Original article:

The outcome of the severity of diarrhoea in adult hospitalized patients with the assessment of nutritional and socioeconomic status

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Abstract

Background: Diarrhoea is a leading cause of morbidity and mortality in developing countries. This study observed the influences of nutritional status and age on the outcome of severe diarrhoea in adult male patients. *Methods and materials:* Data were obtained through interview by arranged questionnaire. It is a prospective longitudinal study, where one group of patient was well nourished and other group was malnourished. *Results:* Significant differences were found in all study factors between malnourished and well nourished diarrhoea patients. Patients with poor nutritional status had low body weight and muscle mass index than well nourished patients. The stool volume was higher in malnourished patients than well nourished patient. In addition mean duration of diarrhoea for malnourished patients was higher than well nourished patients until discharge from hospital. *Conclusion:* Therefore, the diarrhoea of malnourished and low socioeconomic status of adult patients is more severe, and the incidence of this disease can be reduced by growing awareness as well as improve nutritional and socioeconomic status of those patient groups.

Key words: Diarrhoea, nutritional status, BMI, malnourished and wellnourished patients

Introduction

Diarrhoea is an alteration in normal bowel movement, characterized by increased frequency, volume, and water content of stools. The incidence of diarrhoea was associated with 2.2 million deaths worldwide[1]. Deaths due to diarrhoeal illness occur predominantly in children, with an estimated 1.5 million deaths in under 5-year-olds each year, making diarrhoeal illness the second leading cause of death in this age group[2]. However, in developed countries diarrhoea is a major public health problem and estimated to 21-37 million episodes of diarrhea occurs annually[3, 4]. But, in low income country about 6.9% death occurs due to diarrhoea[1]. All estimates derive from population-based studies, including both adults and children. Generally the cause of diarrhoea depends on geographical location, standards of food hygiene, sanitation, water supply, and season. Commonly identified causes of sporadic diarrhoea in adults in low income countries include *Campylobacter*, *Salmonella*, *Shigella*, *Escherichia coli*, *Yersinia*, protozoa, and viruses[5, 6]. In addition, the duration and severity of acute diarrhoea increases in undernourished children[7]. Malnutrition contributes to diarrhoea which is more severe, prolonged, and possibly more frequent[8]. Low body mass index (BMI), indicative of chronic energy deficiency (CED) and malnutrition are associated with compromised immune function, increased susceptibility to infectious illnesses, and reduced survival of people[9]. Although the incidence of diarrhoea is more discussed for children but the severity of acute diarrhoea of adults in low income countries is largely unknown owing to the lack of large-scale surveillance studies in these countries.

In the year 2007, around 11,000 diarrhoeal patients attended to the Dhaka Hospital, and 44% of them were adults, of whom 58.7% had severe

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diarrhoea[10]. In recent years, the frequency and hospitalization period of adult patients who suffering from severe diarrhoea is increases significantly. Therefore, the management of diarrhoea is becoming increasingly difficult. In addition, less attention has been given to adult with acute severe diarrhoea compared to children; thereby deaths among adults may increases during epidemic of acute severe diarrhoea. All of these may significantly contribute to economic loss (through daily weight loss) with reduced disability adjusted life years (DALY). There were many studies conducted on adult diarrhea based on used of antibiotic, ORS , zinc, other medicines and micro nutrients[11-14] but not based on nutritional status of adult diarrhoeal patients. The previous study done on the basis of nutritional status that related with severe diarrhoea in children. Therefore, the purpose of this study is the determination of outcome of the severity of adult diarrhoeal patients based on nutritional status, age and socioeconomic condition. This can help to determine the relationship between nutritional status and outcome of diarrhoea in future.

Materials and methods
Study design
It is a hospital based prospective longitudinal study and conducted in Dhaka hospital of International Center for Diarrhoeal Diseases Research, Bangladesh (ICDDR,B). The duration of the study was conducted from September 2010 to January 2011. There are two criteria: inclusion & exclusion criteria were selected for this study. Inclusion criteria includes adult male patients with age of 20-50 years, two group of patient (wellnourished and malnourished), basal metabolic index (BMI), dehydration (severe or some according to Dhaka Method) and stool characteristics/volume. Stool characteristics/volume (volume/frequency/consistency) was observed for 4 hours prior to study. Written informed consent was taken from every patient. Exclusion criteria include patients with bacillary dysentery (presence of visible blood in stool) and unconscious or patients with medical emergencies. This study was also counted major indicators of patients such as malnourishment (BMI less than 18.5), well nourishment (BMI greater than 18.5), income, weight, height, mean BMI, housing condition, leaving own or rent house, educational status, duration of diarrhoea, stool volume and IV fluid requirement. Total sample size was 130 in which 65 malnourished and 65 well nourished. This research was approved by ethics Committee of ICDDR,B.

Method of data collection
To reduce observer variation, a standardized form was used at the Dhaka hospital for assessment of dehydration. This is a minor modification of the WHO guidelines, known as the Dhaka method, as presented in the Table 1. Patients who fulfill the selection criteria of "Dhaka Method" was admitted to the ward of Dhaka hospital of ICDDR,B and BMI was calculated after measuring the height and weight of patients. Duty nurses were measured and recorded vital signs (pulse and respiratory rates, temperature and blood pressures). Physicians took their detailed medical history and performed thoroughly physical examination, including assessment of dehydration using the "Dhaka Method". According to the dehydration status, patients was either initially re-hydrated by introduce intravenous fluid (patients with severe dehydration and frequent vomiting) or drinking ORS solution (those with some dehydration and able to drink), and then observed for next 4 hours. Patients stool and urine was separately collected by attendant and patients were allowed to drink water and food as their ability. At the end of the 4 hour observation period, stool volume was measured and the patients who fulfill the selection criteria i.e. having watery stool volume of 5 ml/kg/hour or more (20 ml/kg/4-hour observation period) were selected for this experiments and cordially asked for their consent to participation questionnaire of "Dhaka Method" in this study. The selected patients were received a single 1.0 gm dose of azithromycin antibiotic orally. Stool and urine was collected separately, measured and recorded for each 6 hour-period of the study until resolution of diarrhoea. The intake of intravenous and ORS solutions, water and other fluids (e.g. milk) was similarly measured. Patients who developed any complication during study was considered as failures and withdrawn from the study.

Table 1: Dhaka method for the assessment severity of dehydration/diarrhoea

Assessment of dehydration				
Assess	Condition*	Normal	Irritable/Less active*	Lethargic/ Comatose*
	Eyes	Normal	Sunken	
	Mucosa	Normal	Dry	
	Thirst*	Normal	Thirsty*	Unable to drink*
	Skin turgor*	Normal	Reduced*	
	Radial pulse*	Normal		Uncountable or Absent*
Diagnose		No sign of Dehydration	If at least 2 signs including one (*) sign present, diagnose "some dehydration"	If "some dehydration" plus one of these (*) signs are present, diagnose "severe dehydration"

Statistical analysis

Data were coded, scrutinized and put on to entry using statistical package for social science (SPSS). Nutritional status was calculated by WHO Anthro software. Data were expressed as mean±SD and number (percent). Unpaired Student's-'t' 'chi-squared and Mann Whitney Rank Sum tests were performed as applicable. A p value <0.05 was taken as level of significance.

Results

A total number of 130 adult male patients with severe diarrhoea were included in the study of them 65 were malnourished (BMI $\leq$18) and 65 wellnourished (BMI$>$18). The major indicator of patient's were age, monthly income, housing condition, leaving own or rent house, weight, height, mean BMI, educational status, duration of diarrhoea, stool volume and IV fluid requirement.

Age, monthly, housing and leaving condition of the patients

Mean age of malnourished and well nourished group was 28 years and 33 years respectively which demonstrated that malnourished group was significantly younger (p$<$0.001). The monthly mean income of malnourished and wellnourished patients was Tk 4953/- and Tk 6938/- respectively and the difference was statistically significant (p$<$0.02) (Table 2).

Well nourished patients (29.2%) had their own house compared to the malnourished (12.3%) and the distribution did not show statistical significant difference (p=ns).

Housing condition of the patients divided into three types such as khaca, sami pacca and pacca. Among these patients 38.46% malnourished and 23% wellnourished were lived in khaca house, 33.85% malnourished and 43% wellnourished were lived in samipacca house, and 27.7% malnourished and 33.86% wellnourished were lived in pacca house respectively (Table 2).

Table 2: Age, monthly income, housing and leaving condition of the study subjects

Variables	Malnourished Group (n=65)	Well nourished Group (n=65)	P-value
Age (yrs)	28±7.77	33±7.56	<0.001
Monthly income (Tk)	4953±3664	6438±3643	<0.022
Nature of residence			
Own house	8 (12.3%)	19 (29.2%)	ns
Rent house	57 (87.7%)	46 (70.76%)	
Type of housing			
Khaca	25 (38.46%)	15 (23%)	ns
Semi pacca	22 (33.85%)	28 (43%)	
Pacca	18 (27.7%)	22 (33.86%)	

Data were expressed as mean±SD and number (percent) as applicable.

Unpaired Student's-'t' test and chi-squared tests were performed as applicable to calculate statistical difference and/ or association between groups.

Height, weight and BMI of the patient

Mean height (cm) of the malnourished group (162.68 cm) and well nourished Group (162.38 cm) was almost similar (p=0.781). Mean weight (Kg) of the malnourished and well nourished Groups was 45.00 and 56.26 respectively which

showed significant statistical difference (p<0.001) as depicted in Table 3.

Table 3: Weigh, height and BMI of the study subjects

Variables	Malnourished Group (n=65)	Well nourished Group (n=65)	P value
Height (cm)	162.68±5.78	162.38±6.34	0.781
Weight (kg)	45.00±4.48	56.26±8.36	<0.001

Data were expressed as mean±SD.
Unpaired Student's '*t*' test was performed to calculate statistical difference between two groups.

Educational status of the patients
Educational status of the study subjects evaluated in the form of illiterate, attended primary school but did not complete (<Class 5), high school attended (<SSC), SSC passed and, HSC and above. Education attainment of the respondent's showed that 23.07% malnourished and 15.38% wellnourished patients were illiterate. The distribution in the two groups for <Class 5 was 30% and 20%, <SSC 35.38% and 38.46%, SSC 5 (7.69%) and 7 (10.76%) and, HSC and above 3.07% and 7.69% respectively (Table 3). Over all distribution showed statistical significant association (p<0.001) (Table 4).

Table 4: Educational status of adult diarrhoea patients admitted in the hospital

Variables	Malnourished Group (n=65)	Well nourished Group (n=65)	P value
Illiterate	15 (23.07%)	10 (15.38%)	<0.001
<Class 5	20 (30%)	13 (20%)	
Under SSC	23 (35.38%)	25 (38.46%)	
SSC pass	5 (7.69%)	7 (10.76%)	
Over HSC	2 (3.07%)	5 (7.69%)	

Data were expressed number (percent).
Chi-squared test was performed to calculate statistical association.

Stool volume during 4 hour observation before get admission
Stool volume determines the severity of diarrhoea. The mean stool volume of malnourished and well-nourished patient was 38.95 ml and 32.4 ml respectively. The value was showed that in malnourished group the volume was 20% higher than the well nourished counterpart during the 4 hours observation period. The value was significantly different between two groups (<0.001).

Duration of diarrhoea, stool volume and IV fluid volume required for the study subjects
Duration of diarrhoea of the malnourished group was 48.85 hrs and wellnourished 36.13 hrs that is malnourished group had 33.5% time hour longer diarrhea [duration in the two groups was significantly different, p<0.004]. The total stool volume [(median (range); ml/kg body weight) was 310 and 230 for malnourished and well nourished group respectively which showed that it was 34.7% higher in malnourished group compared to well nourished counterpart (p<0.002).

Intravenous (IV) fluid is requires to re-hydration the diarrhoea patients. Median (range) IV fluid (ml/Kg BW) required for the malnourished and well nourished group was 222 and 213 respectively (p<0.001) (Table 5).

Table 5: Duration of diarrhoea, stool volume and IV fluid requirement of the study subjects

Indicators	Malnourished Group (n=65)	Well nourished Group (n=65)	P value
Duration in hours	48.85 ±24.25	36.13±23.66	<0.004
Stool volume (ml/kg BW)	310 (30-1250)	230 (83-1260)	<0.002
Intravenous fluid (ml/kg BW)	222 (0-1055)	213 (0-1350)	<0.001

Data were expressed as mean±SD and median (range) as appropriate.
Statistical difference between two groups was calculated using unpaired Student's-t test and Mann Whitney Rank Sum tests as applicable.

Discussion
The previous study, Islam *et. al.* reported that households having a higher socioeconomic status showed the low incidence of diarrhoea in adult[15]. But they did not assessed nutritional status with severity of adult diarrhoea. However, this study assess the outcome of severity of adult diarrhoea patients according to their nutritional status considering some indicators who come to the Dhaka hospital of ICDDR,B seeking treatment of diarrhoea.

The measured factors age and incomes of the patients were essential due to maintaining hygiene and ensuring proper balanced diet. In addition, the factors weight and height determines nutritional status of the patients, BMI determines malnourishment and well nourishment of patients, house condition determines the hygienic condition of leaving place of patients, education determines the social status of the patients, and stool volume, duration and IV fluid requirement determines the severity of diarrhoea of the patients. The above factors together indicate the socioeconomic condition and severity of diarrhoeal adult patients. This study exhibits that the malnourished patient was significantly younger as compared to wellnourished patients. The monthly income of wellnourished patients was more compared to the malnourished one. The malnourished diarrhoeal patients weighed 25% less compared to the well nourished subjects. The mean height of the malnourished patients was almost similar to well nourished patients (162.68 cm vs. 162.38cm). This study also showed that the mean BMI of malnourished patient was lower than the wellnourished patient. Education pattern of wellnourished patients was better that malnourished patient. The malnourished patient's stool volume (ml) per kg body weight within 4 hours was more compared to the well nourished patients. The stool volume of malnourished study subjects was 20% more than the wellnourished patients because malnourished patients had been found to have extensive mucosal injury and more intestinal infection thus causes severity of diarrhoea and excess stool volume[7]. Therefore, the diarrheal duration of malnourished patients was high then the wellnourished patients malnourished patient may be due to the extensive mucosal injury which changes in intestinal functions in malnourished patients may be one of the factor contributing to the intestinal infection and causes of diarrhoea as a result prolonging diarrhoea of the malnourished patients, 33.5% higher than the wellnourished patients. Literature study also showed that the duration of diarrhoea of underweight children was found to 33% higher than wellnourished children.[16] Malnourished children suffer zinc deficiency, and its supplementation led to significant decrease in diarrhoea duration (6.2 vs. 4.7 days)[7,17] as well as, the supplementation of zinc to the adults diarrhoea patients led to significant reduction (30%) in stool volume. In addition, this study indicates that wellnourished patients group requires less IV fluid than malnourished patient require more IV fluid. Therefore the malnourished patients require more IV fluid to get rehydrated.

Conclusions

In conclusion (i) Severity of diarrhea and requirement of intravenous fluid to rehydrate these patients are increased by the nutritional status of the patients; (ii) Area of their residence, in a way the household hygiene, also associated in contacting the disease and influenced by educational status; and (iii) to reduce the burden of the diarrhoeal disease in the community residence of the people at risk needs to be addressed further and also the improvement of the awareness.

Acknowledgement

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