of error of 5 % (Absolute), the required sample size worked out to be 196. After adjusting for non-response of 10% the final sample size became **217**.
For the selection of study villages and sample Chiraigaon Community Development(CD) Block was selected from 8 CD Blocks of Varanasi district, India by simple random sampling.In the next step stratification of all villages of Chiraigaon was done on the basis of their distance from block headquarter (within 5 km, 5-10 km and >10 km).One village from each stratum was selected, and the selected communities were *Bariyasanpur, Pahadiya* and *Rajnahiya*. In the selected villages, a total enumeration of under-five children was done. This served as the sampling frame for the study, and the required number of study subjects were selected by adopting simple random sampling.

Ethical Approval :

This was obtained from the Ethical Committee of Banaras Hindu University, Varanasi India and consent was taken from parents.

Caregiver of children under study was interviewed with the help of predesigned and pretested proforma. Information for the occurrence of diarrhoea on the day of the visit or within the last 2 weeks from the day of the visit was noted. Information regarding sociodemographic status and environmental characteristics including water insanitation facility, nature of diarrhoea and its severity was collected.

Statistical Analysis

Data was entered in personal computer and was analyzed using Statistical package for social science software version23. For identifying associates of diarrhoea chi square test was used and p value of <0.05 was considered as significant .In order to pinpoint predictors of diarrhoea Logistic regression analysis was applied .Adjusted odd's ratio (AOR) and 95% confidence interval were computed for inferential purpose.

RESULTS

Magnitude And Spectrum Of Diarrhoea

Out of 217 children, 78(35.9%) had diarrhoea in the previous 2 weeks. Thus the period prevalence of diarrhoeain under-five children was 35.9%. Period prevalence of diarrhoea for male and female children was 37.2 and 34.4%, respectively [Table1]. Frequency of stool in diarrhoeal episodes were 3-4 in 35.3%, 5-6 in 38.8% and ≥ 7 in 25.9%

subjects. There were 78 children with diarrhoea in a period of 2 weeks, and a total number of diarrhoeal episodes were 85. Thus the number of episodes per child 1.08.

Table 1: Gender Wise Period Prevalence (recall<2weeks) Of Diarrhoea.

Gender	Diarrhoea status				Total	
	Present		Absent		No.	%
	N	%	N	%		
Male	45	37.2	76	62.8	121	100
Female	33	34.4	63	65.6	96	100
Total	**78**	**35.9**	**139**	**64.1**	**217**	**100**
χ^2 =0.66 df = 1 p>.05						

Out of 85 diarrhoeal episodes, 69.4% were watery whereas blood or/and mucous were present in 19(22.4%). Seven(8.2%) diarrhoeal episodes had increased in frequency of stools without any change in consistency of stool [Figure 1]

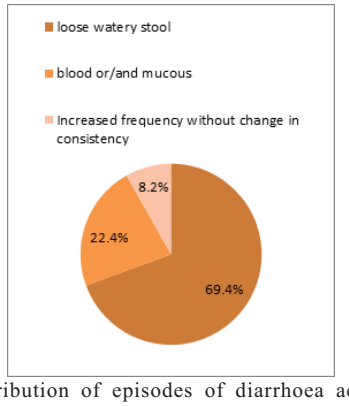

Figure1: Distribution of episodes of diarrhoea according to consistency of stool:

Associates Of Diarrhoea

There existed a significant association between the age of the subjects and diarrhoea (P<0.05). Period prevalence of diarrhoea was maximum (47.8%) in the age group 0-12 months and least in 49-59 months (18.2%). As much as 45.0%, SC/ST. 28.4% OBC and 56.5% subjects from other caste category had diarrhoea in the previous 2 weeks (P<0.01). There existed significant association between diarrhoea and the highest education in the family (P<0.05). This was maximum (66.7%) in the less educated group and least (10.0%) in subjects having the highest education in the family as under-graduate and post-graduate, respectively. Period prevalence of diarrhoea was significantly (P<0.01) more where handwashing before feeding was not practised (56.3%) than with the practice of handwashing (27.5%). There existed significant association between diarrhoea and type of material used for handwashing (P<0.01). Diarrhoea was least (15.0%) when the article for handwashing was soap and water. There existed significant association between diarrhoea in study subjects and the presence of animal shed in their houses (P<0.05). Diarrhoea was to the extent of 25.0% in houses with animal shed and 47.8% in homes without an animal shed. Diarrhoea was 25.2% in subjects where child's stool was disposed in latrine whereas this was 56.8% if the child's stool was left outside (P<0.01). There existed a significant (P<0.01) association between diarrhoea and complementary feeding status of the child. Diarrhoea was least (22.9%) when supplementary feeding was started at 6 months. The extent of diarrhoea was 46.8% in bottle-fed children, and this was significantly (P<0.05) less in subjects without bottle feeding (31.6%). As much as 47.1% and 55.3% subjects without measles vaccination and 23.5% with vitamin A supplementation had diarrhoea; contrary to this extent of diarrhoea was 32.5% in the subjects with measles vaccination (P>0.05) and Vitamin A supplementation (P<0.01). Diarrhoea was to the extent of 60.0% where the storage of water was done in uncovered vessels. Contrary to this, it was significantly (P<0.01) less where the storage of water was done in covered containers (28.2%). As much as 28.3%, 51.4% and 40.0% subjects classified as normal, Grade I and Grade II based on IAP classification using weight for age as parameter had diarrhoea, respectively. All the 7 subjects in Grade III had diarrhoea (P<0.01). There existed an increasing trend of diarrhoea with declining nutritional status based on WHO Z score criteria. Diarrhoea was least (25.8%) in subjects weighing age normal to -1 SD whereas this was 33.8%, 50.0% and 54.3% in subjects having mild, moderate and severe undernutrition, respectively. There existed a significant(P<0.01) association between diarrhoea and crossing over the status of study subjects.[Table2]

Table 2 : Associates Of Diarrhoea

Particulars		Diarrhoea status				Total		Test for significance		
		Present		Absent				χ^2	df	P value
		No.	%	No.	%	No.	%			
Age (months)	0-12	22	47.8	24	52.2	46	100	12.71	4	0.013
	13-24	29	43.9	37	56.1	66	100			
	25-36	11	21.2	41	78.8	52	100			
	37-48	12	38.7	19	61.3	31	100			
	>49	14	18.2	18	81.8	22	100			
Birth Order	1	26	31.7	56	68.3	82	100	7.01	4	0.135
	2	26	31.3	57	68.7	83	100			
	3	18	46.2	21	53.8	39	100			
	4	7	63.6	4	36.4	11	100			
	5	1	50.0	1	50.0	2	100			
Caste	SC/ST	27	45.0	33	55.0	60	100	9.72	2	0.008
	OBC	38	28.4	96	71.6	134	100			
	Other	13	56.5	10	43.5	23	100			
Type of family	Nuclear	56	38.1	91	61.9	147	100	3.22	2	0.119
	Joint	22	33.8	43	66.2	65	100			
	3 Generation	0	0	5	100	5	100			
	3-6	24	32.0	51	68.0	75	100			
	6-9	34	39.5	52	60.5	86	100			
	>9	14	38.9	22	61.1	36	100			
Highest education of family	Illiterate	15	38.5	24	61.5	39	100	12.02	5	0.034
	1-9 Class	9	20.5	35	79.5	44	100			
	High School	18	38.3	29	61.7	47	100			
	Intermediate	31	43.7	40	56.3	71	100			
	Undergraduate	4	66.7	2	33.3	6	100			
	Postgraduate	1	10.0	9	90.0	10	100			

Mother's education	Illiterate	21	37.5	35	62.5	56	100	7.37	5	0.194
	1-9 Class	24	41.4	34	58.6	58	100			
	High School	20	43.5	26	56.5	46	100			
	Intermediate	8	29.6	19	70.4	27	100			
	Undergraduate	5	17.2	24	82.8	29	100			
	Postgraduate	0	0.0	1	100	1	100			
Father's education	Illiterate	17	43.6	22	56.4	39	100	7.48	5	0.187
	1-9 Class	16	30.8	36	69.2	52	100			
	High School	16	30.2	37	69.8	53	100			
	Intermediate	19	47.5	21	52.5	40	100			
	Undergraduate	10	35.7	18	64.3	28	100			
	Postgraduate	0	0.0	5	100	5	100			
Mother's occupation	Home maker	67	34.7	126	65.3	193	100	5.95	4	0.203
	Govt. Employee	0	0.0	1	100	1	100			
	Private gainful work	0	0.0	2	100	2	100			
	Live stock and farm related	8	44.4	10	55.6	18	100			
	Skilled worker	2	100	0	0.0	2	100			
Father's occupation	Govt. Employee	6	31.6	13	68.4	19	100	5.76	5	0.446
	Business/ Merchant	11	44.0	14	56.0	25	100			
	Farmer	11	42.3	15	57.7	26	100			
	Self Emp.	21	32.3	44	67.7	65	100			
	Live stock	10	25.6	29	74.4	39	100			
	Skilled worker & Unskilled	19	44.2	24	55.8	43	100			
Registration of child in Anganwadi	Yes	67	35.8	120	64.2	187	100	0.01	1	0.929
	No	11	36.7	86.3	63.3	30	100			
Hand washing before feeding	Yes	38	27.5	100	72.5	138	100	13.32	2	0.001
	No	27	56.3	21	43.8	48	100			
	Sometimes	13	41.9	18	58.1	31	100			
Material used for hand washing.	Water only	43	38.7	68	61.3	111	100	13.68	3	0.003
	Mud & water	7	18.9	30	81.1	37	100			
	Soap & water	3	15.0	17	85.0	20	100			
	No Hand- washing	25	51.0	24	49.0	49	100			
Light in child room	Present	39	37.9	64	62.1	103	100	0.31	1	0.575
	Absent	39	34.2	75	65.8	114	100			
Cross ventilation in child living room	Present	37	35.9	66	64.1	103	100	0.00	1	0.995
	Absent	41	36.0	73	64.0	114	100			
Type of house	Kuccha	15	37.5	25	62.5	40	100	1.23	2	0.541
	SmiPuckka	33	39.8	50	60.2	83	100			
	Puckka	30	31.9	64	68.1	94	100			
Animal shed	Present	14	25.0	42	75.0	56	100	3.35	2	0.025
	Absent	33	47.8	36	52.2	69	100			
	Not applicable	31	33.7	61	66.3	92	100			
Main source of drinking water	Own handpump	31	30.4	71	69.6	102	100	7.29	4	0.122
	Other/public handpump	35	41.7	49	58.3	84	100			
	Own well	1	11.1	8	88.9	9	100			
	Other/public well	2	66.7	1	33.3	3	100			
	Pipe water supply	9	47.4	10	52.6	19	100			
Latrine available	Yes	68	35.2	125	64.8	193	100	0.38	1	0.536
	No	41.7	14	58.3	24	100				
Child stool disposal in	Latrine	36	25.2	107	74.8	143	100	21.12	1	0.000
	Outside Latrine	42	56.8	32	43.2	74	100			
Child breastfeeding currently	Yes	39	38.2	63	61.8	102	100	0.44	1	0.508
	No	39	33.9	76	66.1	115	100			
Complementary feeding started	Not started	7	53.8	6	46.2	13	100	11.60	1	0.009
	Before 6 mths	21	33.3	42	66.7	63	100			
	After 6 mths	34	47.9	37	52.1	71	100			
	At 6 mths	16	22.9	54	77.1	70	100			
Deworming done for child in last 6 months	Yes	18	29.5	43	70.5	61	100	5.49	2	0.064
	No	42	34.4	80	65.6	122	100			
	Not applicable	18	52.9	16	47.1	34	100			
Bottle feeding	Yes	29	46.8	33	53.2	62	100	4.42	1	0.035

	No	49	31.6	106	68.4	155	100			
Who feeds the child	Father	3	50	3	50	6	100	5.11	4	0.276
	Mother	39	36.1	69	63.9	108	100			
	Elder sibling	1	16.7	5	83.3	6	100			
	Child feeds on own	33	34.7	62	65.3	95	100			
	Other family member	2	100	0	0.0	2	100			
Immunization card	Yes	77	36.8	132	63.2	209	100	1.99	1	0.159
	No	1	12.5	7	87.5	8	100			
Measles vaccination	Yes	54	32.5	112	67.5	166	100	3.58	1	0.059
	No	24	47.1	27	52.9	51	100			
Child given Vitamin A	Yes	31	23.5	101	76.5	132	100	22.75	1	0.000
	No	47	55.3	38	44.7	85	100			
Number of doses of Vitamin A	0	47	55.3	38	44.7	85	100	23.85	4	0.000
	1	24	26.1	68	73.9	92	100			
	2	6	17.1	29	82.9	35	100			
	3	1	25.0	3	75.0	4	100			
	>3	0	0	1	100	1	100			
Child vaccinated with rotavirus	Yes	5	27.8	13	72.7	18	100	0.57	1	0.000
	No	73	36.7	126	63.3	199	100			
Storage of water	Covered	40	28.2	102	71.8	142	100	18.59	2	0.000
	Uncovered	33	60.0	22	40.0	55	100			
	Not applicable	5	25.0	15	75.0	20	100			
IAP classification	Normal (>80%)	41	28.3	104	71.7	145	100	20.03	3	0.000
	Grade 1 (71-80%)	18	51.4	17	48.6	35	100			
	Grade 2 (61-70%)	12	40.0	18	60.0	30	100			
	Grade 3 (51-60%)	7	100	0	0.0	7	100			
WHO Classification	Normal to -1 SD	24	25.8	69	74.2	93	100	11.95	3	0.008
	-1 to -2SD (mild)	20	33.8	39	66.1	59	100			
	-2 to -3SD (moderate)	15	50.0	15	50.0	30	100			
	<-3SD (severe)	19	54.3	16	45.7	35	100			
Cross over	Not applicable Yes No Equal	17 21 37 3	54.8 28.8 44.0 10.3	14 52 47 26	45.2 71.2 56.0 89.7	31 73 84 29	100 100 100 100	17.09	3	.001
Height for age	No stunting Grade 1 Grade 2 Grade 3	18 24 25 11	27.3 34.8 43.1 45.8	48 45 33 13	72.7 65.2 56.9 54.2	66 69 58 24	100 100 100 100	4.50	3	.212
Complementaryfeeding										
1.still feeding	0.401	1.573	.799	.670	.031	14.61				
2.Before 6 months	0.343	.783	.662	.710	.153	3.30				
3.After 6 months	1.529	.685	.026	4.613	1.205	17.65				
4. At 6 months	-	-	-	-	-	-				

Predictors Of Diarrhoea

The significant influence of age, religion, highest education of family, hand washing before feeding, the material used for handwashing, animal shed,crossing over and a class of water on diarrhoea in univariate analysis got eliminated on the logistic model. Taking OBC as reference AOR for diarrhoea in other caste category and SC/ ST were 4.91 (95% CI, 0.96-25.14) and 2.66 (95% CI 0.76-9.31). AOR for diarrhoea was significantly more with subjects without Vitamin A supplementation(AOR15.86; 95%CI4.22-59.66). If we take covered water storage as a reference, it was observed that AOR for diarrhoea where unsafe water storage practice was there was 5.00 (95%CI,1.69-14.82.In contrast to subjects with complementary feeding 6months, AOR was significantly more(AOR4.61,95%CI1.20-17.65) for subjects with supplementary feeding after 6 months[Table 3].

Table 3 : Logistic Regression For Diarrhoea:

Particular	Estimation of B	SE of B	P value	AOR	95% CI	
					Lower	Upper
Caste Other SC/ST OBC	 1.591 .979 -	 .833 .639 -	 .056 .126 -	 4.909 2.661 -	 .958 .760	 25.14 9.31
Vitamin A Absent Present	 2.764 -	 .676 -	 .000 -	 15.861 -	 4.217 -	 59.66 -
Water storage Uncovered Covered	 1.610 -	 .554 -	 .004 -	 5.004 -	 1.689 -	 14.82 -

DISCUSSION:

This study primarily focused on the extent, spectrum and predictors of diarrhoea in rural under-five children. As far as national data is considered nearly four out, ten persons in India are OBC. According to this study, six out of ten subjects were belonging to this caste category. The scenario of higher education in the study area has been low,which has been revealed by the fact that higher education of the family as a post-graduate prevailed in one out of twenty subjects. Measurement of poverty had been a burning issue in India for several decades.

As per the National Health and Family Survey 4 (IIPS, 2017), nine out of ten households had improved water source, and 7 out of 20 had improved sanitary facilities. Environment-related information in the study area was satisfactory on several indicators. However, some pertinent issues are [a]existence of open field defecation in 1 out of 9 subjects, [b]outside disposal of child's stool in 1 outof 3cases [c]exposure to smoke from firewood in half of the cases [d]unfavourable storage facilities of drinking water etc. Unsanitary environmental conditions put children at increased risk of diarrhea, including environment enteropathy (George 2016). Those children

develop diarrhea where faeces remain in open and children either crawling or walking and put in the mouth dirt or other contaminated objects while playing or eating.

Several adversities in the feeding of child is seen in the study. Exclusive breastfeeding has been less than the situation reported in NFHS 4(IPPS,2015-16). Initiation of complementary feed was not satisfactory. Although regular hand washing before feeding has been practised in 13 out of 20 subjects, soap and water was used in 2 out of 10 cases only.

Administration of VitaminA to the subjects have been similar to NFHS4 reports. However, measles coverage was less than the overall value for the country as a whole (IIPS, 2017). Although enrolment of subjects to Anganwadicentres had been satisfactory, there was the inadequate distribution of *Poshaahar* in last months.

Recognizing diarrhea as a considerable problem on a child's survival and optimum growth and development, significant inputs needed to create awareness andimprove access of safewater among the rural population. However, the results of this study reflect that diarrhea is a significant problem in <5 children of rural Varanasi. This is substantiated by the fact that 2 out of 10 and 7 out of 20 children had diarrhea at the time of the survey and in the previous 2 weeks. Several workers within (Rajegowda et al, 2018) and outside India(Brown, 2013, Siziya, 2013) have reported lower figures than the present study. However, some studies have reported a higher prevalence of diarrhea in comparison to the current study (Degebasa 2018). This variation in the occurrence of diarrhea maybe due to difference in study design, time of survey and access to preventive and promotive services as well as geographical and climatic content. The practise of exclusive breastfeeding, bottle feeding, early and late initiation of complementary feeding and unhygienic practices during feeding of the child maybe responsible for a higher presence of diarrhea in the younger age group. In this study, nearly half of the subjects in the age group of 0-12 months had diarrhea in the previous 2 weeks, whereas the period prevalence of diarrhoea was least in children in 5th year of life. It is interesting to note that gender-wise differences in the extent of diarrhea doesn't prevail in the study area. In one out of 10 episodes frequency of diarrhea was more than 7.

Nutritional status of study subjects was assessed based on Indian academy of Pediatrics classification (IAP Classification) and Zscore criteria using weight for age as a parameter .Nearly two-third of subjects were characterized as normal by IAP Classification whereas 9 out of 20 subjects were considered as normal on the basis of WHO Zscore classification. In the event of diarrhea a child's weight may decrease due to loss of electrolyte and water.Besides this, a decrease in the frequency of breastfeeding and a reduction in top feeding and complementary feeding are responsible for the decline in the nutritional status of the subjects. Diarrhea is a catabolic process, and therefore, nutritional requirements will be more during and after an episode of diarrhea. Inspite of the existence of programme, effective management of diarrhoea has been far from being satisfactory in the study area.

CONCLUSION

One-third of subjects had diarrhoea. Predictors of diarrhoea (viz.age, caste, handwashing before feeding , material used for hand washing , animal shed, child stool disposed outside latrine , complementary feeding started , bottle feeding , Viamin A , storage for water , weight for age , crossover and class of water) identified in the study call for focused attention for prevention of diarrhoea.

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