Original Article

A Longitudinal Study of Acute Diarrhoeal Diseases Among Children Under Five Years in an Urban Area of Goa

Apika K Sawant, Nitin Y Dhupdale
Department of Community Medicine, Goa Medical College, Bambolim Goa, Goa, India

Abstract

Background: Acute diarrhoeal diseases (ADD) account for a large number of preventable deaths in India, especially in children less than five years who are more at risk than adults with respect to the degree of dehydration and complications. (1) To measure the incidence of ADD among children under 5 years; (2) Determine risk factors associated among children; (3) Study treatment-seeking behaviour of their mothers. Community-based, prospective, longitudinal study conducted in an urban area of Goa. **Material and Methods:** 250 children enrolled in the study with their mothers by stratified random sampling technique, conducted house-to-house visits every three months and mothers were interviewed with pre-tested semi-structured questionnaire. The duration of study was one year from January to December 2018. Data entered using EpiData Entry Client®, Analysed using SPSS® software version 22. Student's t-tests and Chi-square tests were used. **Results:** The incidence of ADD was 0.124 episodes/child/year. Significant association was noted between ADD in children and certain socio-demographic factors like child's sex, birth order, birth weight, immunization status, malnutrition, mother's age group, mother's education, and mothers' hygiene practices. **Conclusions:** Efforts should be made to educate all mothers about the seeking timely treatment, awareness about home-based management and their types, awareness of ORS, zinc, importance of hygienic practices like hand washing for mother and child.

Keywords: Incidence of ADD, risk factors, treatment-seeking behaviour, under five children

Introduction

More than 160 years have passed since Sir John Snow discovered that cholera spread through contaminated water which led to diarrhoea and severe dehydration resulting in many deaths.[1] Diarrhoea is defined as "the passage of three or more loose or liquid stools per day or more frequently than is normal for the individual."[2] Acute watery diarrhoea is "characterized by sudden onset of watery, loose stools, without visible blood, lasting less than two weeks."[2] Dysentery "is defined as diarrhoea containing blood and mucus in faeces."[3] Chronic diarrhoea "refers to diarrhoea which is long-lasting and is mainly due to non-infectious causes."[3]

Diarrhoea remains the third most common cause of death among children below five years and is responsible for killing 300000 children in India every year.[4,5] The National Family Health Survey (NFHS)-4 reported the prevalence of diarrhoea in the state of Goa as 3.8% (3% in urban areas and 5.2% in rural areas of Goa).[6] As per NFHS-5 in the year 2019–2020 reported the prevalence of diarrhoea in children as 3.2% (2.1% in urban areas and 5% in rural areas).[7]

Access this article online

Quick Response Code:

Website: www.ijcm.org.in

DOI: 10.4103/ijcm.ijcm_382_22

The majority of diarrhoea causes some dehydration (mild-moderate) and can be managed at home with home-based fluids. Since the mother is usually the primary caregiver to the child, her knowledge regarding spread of diarrhoea, feeding practices during diarrhoea, health-seeking behaviour is of utmost importance.

We conducted this study to supplement the epidemiological data on acute diarrhoeal diseases (ADD) in an urban area of Goa. As per our literature search, there are very few studies published on diarrhoea in urban areas. There are very few studies published on incidences of diarrhoeal disease in children in India and none in Goa. Hence, we undertook this study to measure the incidence of ADD and associated risk factors, health-seeking behaviours of mothers in Santa Cruz.

Address for correspondence: Dr. Apika K Sawant, Department of Community Medicine, Goa Medical College, Bambolim, Goa, India.
E-mail: sawantapika@gmail.com

How to cite this article: Sawant AK, Dhupdale NY. A longitudinal study of acute diarrhoeal diseases among children under five years in an Urban Area of Goa. Indian J Community Med 2024;49:593-8.

Received: 06-05-22, **Accepted:** 09-11-23, **Published:** 09-07-24

Aims and Objectives

(1) To measure the incidence of ADD among children less than 5 years.
(2) To determine the risk factors associated among children under five years.
(3) To study the health-seeking behaviour of their mothers.

Methodology

This study was a community-based prospective longitudinal study to estimate the incidence of ADD. We conducted this study in an urban area of Santa Cruz which is a field practice area under the Department of Community Medicine of Goa Medical College at Bambolim in Goa. The ethical clearance of the study was obtained from the Institutional Ethics Committee (IEC) of Goa Medical College (dated: 18/11/2017). Informed consent was taken from all the mothers.

The following criteria were used to enrol children less than five years old along with their mothers residing in Santa Cruz for previous twelve months. The children under five years who were either residents or migrants and gave consent were enrolled.

The mother who had children with ongoing diarrhoea, language barriers, and severely sick children were excluded from the study. The children less than five years' old who had diarrhoea for more than 14 days (chronic diarrhoea), GI anomalies, congenital errors, and absorption disorders were also excluded. Stratified sampling technique was employed for the selection of study participants using the following formula[8]:

$$N = [Z_{1-\alpha/2} / E]^2,$$

where N is the sample size, $Z_{1-\alpha/2}$ is the standard Z score value of 1.96 at 95% confidence level, is the allowable error which was arbitrarily selected as 13%. The total population of Santa Cruz was 14077.[9] The percentage of under five years children in the area was 13.5%.[10] The estimated sample size calculated was 225 which was rounded to 250 participants. The data was collected for a period of one year, i.e., January to December of 2018.

We collected data by using a designed study proforma which was tested on a pilot study. We modified the proforma based on the pilot study results. We used this study proforma to collect data by interviewing the mothers on a quarterly basis. The child and mother pairs were selected by a stratified sampling, and every second house was selected for the enrolment. From every selected house, we selected one child and mother pair. The anthropometric tools like weighing machine, stadiometer, infantometer, and growth charts were used for the measurement of parameters.

We followed up the child and mother pair for the occurrence of diarrhoea every three months, and we also followed them every month over the phone for any admissions to a hospital.

A list of children under five years old was obtained from the Anganwadi worker, which served as a sampling frame. There are 12 wards in Santa Cruz area. Each ward was considered as one stratum, and from each stratum, every second house was selected. Every attempt was made to include the selected mother and child pair. However, even after two attempts if the family was not contactable then next house was selected. Following study variables were assessed, namely age, gender, education status of the mother, socio-economic status (SES), per capita income, number of diarrhoeal episodes in child, frequency, feeding practices, cooking practices, weaning history, immunization history, hygiene practices, knowledge about oral rehydration solution (ORS), home-based fluids. Physical examination of the child comprised of weight, height, expected weight, expected height, mid-arm circumference (MAC), examination of respiratory system, cardiovascular system, and abdominal examination.

Data was entered using EpiData ClientEntry® and analysed using SPSS® software version 22. The incidence rate along with 95% confidence interval (CI) was calculated. The statistical tests of significance used were Student's t-tests and Chi-square test. *P* value <0.05 was considered as statistically significant.

Results

The study participants consisted of 250 children aged less than 5 years along with their mothers from various heterogeneous groups such as religion, education status, income, residents, and migrants. There were 52.8% male and 47.2% female children included.

Socio-demographic profile of children

Almost 22.4% children belonged to 6–14 and 23–31 months of age. About 16% were between 32 and 40, and 14.8% were between 41 and 48 months of age. The mean age of children was found to be 28.26 ± 15.35 months. Majority (54%) were first-order born children, 36% were second-order born children, and 10% were third-order born children. Majority (49.2%) of children belonged to SES class 3, followed by 20.8% belonged to SES class 2, and 12% belonged to class 4. Majority of children (70%) belonged to nuclear family, 22.4% children belonged to joint families, and 7.6% children belonged to three generation family.

Socio-demographic factors of mothers

The mean age of the mothers was 28.57 ± 4.704 years. The mother's age ranged from 20 to 43 years. Also, majority of the mothers (32%) were in age group of 30–32 years and 29.6% mothers were equal to or less than 25 years. Majority of the mothers (66.8%) were practising Hindus followed by 24% Christians, 6.4% Muslims, and 2.8% others.

Majority of the mothers (35.6%) had completed their high school education while 18.8% had completed graduation. Only 2.8% of the mothers had done post-graduation studies while 8% of the mothers were illiterate. With regard to employment,

it was observed that 76% of the women were homemakers while 24% were working mothers.

Out of 250 children enrolled in this study, 31 children developed ADD during the follow-up period of 1 year, and there were total of 38 episodes of ADD. The present study showed that the incidence of ADD among children was 0.124 episodes/child/year (95% CI: 0.102, 0.146). The attack rate was 15.2% (95% CI: 12.9, 17.4), and cumulative incidence was 124 episodes/1000 children/year (95% CI: 123.95, 124.04). A total of four house visits were conducted during the study period of one year. The visits were in the month of January 2018 (ten ADD cases), April 2018 (seven ADD cases), September 2018 (twelve ADD cases), and December 2018 (ten ADD cases).

Table 1: Incidence rate of acute diarrhoeal diseases (ADD)

Sr. No	Magnitude of Diarrhoea	Magnitude	95% CI
1.	Incidence Rate	0.124	0.102-0.146
2.	Attack Rate (in percent)	15.2%	12.9-17.4
3.	Cumulative Incidence (per 1000 children per year)	124	123.95-124.04

Risk factors associated with ADD among children under study

The mothers of children with ADD belonged to mean age 26.77 ± 4.917 years while mothers of children without ADD had mean age of 28.83 ± 4.628 years. The occurrence of ADD was more among children with young mothers. The association between mother's age and occurrence of ADD in child was found to be statistically significant. It was also observed that the children whose mothers mean age was 28.83 ± 4.628 years had no ADD (95% CI: 28.21, 29.44), whereas the children whose mothers had mean age of 27.80 ± 4.916 years had one

Table 2: Various risk factors influencing diarrhoea

Risk factors	Diarrhoea (%)	No Diarrhoea (%)	Total (%)	Statistical analysis			RR	Confidence interval
				Chi-square				
				X^2	df	*P*		
1. Sex of the child								
Female	20 (16.9)	98 (83.1)	118 (100)	4.258	1	0.050	2.034	1.018-4.065
Male	11 (8.3)	121 (91.7)	132 (100)					
2. Birth order of child								
Second/Third born	22 (19.13)	93 (80.86)	115 (100)	8.881	1	0.0050	2.870	1.377-5.982
First born	9 (6.7)	126 (93.3)	135 (100)					
3. Immunization status								
Incompletely immunized	14 (60.9)	9 (39.1)	23 (100)	54.78	1	0.001	8.128	4.631-14.265
Fully immunized	17 (7.5)	210 (92.5)	227 (100)					
4. Birth weight								
<2.5 kg	13 (30.2)	30 (69.8)	43 (100)	15.203	1	0.001	3.477	1.846-6.549
≥2.5 kg	18 (8.7)	189 (91.3)	207 (100)					
5. Exclusive breastfeeding								
<6 months	9 (23.7)	29 (76.3)	38 (100)	5.253	1	0.0250	2.282	1.140-4.570
≥6 months	22 (10.4)	190 (89.6)	212 (100)					
6. Weaning								
Before 6 months	11 (29.7)	26 (70.3)	37 (100)	12.007	1	0.001	3.166	1.657-6.051
After 6 months	20 (9.38)	193 (90.61)	213 (100)					

Table 3: Various risk factors influencing ADD

Risk factors	Diarrhoea (%)	No Diarrhoea (%)	Total (%)	Statistical analysis			RR	Confidence interval
				X^2	Df	*P*		
1. Malnutrition								
Malnutrition present	17 (34.69)	32 (65.30)	49 (100)					
Malnutrition absent	14 (7)	187 (93)	201 (100)	27.88	1	0.001	4.981	2.640-9.397
2. Mother washes hands before feeding the child								
Sometimes	16 (29.62)	38 (70.37)	54 (100)	18.82	1	0.001	3.872	2.048-7.319
Always	15 (7.7)	181 (92.3)	196 (100)					
3. Mother washing child's hands with soap								
Sometimes	14 (31.81)	30 (68.18)	44 (100)	19.235	1	0.001	3.85	2.058-7.225
Always	17 (8.3)	189 (91.7)	206 (100)					

Table 4: Health-seeking behaviour of mothers

Variables	Responses	N	%
1. Mother's awareness of ORS	Aware of ORS	175	70
	Not aware of ORS	75	30
2. Whether mother ever used of ORS for child	Used ORS	118	47
	Not used ORS	132	53
3. Mother's awareness of zinc	Aware of zinc	84	33.6
	Not aware of zinc	166	66.4
4. Mother's awareness of home-based fluids	Sugar salt solution	166	66.4
	Dal water/rice water	41	16.4
	Vegetable soup	11	4.4
	Coconut water	12	4.8
	Others	4	1.6
	Don't know	16	6.4
5. Whether mother washes hands before feeding child	Sometimes	53	21.2
	Always	193	78.4
	Never	1	0.4
6. Whether mother cleans child's hands with soap and water regularly	Sometimes	40	16
	Always	206	82.4
	Never	4	1.6

episode of ADD (95% CI: 25.77, 29.83) and children whose mothers had mean age of 22.50 ± 1.378 years had more than one episode (95% CI: 21.05, 23.83). Our study showed that the children of younger mothers were more likely to develop multiple episodes of ADD, and this association was found to be statistically significant.

The children who had diarrhoea were in the mean age group of 26.48 ± 15.319 months, and the children without diarrhoea were in the age group of 28.51 ± 15.375 months. However, this association was found to be statistically insignificant. There was no significant association observed between child's age and number of diarrhoeal episodes.

Out of 250 mothers studied, 24% were working and 76% were housewives. There was no association found between employment of mother and diarrhoea occurrence in child. Majority of the children belonged to SES class three followed by SES class two. It was observed that majority of children belonging to SES class five had diarrhoea followed by class four and class three. The association between SES and diarrhoea occurrence was found to be statistically significant. ADD cases were significantly higher among children of mothers who were illiterate or had studied up-to preschool.

Majority of the children in our study belonged to nuclear family (70%) followed by joint (22.4%) and three generation family (7.6%). Children belonging to nuclear family had diarrhoea (8.8%), followed by joint family (2.8%), and three generation family (0.8%). No statistical association was found between type of family occurrence of ADD. A significant association was observed between child's immunization status and occurrence of ADD as well as number of episodes of ADD.

Almost 96.77% of the children with diarrhoea were treated with ORS and home-based fluids, whereas 3.23% children needed admission to a hospital due to severe diarrhoea. They were administered IV fluids (including antibiotics) and ORS. There were no deaths reported due to severe dehydration. Almost, 80.64% of the children received treatment from a qualified doctor (government/private) while for the rest of the children (18.7%), treatment was given by others like nurses, pharmacists, ANM, parents/relatives, and neighbours. Out of 250 children who participated in the study, 38% of the children were not dewormed. This study showed that almost all (98%) mothers were willing to take their child to a doctor for the treatment of diarrhoea. Only 2% were hesitant to visit the doctor.

Discussion

In our study, the incidence of ADD [Table 1] among children was found to be 0.124 episodes/child/year (95% CI: 0.102, 0.146). This incidence of ADD was much less as compared to other studies. This may be due to the availability of improved drinking water, availability of sanitary latrines, high literacy rate among mothers, hygienic practices, and awareness about prevention of diarrhoea among mothers. In a similar study by Kumar and Borkar,[11] incidence rate was 0.65 episodes/child/year, the cumulative incidence rate was 487.7/1000 children/year, and attack rate was 63.5%. However, this study was conducted among 0–6 years old children.

A similar study in Pondicherry (1–4 years children) found incidence of 1 episode/child/year.[5]

Another study among children of refugee camp and fishermen community found incidence rate was 0.5 episodes/child/year.[12] In our study, the occurrence of diarrhoea was noted among children of young mothers, which might be because of lack of knowledge in young mothers. Similar finding was noted a study conducted in Kenya.[13] Majority of children belonging to SES class 5 had diarrhoea followed by class 4 and class 3 which was similar finding to another study showed that the poorest family had higher prevalence of diarrhoea.[13,14]

Our study showed that ADD cases were significantly higher among children of mothers who were illiterate or had studied up-to preschool. This may be because education increases the awareness of the mother related to hygiene and importance of sanitation which overall improves the family's health. Hence, the education of mother had a significant association with occurrence of ADD. Similar findings were reported by a study done in Kenya[13] and Bolivia.[15] Female children were found to be twice at risk to develop diarrhoea compared to male children, which could be because of neglect of female children in some ethnic groups, which deprives them access to healthcare facilities. Gupta *et al*.[15] found higher prevalence among female children than male children in West Bengal. A Meriton Stanly *et al*.[16] conducted a study in a rural community in south India and found higher prevalence of acute diarrhoea among females. This study showed more cases [Table 2] of diarrhoea among children belonging to higher birth order, i.e., third birth order (24%) followed by second birth order (17.8%), and least episodes were seen

in first-born children (6.7%). This may be because, as the birth order increases the care towards the child decreases as mother and other family members may be preoccupied with other children. A study done in Andhra Pradesh by Rajegowda *et al*.[17] reported similar findings.

The relative risk of ADD was found to be eight times more in children who were partially immunized compared to completely immunized children (95% CI: 4.631,14.265), which may be due to the protective effects of vaccination like measles vaccine and rotavirus vaccine. Similar findings were reported by Meriton Stanly *et al*.[16]

Diarrhoea cases were found to be more among children whose birth weight was <2.5 kg, [Table 2] i.e., 30.2%. Thus, a significant association was found between child's birth weight and ADD. A study in central India also reported similar findings.[17]

The significant association was also found between ADD and breast feeding exclusively for six months and weaning [Table 2]. Early weaning in fact showed three times higher risk of ADD (95% CI: 1.657, 6.051). Similar findings were reported by Ittiravivongs *et al*.[18] and Ogbo *et al*.[19], respectively. Early weaning may expose the child towards contaminated food which can result in diarrhoea.

It was observed that 14% children and 5.6% children were having grade 1 and grade 2 malnutrition respectively as per IAP classification. The risk of ADD was five times more in children with malnutrition compared to normal children (95% CI: 2.640, 9.397) [Table 3]. A study done by Singh *et al*.[20] in Bihar reported similar findings. Hygiene practices among mothers like washing hands with soap and water before cooking, after using latrine, handwashing before feeding the child, and regularly washing child's hands with soap and water showed a significant association with ADD among children [Table 3]. The relative risk of ADD was 3.8 times more among children whose hands were not washed with soap and water regularly (95% CI: 2.058, 7.225). In our study, it was found that 70% of the mothers were aware about ORS [Table 4] and 47% mothers had used ORS for their child. Also, 66.4% mothers had knowledge about various home-based fluids which can be given to a child during a diarrhoeal episode. However; awareness about role of Zinc was fairly low i.e, 33.6%. Majority of mothers (78.4%) used to always wash their hands before feeding the child as well as clean child's hands with soap and water (82.4) [Table 4].

Our study did not find any association between occurrence of ADD in children and age of the child, employment status of the mothers and type of family. The study has certain limitations which included, a small sample size, stool examination was not performed, case control study is better design for finding association between disease and risk factors.

Strength of the study is that it is one of its kind, which aimed to measure the incidence of diarrhoea by following children for one year. No studies are available in the literature in this state which measured the incidence of diarrhoea among children.

Conclusion

Our study found a low incidence rate of diarrhoea among children residing in Santa Cruz. However, various socio-demographic factors, nutritional factors, and certain unhygienic practices played an important role in the occurrence of diarrhoea in our study which can be easily controlled by making the community aware about it.

Acknowledgement

We are grateful to the Department of Community Medicine, Goa Medical College for helping us to conduct this study. We are also grateful to Anganwadi workers, mothers, and children who took part in this study.

Key message

Proper awareness about easily available home-based fluids and seeking timely treatment are two key factors which can prevent millions of diarrhoeal deaths in children in developing nations.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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