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Socio-demographic Determinants of Appropriate Utilization of Oral Rehydration Solution Therapy in Under Five Children with Acute Watery Diarrhoea: A Hospital Based Study

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Abstract

Background:
Acute watery diarrhea (AWD) continues to be a primary cause of morbidity and mortality in children under five. Oral rehydration solution (ORS) is a simple and affordable technique demonstrated to minimize the complications and death associated with dehydration.

Objective:
The effective use of ORS is frequently affected by parental socio-demographic factors.

Methods:
The cross-sectional study was carried out at the Department of Paediatrics, Jalalabad Ragib - Rabeya Medical College Hospital (JRRMCH), Sylhet. All children under the age of 5 years with AWD admitted to the paediatrics ward comprised the study population. Among them, a total of 300 children were selected with purposive sampling. The duration of the study was 6 months. A questionnaire was used to collect data on the sociodemographic characteristics of the study population, as well as maternal knowledge and practices regarding oral rehydration solution (ORS) and their impact on appropriate utilization of ORS were documented.

Results:
Most of the mothers (67%) correctly prepared ORS but only 54.3% utilized it appropriately. Among the 300 children, most of them belonged to 1 to 2 years of age group and male children were affected by diarrhoea more (61.7%), but inappropriate utilization of ORS was also predominant in male children ($p < 0.05$). Most of the mothers were in 20 to 30 years of age (75%), resided in rural areas (77%) and were home makers (95.3%). Parents with higher education and better financial condition were associated with improved utilization of ORS ($p<0.05$). Fathers having business or in service were found utilizing ORS more efficiently than farmers ($p < 0.05$). Apart from sociodemographic factors, maternal knowledge regarding ORS also influenced appropriate use of it. More than 97% of mothers knew about ORS while only 10.7% accurately knew its purpose of replacing salt and water and this group had used ORS significantly better than other groups. Approximately half of the mothers were advised by doctors and good number of them used ORS appropriately ($p<0.05$). Only 48 % of mothers knew the preservation time of ORS. Majority of the mothers (38%) used cup- spoon for providing ORS to their children, and 75.3% mothers also took ORS along with their children. Food restriction was also a common practice during diarrhoealillness including both babies (59.7%) and mothers (45.7%).

Conclusion:
This study showed that most of the mothers were familiar with ORS and its preparation. There were several factors which influenced the appropriate utilization of ORS including gender, parental education, monthly income, source of information and knowledge regarding function of ORS.

Keywords: ORS, Appropriate utilization, Education, Diarrhoea

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Introduction:
Diarrhoea is characterized by the passage of three or more loose or liquid stool within a 24-hour period. Acute watery diarrhea (AWD) continues to be one of the main causes of morbidity and mortality among children under five in developing countries, despite the existence of basic, effective, and affordable interventions.[1] Worldwide, each year, diarrhea results in the death of approximately 443,832 children under the age of five and approximately 1.7 billion cases of childhood diarrhoeal disease are reported annualy. [1] In Bangladesh, diarrhea mortality rates among children under five has declined from 15.1 per 1,000 to 6.0 per 1,000 live births from 1980 to 2015. Comparable decrease was noted in the incidence of diarrheal illnesses also.[2] Highest rate of advice for diarrhoeal disease in children taken from health care facility was in Dhaka division (50.7 %).[3] Sylhet was at the bottom (25.5%) only second to Rajshahi Division (23.8%).[3]

Oral rehydration solution (ORS) is widely acknowledged as the fundamental approach to managing diarrhoeal diseases, considerably decreasing complications and death associated with dehydration.[4] The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) clearly recommend oral rehydration solution (ORS) as the primary treatment for diarrhoea in children. The proper use of ORS involves correct preparation, adequate volume, appropriate frequency, and suitable administration methods. But inappropriate utilization of ORS, such as inaccurate dilution, insufficient consumption, or replacement with alternative fluids diminish its efficacy.[1,5] In many low and middle-income countries, inappropriate utilization of ORS remains affected by various socio-demographic factors, including parental education, socioeconomic status, residence, social traditions, and access to health information and healthcare services.[6] Caregivers' knowledge, attitudes, and practices are essential factors in ensuring the proper use of ORS during episodes of diarrhea.[7] Understanding the socio-demographic determinants linked to proper ORS utilization is essential for developing targeted interventions and enhancing health education initiatives. Though diarrhoea is common in children and ORS is the cornerstone, very few studies were conducted in this part of the country. Therefore, this hospital-based study was carried out with an aim to find out baseline understanding of mothers regarding ORS use and factors affecting appropriate use of ORS by them.

Method:
This cross-sectional study was conducted at the Department of Paediatrics of Jalalabad Ragib -Rabeya Medical College Hospital (JRRMCH), Sylhet. All under 5 children with AWD who were admitted to the paediatrics ward were study population. Among them, total 300 children were selected by purposive sampling. Duration of the study was September 2024 to February 2025. Children with diarrhoea with severe acute malnutrition, with severe illness (like pneumonia, acute kidney injury, heart disease etc.), dysentery, persistent diarrhoea, hospital acquired diarrhoea and those who were not willing to continue in the study were excluded from the study. A preformed questionnaire was used to take data of sociodemographic variables of study population along with maternal knowledge and practice of ORS and their utilization of ORS at home before hospitalizing their babies. After taking verbal permission, mothers were queried with easily understandable local language. Mothers who dissolved one packet of ORS in 500 ml of water were considered to have appropriately prepared ORS. Mothers who accurately prepared ORS and administered it to their sick child after each episode of loose stool were considered to be utilized ORS appropriately. Statistical Package for Social Sciences (SPSS) version 27 was used to analyze data. Results are presented in tables and charts. P value <0.05 was considered statistically significant.

Results:
Two-thirds of participants (201 or 67%) correctly prepared Oral Rehydration Solution (ORS). Most respondents (228 or 76%) gave ORS after each loose stool, while 52 (17.33%) did so only when the baby asked, and 20 (6.67%) did not know when to give it. Overall, 163 participants (54.3%) used ORS appropriately, while 137 (45.7%) did not (Table-I).

Table-I: Proper preparation and utilization of ORS among participants (N=300)

Variables	no.(%)
Preparation of ORS	
Correct	201 (67)
Incorrect	99 (33)
ORS given to child	
After each loose stool	228 (76)
If baby wanted occasionally	52 (17.3)
Don't know	20 (6.7)
Appropriate utilization of ORS	
Yes	163 (54.3)
No	137 (45.7)

The study showed that 127 participants (42.3%) were aged 1-2 years, and 99 (33%) were 6-12 months. Male children numbered 185 (61.7%), while females were 115 (38.3%). Inappropriate ORS use was higher among males (70.8%) (p=0.0031) (Table-II).

The study included 69 urban residents (23%), with 44 (27%) using ORS properly, compared to 231 rural residents, where 73% had appropriate use of ORS (p=0.073). Half of the 300 respondents came from nuclear families, with the rest from joint families, showing no significant difference in ORS use (p=0.728). Most mothers (75%) were aged 20-30, while fewer were above 30 (16.7%) or under 20 (8.3%) (p=0.728). Educated mothers utilized ORS better than less educated ones, with 71 (23.67%) least educated mothers showing inappropriate use (p=0.003) Most mothers were homemakers (95.3%) (p=0.062). Families earning over 20,000 takas had the highest proper ORS use, while those earning under 10,000 takas had more incorrect use (p=0.039). Fathers with higher education also supported better ORS utilization than fathers with just primary education or no formal schooling (p=0.001). Fathers in business sectors used it properly, while improper use was common among and individuals in "other" jobs (p=0.033) (Table-III).

Most mothers (292, 97.3%) knew about ORS, with 162 using it correctly. Only 8 were unaware of ORS, and incorrect usage was higher among them[7] (p=0.043). Just 32 (10.7%) recognized ORS for replacing lost salt and water, with 22 using it correctly. Additionally, 145 (48.3%) knew ORS corrects water loss, while only 89 used it appropriately. Those who thought ORS stopped diarrhea (49) or were unaware of its purpose (74) had more inappropriate use (p=0.016). Most mothers learned about ORS from doctors (146, 48.7%), and the largest appropriate utilization occurred among individuals who obtained information from doctors (82, 50.3%) (p=0.003). 144 (48%) mother knew ORS can be stored for 12 hours, with 85 using it properly and out of 156 mothers who had improper knowledge 78 used ORS appropriately (p=0.053) (Table-IV).

Most women used a cup and spoon to give ORS to their children (114 or 38%), while 98 (32.67%) used other methods, and 88 (29.33%) used feeding bottles. The best proper use was with cup-and-spoon (22.67%) (p=0.099). Among the respondents, 74 (24.67%) stated that only the baby took ORS, whereas 226 (75.33%) reported both mother and baby consumed it. Food limitation during diarrhea was noted for both mother and baby, affecting ORS use (p=0.862) (Table-V).

Discussion:

Table-II: Age and gender distribution of the participants (N=300)

Variables	Total (N=300) no. (%)	Appropriate utilization Frequency (n=163) no. (%)	Inappropriate utilization Frequency (n=137) no. (%)	p-value
Age of baby				
<6 months	26 (8.7)	16 (9.8)	10 (7.3)	0.339
6-12 months	99 (33)	47 (28.8)	52 (38)	
1-2 years	127 (42.3)	71 (43.6)	56 (40.9)	
2-5 years	48 (16)	29 (17.8)	19 (13.8)	
Gender				
Male	185 (61.7)	88 (54)	97 (70.8)	0.0031
Female	115 (38.3)	75 (46)	40 (29.2)	

Table-III: Sociodemographic features associated with appropriate ORS utilization (N=300)

Variables	Total (N=300) no. (%)	Appropriate utilization Frequency (n=163) no. (%)	Inappropriate utilization Frequency (n=137) no. (%)	p-value
Residence				
Rural	231(77)	119(73)	112(81.8)	0.073
Urban	69(23)	44(27)	25(18.2)	
Type of family				
Nuclear	150(50)	83(50.9)	67(48.9)	0.728
Joint	150(50)	80(49.1)	70(51.1)	
Age of mothers				
<20 years	25(8.3)	13(8)	12(8.8)	0.728
20-30 years	225(75)	122(74.8)	103(75.2)	
>30 years	50(16.7)	28(17.2)	22(16)	
Maternal education				
Illiterate to primary	129(43)	58(35.6)	71(51.8)	0.003
Up to SSC or Dakhil	70(23.3)	37(22.7)	33(24.1)	
Up to HSC/ Alim	58(19.3)	36(22.1)	22(16.1)	
Graduate/ Above	43(14.3)	32(19.6)	11(8)	
Maternal occupation				
Home maker	286(95.3)	152(93.3)	134(97.8)	0.062
Working mother	14(4.7)	11(6.7)	03(2.2)	
Monthly income				
<10 thousand	54(18)	21(12.9)	33(24.1)	0.039
10-20 thousand	84(28)	50(30.7)	34(24.8)	
>20 thousand	162(54)	92(56.4)	70(51.1)	
Father's education				
Illiterate to primary	160(53.3)	76(46.6)	84(61.3)	0.001
Up to SSC or Dakhil	67(22.3)	42(25.8)	25(18.3)	
Up to HSC/ Alim	34(11.3)	20(12.3)	14(10.2)	
Graduate/ Above	39(13)	25(15.3)	14(10.2)	
Father's occupation				
Farmer	32(10.7)	14(8.6)	18(13.1)	0.033
Work abroad	86(28.7)	41(25.2)	45(32.9)	
Small business	57(19)	36(22.1)	21(15.3)	
Service	26(8.6)	17(10.4)	09(6.6)	
Others	99(33)	55(33.7)	44(32.1)	

Table-IV: Maternal knowledge of ORS (N=300)

Variables	Total (N=300) no. (%)	Appropriate utilization Frequency (n=163) no. (%)	Inappropriate utilization Frequency (n=137) no. (%)	p-value
Heard of ORS				
Yes	292 (97.3)	162 (99.4)	130 (94.9)	0.043
No	08 (2.7)	01 (0.6)	07 (5.1)	
Purpose of ORS use				
Stop diarrhoea	49 (16.3)	16 (9.8)	33 (24.1)	0.016
Replace water loss	145 (48.3)	89 (54.6)	56 (40.9)	
Replace salt and water loss	32 (10.7)	22 (13.5)	10 (7.3)	
Don't know	74 (24.7)	36 (22.1)	38 (27.7)	
Source of information				
regarding ORS				
Doctor	146 (48.7)	82 (50.3)	64 (46.7)	0.003
Health assistant or nurse	30 (10)	16 (9.8)	14 (10.2)	
Family members	109 (36.3)	60 (36.8)	49 (35.8)	
Medicine shop	15 (5)	05 (3.1)	10 (7.3)	
ORS can be preserved for 12 hours				
Know	144 (48)	85 (52.1)	59 (43.1)	0.053
Don't know	156 (52)	78 (47.9)	78 (56.9)	

Table-V: Maternal practice of ORS (N=300)

Variables	Total (N=300) no. (%)	Appropriate utilization Frequency (n=163) no. (%)	Inappropriate utilization Frequency (n=137) no. (%)	p-value
ORS given with				
Feeding bottle	88 (29.3)	49 (30.1)	39 (28.5)	0.099
Cup spoon	114 (38)	68 (41.7)	46 (33.6)	
Others	98 (32.7)	46 (28.2)	52 (37.9)	
ORS taken by (at home)				
Baby only	74 (24.7)	38 (23.3)	36 (26.3)	0.484
Both mother and baby	226 (75.3)	125 (76.7)	101 (73.7)	
Food restriction during diarrhoea and ORS therapy				
To baby	179 (59.7)	92 (56.4)	87 (63.5)	0.862
To mother	137 (45.7)	69 (42.3)	68 (49.6)	

The study focused on how mothers of children under five use ORS. It found that 67% prepared it correctly, while 33% did not, showing a lack of practical knowledge. Anne et al reported that 48.6% of mothers could prepare ORS properly.[8] Yimenu et al noticed that roughly 94.1% of the caregivers did the appropriate steps when making ORS solution.[9] Rahman et al conducted a study revealing that, 47% of mothers inappropriately prepare ORS.[10] Khatun et al observed that 95.1% of the mothers knew how to make ORS correctly, but only 42.8% of them used it correctly when their infants had diarrhea.[11]

In this study, appropriate use of ORS involves correct preparation and administration after each loose motion revealed 67% of mothers prepared ORS accurately, while 76% administered it after each episode. However, the overall appropriate utilization rate was only 54.3%. A 2022 survey in Bangladesh showed a decline in ORS therapy from 85% in 2017-18 to 76% in 2021.[3] Anne et al reported that 60% of mothers gave their babies as

much ORS as they wanted. [8]

Yimenu et al revealed that approximately 65% of caregivers possessed enough knowledge regarding the use of ORS and zinc for diarrhea treatment.[9] Yusuf, Junaidu, and Abubakar stated that the majority of respondents possessed information regarding the utilization of ORT.[12] A study by Rani et al. found that 40% of mothers knew how to properly prepare ORS and 60% knew how much ORS to give their child.[7] As per the study conducted by Benzamin and Hoque, around 6% of women were unsure about how to prepare ORS and ended up feeding their infant concentrated ORS.[13]

Most mothers (97.3%) knew about ORS, but only about half used it correctly. Believing ORS stops diarrhea led to more inappropriate use. Anne et al found 98.3% awareness among mothers.[8] Rani et al showed that 73% of mothers were aware of ORS.[7]

The results indicated no significant relationship between a child's age and the correct use of ORS (p=0.339). Most children studied were 1–2 years old, but usage rates were similar across ages. Kamal et al noted younger children are more vulnerable to diarrhea due to various factors during this developmental stage.[14]

On the other hand, gender was statistically significantly linked to ORS use (p=0.0031). Male children used ORS inappropriately more than females. Kamal et al[14] showed that more boys than girls had diarrhea. This may be due to boys playing outside in dirty areas and having less immune maturity in early life compared to girls.[15,16] Female children predominantly suffered from diarrhoea in Yimenu et al. (53.3% of the subjects were female and 47.7% were male).[9]

The study looked at sociodemographic factors affecting the use of ORS among mothers. It found no significant link between ORS use and factors like residence, family type, or maternal age. Most mothers in the sample were aged between 25 and 35, with most being under 36 years old.[12] This matches our data, which demonstrated that most mothers were under 30 years old. One of the most critical factors that affects a child's health is maternal education.[7] The educational status of women significantly influences the health status of their children, as it is closely correlated with their levels of awareness. Mothers lacking formal education are more prone to have children suffering with diarrheal disorders in contrast to educated mothers.[17]Maternal education is strongly linked to the correct use of oral rehydration solution (ORS), with educated mothers using it more effectively (p=0.003). A study found that 65% of mothers had primary education or less, while another showed 88% were educated, with over half graduating high school.[7] According to Yimenu et al, 42.5% of caregivers possess a higher educational status, with over 90% residing in urban areas.[9] Chowdhury et al. found that those who lived in areas with a greater prevalence of educated people were less likely to have diarrhea.[18] Education has a positive impact on health seeking behaviour of mothers. It was found that literate mothers have better knowledge and awareness to accept and initiate ORS therapy during the course of the disease.[19] This study found a significant correlation between monthly household income and appropriate ORS use (p=0.039). Families with more money used ORS more often and more accurately. [7] In Yimenu et al, over half of the caregivers (55.6%), earned a high monthly salary, consistent with our findings.[9] Similar findings was also observed in Bangladesh demographic and health survey of 2022 where ORS was used more accurately in wealthier households.[3] Rani et al reported that 61% of children came from homes living below the poverty level.[7] Father's education significantly impacted the study (p=0.001). Fathers with higher education and better jobs had more opportunities and awareness. Additionally, individuals in small businesses or service roles demonstrated better utilization patterns compared to farmers.

Only 10.7% of mothers understood that ORS replaces lost salt and water, leading to better use of ORS. About 45% of mothers knew ORS helps replace fluids lost in diarrhea.[8] In the study, 48.7% of mothers got information from doctors, linking this to better usage. This contrasts with Chowdhury et al, where 80% relied on nonprofessionals.[18] Anne et al found that 54.3% of mothers learned about ORS from doctors.[8] Yimenu et al found that 86.9% of caregivers learn about using ORS and zinc from health workers. Better knowledge of ORS among mothers leads to improved attitudes and practices.[9] Yusuf, Junaidu, and Abubakar noted that the majority had learned about ORS from community health care facilities.[12] In Rani et al, the majority of mothers (34.3%) indicated that their primary source of knowledge regarding diarrhea was from doctors. Other sources included

television (20%), other mothers (22%), media (21%), and health care providers (2.9%).[7]

ORS can be stored for up to 12 hours.[1] In the current study, around 48% of mothers were aware of the appropriate storage time; yet, incorrect storage practices remained prevalent. Anne et al. found that just 38% of mothers knew how to store ORS correctly, which was a lot less than what we found.[8]

The results showed mothers used different methods to give ORS to their children, with cup-and-spoon feeding being the most common and associated with the highest correct use, although not statistically significant. Approximately 29.3% of mothers used bottles, which can easily become contaminated.[17]

A significant number of mothers reported using ORS at home, with 75.3% indicating both they and their children consumed it. Benzamin and Hoque found that in 22% of cases, both took ORS, while only the mother took it in 4%. Some mothers believed ORS would benefit their babies through breast milk.[13] Food restriction during diarrheal episodes was common among infants and mothers, but it didn't significantly affect proper ORS use. Rani et al found that 34.3% of cases offered solid food to children.[7] Traditionally many people in our country recommend delaying or reducing solid food during diarrhoeal illness but numerous studies have shown that continuing feeding is safe and beneficial.[20] These data show that people still have wrong ideas about feeding during diarrhea. In Bangladesh, it is an old tradition to limit dietary intake during episodes of diarrhea.[13]

Limitation:

This study's limitations include a small group from one center and potential recall bias in home management data during diarrheal disease.

Conclusion:

This study revealed that ORS use in acute watery diarrhoea in children under five is affected by several socio-demographic characteristics, like male children, families with lower parental education and income were more susceptible. Despite the fact that nearly all mothers heard of ORS, there were significant variations in knowledge and appropriate utilization. Although two-thirds of mothers accurately prepared ORS and the majority gave it following each episode of diarrhoea, its proper utilization was still inadequate. The insufficient understanding of the physiological function of ORS and the lack of knowledge concerning its appropriate preservation underscore errors in its effective utilization. Health professionals served as the principal source of information for over half of the respondents. Enhancing focused health education, particularly for less-educated parents, is crucial for ensuring proper ORS usage and decreasing diarrhoea-related morbidity in children under five.

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