Original Research Article

Nutritional status and Existing early childhood feeding practice of under five children: A cross-sectional study in Rural Bangladesh

Abstract:

Introduction: The present study aimed at evaluating the prevalence of malnutrition and its association with existing feeding practices and other factors among under-five (U5) children in a rural setting of Bangladesh.

Methods: A community-based cross-sectional study was carried out on 404 children (0-59 months) from the Noakhali district, Bangladesh. Binary logistic regression analysis was performed to investigate the significant predictor variables for child malnutrition.

Results: The study revealed, there were 30.4% stunting, 37.3% underweight, and 16% wasting in children. A strong relationship was found between underweight and three variables, namely-maternal education, paternal occupation, and child's age ($p<0.05$) respectively. The risk of being underweight for a child from an illiterate mother was 2.18 times more (AOR: 2.18, 95% CI: 1.09, 4.37) compared to children from mothers having secondary/higher education. Child's gender also had a strong association with wasting where male child was more prone to wasting than its female counterpart ($p<0.05$). The SEM results showed that, nutritional status of children was negatively affected by mother's education, age of child and family income (<0.01). Maternal education and age of children were considered to be important determinants of chronic malnutrition (stunting). The prevalence of exclusive breast-feeding under the age of 6 months was 57.9%, and continued breast-feeding till the age of one year was 86.2%.

Conclusion: Social and cultural issues need to be addressed, and appropriate strategies should be taken to ameliorate the existing feeding practice for U5 children to reduce malnutrition in this rural setting of Bangladesh.

Keywords: Bangladesh, Infant feeding and nutrition, Stunting, Underweight, Wasting.

Introduction

Nutrition is a prerequisite for the growth and physical as well as mental development of children. Malnourished children are at high risk of morbidity and mortality [1]. Malnutrition causes more than 3.3 million deaths occurred in children worldwide [2]. Bangladesh is one of the low middle-income countries (LMICs) where the occurrence of stunting, underweight and wasting among under-five (U5) children are 26.5%, 22.6% and 9.8% respectively, reported in the Multiple Indicator Cluster Survey (MICS) Bangladesh [3]. The rate reduced from 5.2% in 2014 to 2.7% in 2018 [4]. The term 'U5 children', commonly involves all the children falling into the categories of newborn and infant (0–1 year-old); toddler (1-3 years old); preschooler (ages 3-5 years old) and in each stage, careful selection of feeding is important for maintaining a good health. Because during this period, they experienced a rapid physical and psychosocial growth and development (growth spurt). The quality of nutritional intake could have a direct impact on U5 children in the long run [5]. Dietary diversity is a disputable issue, especially in rural areas of underdeveloped nations- where the population growth is relatively high, the literacy rate is poor, lack of necessary infrastructure and poor economic movement are observed. The rural diet primarily consists of staple grains (rice or flour) with little portion from vegetables and fruits and only a negligible portion from animal food [6]. Therefore, once a baby stops taking breastmilk and starts complementary feeding, mothers or caregivers usually do not notice what actually they are eating, what is needed for their proper growth and development due to the lack of affordability, accessibility, as well as availability of nutritious food in their surroundings [7]. However, globally, optimal level of infant and young child feeding practice (IYCF) plays an important function in a child's betterment, growth, and survival and it is also related to the mother's health [8]. IYCF is particularly important for the first two years of a child's life and it includes the use of colostrum, initiation of breastfeeding or similar substitutes, exclusive breastfeeding (EBF) (from birth to first 6 months of life), continued breastfeeding or similar substitutes, weaning food, components of complementary feeding (CF) following adequate dietary diversity with different types of meals [9, 10]. According to the World Health Organization (WHO) recommendation, infants should be breastfed within one hour of birth and should continue EBF for the first six months. Complementary foods should be initiated at six months of age and continued breastfeeding up to two years without bottle feeding [11]. Studies showed that, the nutritional status of children is associated maternal nutritional status, child's

gender, paternal education, cultural beliefs and attitudes, poverty, and health services along with feeding practices [12]. Another study showed a significant association between mother's feeding practice, parent's health seeking behavior, and personal hygiene with their children's nutritional status [13].

Malnourished children who did not experience proper feeding environment as per their requirement are usually more prone to different types of diseases like acute respiratory infection (ARI), diarrheal diseases, anemia, and other deficiency diseases and are at greater risk of developing health hazards from non-communicable diseases (NCDs) in adulthood [14]. In the year 2013, the prevalence of U5 children in Bangladesh who were stunted was 42%, by the year 2019, it declined to 28%, a decrease of approximately 14%, due to its advancement in health system and nutritional awareness actions, availability of safe drinking water, betterment in sanitation and hygiene; universal education coverage, and enforcement of laws in child protection [15].

Although, the government took several steps to improve the maternal and child nutritional status, a large proportion of them are still suffering from malnutrition in Bangladesh where the rate is much lower in urban areas compared to the rural areas. It was estimated that, 1.4 million deaths and 10% of disease burden can be reduced by appropriate IYCF practice especially through practicing exclusive breastfeeding [16]. However, in Bangladesh, little evidence was found about IYCF practice and children's nutritional status from rural part of the country [9, 17]. Thus, this study aimed to explore the nutritional status of rural U5 children in one of the upazila of Noakhali district which is located in the southeastern part of Bangladesh. The findings of the current study will help to understand the current occurrence of malnutrition and its associated factors, thus will aid in taking strategies for the reduction of the rates of morbidity and mortality among children in Bangladesh.

Methods.

Study design and settings:

This community-based cross-sectional study was carried out from September 2020 to March 2021. Data were collected from *Subornochor* upazila, a salty char/island, located in Noakhali district, Bangladesh (*Figure 1*). The Bhulua river and Sandwip channel flows through this island.

This upazila is subdivided into eight (8) union parishads (UP) and 53 villages. Study data were collected from two of these eight UPs, namely *Charamanullah* and *Charjabbar*.

Eligibility criteria:

Children (0-59 months) were included in the study based on the consent given by their caregivers (e.g., mother) to participate into the study. Only one child was selected from each household. In case of households having two or more children, the child whose age was less than 2 years, was enrolled on the basis of one child per family. Households having no children or children (older than 5 years), or children who were critically ill or whose caregivers did not provide any consent to participate into the study were excluded.

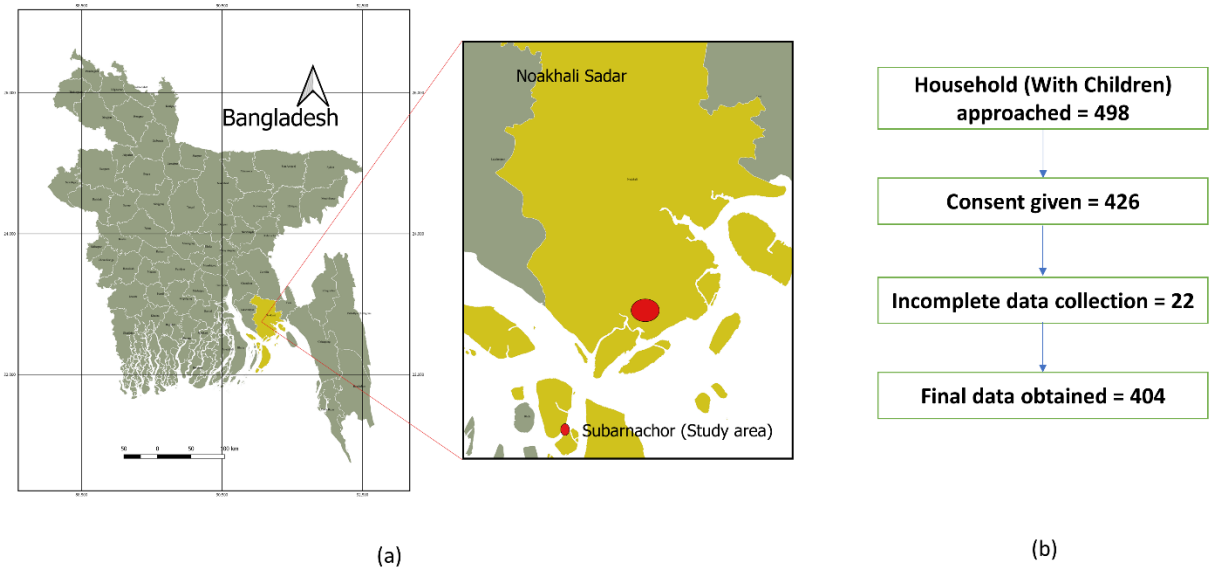

Figure 1: **(a) Study area covered (by QGIS 3.10.2), (b) Selection of the study population**

Sample size and sampling procedure:

Data were collected from a total of 404 U5 children, living in two out of eight union parishads of *Subornochor* upazila, Noakhali, Bangladesh. The sample size was estimated using the Cochrane formula [18] via a simple random sampling technique to explore the current condition of infant feeding and child nutrition by the caregivers living in that area. However, data were primarily collected from all mothers/caregivers who has U5 children. A total 361 samples were required

for a 5% margin of error with 95% confidence interval, assuming that, the population proportion of undernutrition is 31% [19]) with adding 10% non-response rate. Therefore, we approached around 494 households (one child per household), and finally obtained data from 404 children from the same number of households.

Data collection tools:

A structured questionnaire was designed for conducting the study, and it was previously standardized by a pilot study in a village near one of the study sites. Participants were interrogated face to face using a standard questionnaire in the local language. Height scales (both measuring board and stadiometer), weighing scales (both salter scale for child<2 years old and digital weight scale), and color-coded Mid Upper Arm Circumference (MUAC) tapes (for 6 months to 59 months old children) were used to measure children's nutritional status. Android-based Kobo Collect (version 1.23.3k) software was utilized to collect information from the participants.

Measurement of nutritional status and IYCF indicator: Childhood malnutrition is measured by standard indicators of *height for age (HAZ), weight for age (WAZ) and weight for height (WHZ)*. Stunting is defined by *HAZ score -<2SD*, wasting is *HAZ score -<2SD* and underweight is *WAZ score -<2SD*. Emergency Nutrition Assessment (ENA) software version 1.0, a user-friendly anthropometric measurement analysis and report generating tool was employed to analyze the scores. Stunting, wasting and underweight of children was measured using WHO growth standards 2006 [20, 21]. Infant and young child feeding practice were assessed according to WHO recommendation 2008 [22]. Four (4) out of eight (8) indicators of infant and young child feeding (IYCF) 2008 [23] were employed only for children with age less than 2 years, and no dietary data were collected for older children (with age more than 2 years).

Statements of ethical approval: This research confirms to the Helsinki Declaration, outlining the principles for research involving human subjects. The Ethics board of the department of Food Technology and Nutrition Science, Noakhali Science and Technology University provided permission to conduct the study. The objectives and pros and cons of the study were discussed with each participant before taking consent from them for participating into the study.

Statistical analysis:

From KoBoCollectv1.23.3k software, the collected information was first accumulated into Microsoft Excel, and then were analyzed using SPSS Version 23.0. For developing structural

equation modelling (SEM), SPSS AMOS version 22.0 was used to establish the associations between nutritional status of child and demographic profile. *ENA* software was utilized for Z-score calculation. Descriptive statistics and a Binary logistic regression analysis was performed to investigate the significant predictor variables for child malnutrition (Stunting, Wasting, Underweight). The odds ratio (OR) was calculated to assess the strength of associations of the independent variables with the outcome variable at a 95% Confidence Interval (CI). A *p-value of <0.05* was considered statistically significant.

Results:

Socio-demographic profile:

The overall socio-demographic profile of respondents was shown in *Table 1*. Among the respondents 55.9% were boys and 44.1% were girls. More than half (59.7%) of the participants' age was more than 24 months. Around 9.4% were below the age of 6 months, 11.1% were between the ages of 6-12 months, 19.8% were between the ages of 12-24 months, and 59.7% were between the ages of 24-59 months. Majority of the participants (94.8%) were Muslims. The percentages of both parents having primary education (42.2% for father and 40.8% for mother) were higher compared to parents with no literacy (39.5% for father and 37.6% for mother) respectively. The percentage of secondary/higher education was not satisfactory which was only 18.4% for father and 21.5% for mother respectively. Major portion of children's father were day laborers (52.2%) and farmers (28%) respectively, whereas 96.5% of their mothers were housewives. Additionally, as expected, only 11.9% of households had a monthly income of more than 20,000 Taka ($250).

Table 1 also provides information on the background attributes of children, their existing feeding practices (exclusive and complementary types only for children less than 2 years old), and nutritional status, where, it was found that, only 57.9% children under 6 months of age were exclusively breastfed, 86.2% of children continued breastfeeding till the age of one year and around 55.2% children were reported to complete breastfeeding till the age of 2 years. More than 64% (64.3%) of children were introduced to solid, semi-solid, or soft foods as complementary feeding at the age of 6-8 months. The nutritional status using HAZ, WAZ, and WHZ scores

revealed the prevalence of 30.4% stunting, 37.3% underweight, and 16% wasting with 95% CI respectively among these children.

Associated factors with infant and child nutritional status:

Factors associated with the nutritional status of children had shown in *Table 2*, where, maternal education was significantly associated with the chances of a child being underweight and the risk was 2.18 times more (OR 2.18, 95%CI: 1.09, 4.37) among children whose mother was illiterate compared to those with mothers having the secondary/higher education. Although similar association was found in case of both stunting and wasting, the values were not significant.

While considering the age of a child, a strong association was found, where, the risk of a child being underweight was 0.29 (AOR: 0.29, 95% CI: 0.08, 0.94) times higher among children who was <6 months of age than child who were aged 24 months. The same association had been found in children having both stunting and wasting, though these were not significant. However, there was no strong association found between the nutritional statuses of children and other variables like gender, father's education or occupation, income, or family size.

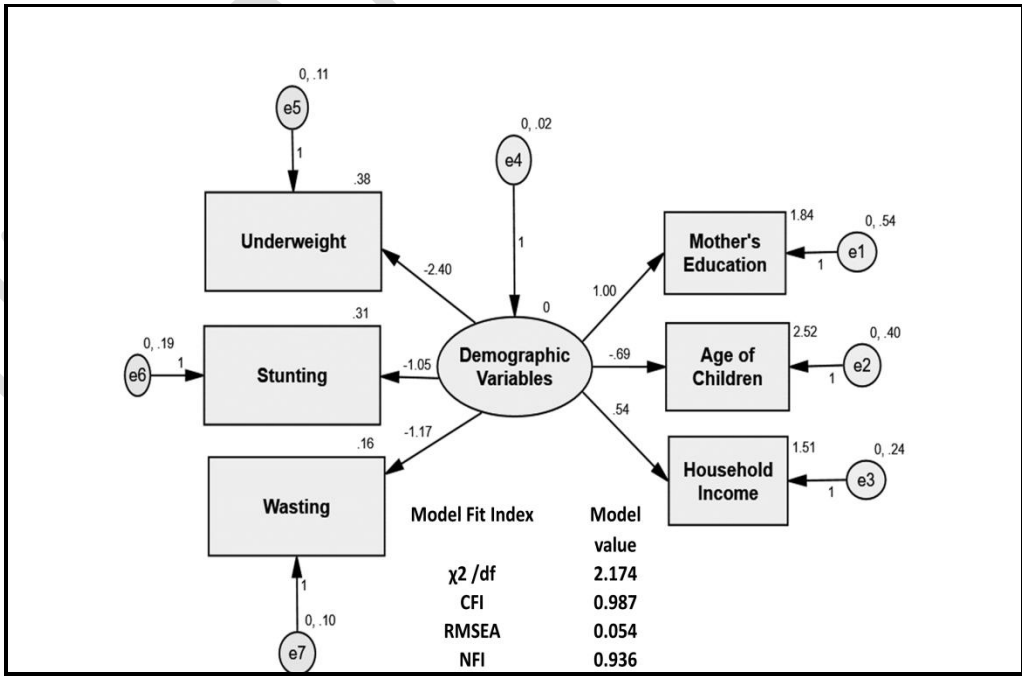

Figure 2: Structural Equation Modelling (SEM) for assessing the relationship between nutritional status of children and demographic variables.

Table 3 compared the goodness of fit indices to the reported accepted values. It is recommended to use more than one indicator to evaluate model fit when evaluating goodness of fit indices [24, 25]. In this case, all fit indices meet the accepted values. The CMIN/DF ($\chi 2$ /df) was estimated to be 2.174, indicating a good fit [26]. The Comparative Fit Index (CFI) and Normed Fit Index (NFI) were both greater than 0.90, indicating an acceptable fit [27, 28], while the Root Mean Square Error of Approximation (RMSEA) was less than 0.10, indicating a good fit [29].

As a result, the SEM for the nutritional status of U5 children had a good fit and is acceptable. The structural model between the variables of nutritional status (underweight, stunting, and wasting) and other demographic variables (mother's education, age of children and household income) was shown in *Figure 2.*

The direction and extent of relationships in the nutritional status and demographic variables was shown in both *Figure 2* and Table 3. Demographic variables had a negative and significant relationship ($\beta 1 = -2.396$, $p<0.05$) with underweight. This finding clearly indicated that, demographic variables directly affect underweight. Again, demographic variables also showed a negative and significant relationship with stunting ($\beta 1 = -1.045$, $p<0.05$) and wasting ($\beta 1 = -1.172$, $p<0.05$). That means demographic variables (mother's education, age of children and household income) directly impact on the nutritional status of U5 children and the directions between them were negative relationship.

Discussion

The findings of the present study showed that, the nutritional condition of U5 children, particularly, underweight was significantly related to different factors like maternal education and age of child, although, stunting and wasting were not found significantly associated with any of these. Exclusive breastfeeding (till the age of 6 months), complementary feeding along with breastfeeding (till the age of 2 years) are necessary to provide the optimum nutrition required for proper growth and development of children [30]. Only the mother's education, father's occupation, and child's age had shown strong association with being underweight. The findings

also reported that, the father's education did not affect the nutritional status of a child. Additionally, gender of child also had a strong association with nutritional status (wasting) where male children were found more prone to wasting than their female counterparts ($p<0.05$). In contrary, another study conducted in urban slum population, living in extreme poverty in Bangladesh found a significantly high occurrence of stunting and underweight among female children and similar trend of wasting in both gender [31].

SEM showed that, mother education, child's age and income level had significant influence on its nutritional status. Parental education is an important determinant of childhood malnutrition [32]. One study showed that, maternal education was associated with the nutritional status of their children where the rate of the children being stunted were 1.76 times higher among children whose mothers were illiterate than the secondary/higher educated ones [33]. Similar association was also found in our study in case of underweight children. Again, in this study, the father's occupation was found to be significantly associated with nutritional status, specifically underweight. We found that, children of day laborers were more likely to be underweight, which was consistent with other studies [34] that found that, the father's occupation had a significant influence on the nutritional well-being of U 5 children. This is due to the close connection between the occupation and income. Low income also had a negative impact on a child's nutritional state because it means they do not have access to enough food.

Studies showed that, socioeconomic status is one of the important determinants of childhood malnutrition. The nutritional status of children was better among high-income households compared with low-income households [35]. Similarly, in the current study, being underweight and stunted had shown a significant association with family income ($p<0.05$). Dietary diversity at the household level was found to be associated with the income status of the family and the opportunity to take diversified food by children was associated with dietary diversity at the household level [36].

One study indicated that, exclusive breastfeeding protects against infectious diseases as well as improves the immune system of children [37, 38]. Another study showed that, the length and weight gain of infants in a developing country were positively related to exclusive breastfeeding [39]. Our study revealed that, the rate of exclusive breastfeeding till 6 months of age was very poor, only 57.9% in this particular *Char* area of Noakhali district in Bangladesh, and this may be

one of the reasons for a high prevalence of malnourished children in this community. Some studies showed that, urban mothers are unable to breastfeed their children due to poor physical conditions that may occur due to a large number of C-section delivery whereas normal delivery is still a common practice among rural people [40, 41]. This study also demonstrated that, exclusive breastfeeding was carried out for more than 6 months of child's age due to the poor economic status of the household, that may be a reason for not showing a strong association between the nutritional status with exclusive breastfeeding (EBF), duration of breastfeeding, and complementary feeding of children in this current study. The reasons behind this may be disease conditions, malnourished mothers, poor maternal educational background, social taboos, lack of awareness, and difficulties in time management. One study concluded some reasons that could influence the EBF practices like the mother's workload, breast-milk insufficiency, dominant gender roles, and lack of support from fathers [42]. Other studies found that, cultural factors, maternal age, and feeding patterns of children also influence EBF practices[43].

It is said that, infection such as malaria, measles, and gastroenteritis also possess influence on the nutritional status of a child, e.g., the presence of gastroenteritis slows down the catch-up growth of children [44]. Mother's time management for household chores and having more children could also be other influencing factors. It has also been found that, working mothers' children suffer from malnutrition much more compared to women who do not work. Due to the lack of proper education, mothers do not feel the necessity of including diversified, wholesome and nutritious diet for their children who need it the most [45].

Practical Implications

In the present study, we aimed to investigate the nutritional status, the existing infant feeding and nutrition practices as well as their effect on children's nutritional status. The finding of this study provided insight on how demographics and other variables were associated with the nutritional status of children in a coastal region (island or Char area) of a developing country like Bangladesh. Different programs and policies need to be addressed in each and every part of this country to increase the knowledge about the necessity of appropriate IYCF practice among mothers, bringing dietary diversity in the household focusing the vulnerable group like U5 children and also for the diminution of cultural beliefs.

Conclusion

Although assessment of infant and young child feeding (IYCF) practice was not up to the mark in the study area, and a high prevalence of different forms malnutrition was observed in the study location. Family income, fathers' occupation and mothers' education were recognized as important factors, responsible for childhood malnutrition. According to the assessment based on SEM, there is a direct negative relationship between nutritional status of children and their demographic profile. Malnutrition not only affects children's healthy development but also reduces their productivity in later adult life. Therefore, necessary strategies to improve exclusive breastfeeding (initiation with colostrum), duration of breastfeeding as well as bringing diversity in complementary and other feeding for U5 children should be taken into consideration to address childhood malnutrition in each and every corner of 64 districts in Bangladesh.

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Table 1: Socio-demographic characteristics of respondents for assessing infant feeding practices and nutritional status of U5 children

Characteristics	**Frequency (n)**	**Percentage (%)**	**Characteristics**	**Frequency (n)**	**Percentage (%)**
Religion			**Gender of Child**		
Islam	383	94.8	Boy	226	55.9
Hinduism	21	5.2	Girl	178	44.1
Father's occupation			**Father's education**		
Day labor	211	52.2	Illiterate	159	39.5
Farmer	113	28.0	Primary	170	42.2
Professional/other	80	19.8	Secondary/higher	74	18.4
Mother`s occupation			**Mother's education**		
Housewife	390	96.5	Illiterate	152	37.6
Others	14	3.5	Primary	165	40.8
Family income			Secondary/Higher	87	21.5
<10,000 BDT	169	41.8	**Child's age in months (mean ±SD)**		37.3 ± 21.9
10,000-20,000 BDT	187	46.3	0 – < 6 months	38	9.4
>20,000BDT	48	11.9	6 – 12 months	45	11.1
			12 – 24 months	80	19.8
Exclusive breastfeeding (under 6 months)			>24 months	241	59.7

(n=38)					
Yes	22	57.9	**Frequency of Childbirth/mother**		
No	16	42.1	1-2 times	208	51.5
Continued breastfeeding at 1 year (12-15 months age)			3 or more times	196	48.5
Yes	25	86.2	**Stunting (n = 401)**		
No	4	13.8	Normal (HAZ ≥ -1.99)	279	69.6
Introduction of solid, semi-solid, or soft foods (6- 8 months age)			Stunted (HAZ ≤ -2.0)	122	30.4
Yes	9	64.3	**Underweight (n =370)**		
No	5	35.7	Normal (WAZ ≥ -1.99)	232	62.7
Completed Exclusive breastfeeding (6-24 months age)			Underweight (WAZ ≤ -2.0)	138	37.3
Yes	69	55.2	**Wasting (n=393)**		
No	56	44.8	Normal (WHZ ≥ -1.99)	330	84.0
			wasted (WHZ ≤ -2.0)	63	16.0

Data were collected from 404 U-5 children from two of eight union parishads of *Subornochar* upazila of Noakhali district, Bangladesh; HAZ, height foe age; WAZ, weight for age; WHZ, weight for height.

Table 2: Logistic regression Model for the determining factor for Nutritional Status

	Underweight						Stunting						Wasting					
	Univariable			**Multivariable**			**Univariable**			**Multivariable**			**Univariable**			**Multivariable**		
Variables	**OR**	**95% CI of ORs**	**Sig**	**AOR**	**95% CI of AORs**	**Sig**	**OR**	**95% CI of ORs**	**Sig**	**AOR**	**95% CI of AORs**	**Sig**	**OR**	**95% CI of ORs**	**Sig**	**AOR**	**95% CI of AORs**	**Sig**
Father Education																		
Illiterate	0.99	0.55-1.79	0.99	0.57	0.29-1.14	0.11	0.91	0.50-1.64	0.75	0.67	0.34-1.33	0.26	0.62	0.29-1.28	0.19	0.47	0.21-1.10	0.08
Primary	0.84	0.49-1.51	0.56	0.60	0.31-1.17	0.13	0.88	0.49-1.59	0.67	0.79	0.41-1.53	0.49	0.78	0.39-1.57	0.49	0.63	0.28-1.37	0.24
Secondary/Higher (R)	1			1			1			1			1			1		
Mother's education																		
Illiterate	2.38	1.29-4.36	*0.005**	2.18	1.09-4.37	*0.02**	1.67	0.92-3.02	0.09	1.79	0.90-3.54	0.09	1.29	0.61-2.73	0.49	1.13	0.47-2.71	0.77
Primary	1.80	0.98-3.29	0.06	1.75	0.89-3.44	0.10	1.34	0.74-2.42	0.34	1.42	0.73-2.76	0.29	1.17	0.56-2.45	0.67	1.08	0.47-2.50	0.84
Secondary/Higher (R)	1			1			1			1			1			1		
Gender																		
Girls	1.12	0.73-1.71	0.61	1.27	0.80-2.02	0.30	0.89	0.58-1.38	0.62	0.97	0.61-1.53	0.89	0.54	0.31-0.97	*0.03**	0.59	0.32-1.10	0.10
Boy (R)	1			1			1			1			1			1		
Age of Child																		
<6 Months	0.24	0.09-	*0.01**	0.29	0.08-	*0.04**	0.34	0.13-	*0.03**	0.43	0.14-	0.14	0.29	0.06-	0.10	0.66	0.12-	0.62

		0.64			0.94			0.92			1.34			1.28			3.38	
6- 12 Months	1.17	0.55-2.46	0.68	1.55	0.67-3.59	0.29	0.77	0.34-1.72	0.52	0.84	0.34-2.06	0.70	0.73	0.27-2.00	0.55	0.76	0.23-2.55	0.65
12 - 24 Months	0.91	0.52-1.58	0.73	1.03	0.55-1.92	0.93	1.15	0.67-1.95	0.60	1.23	0.67-2.25	0.49	0.54	0.25-1.16	0.11	0.46	0.17-1.21	0.11
>24 Months (R)	1			1			1			1			1			1		
Father's occupation																		
Day labor	1.58	0.91-2.74	0.10	1.68	0.91-3.11	0.09	0.95	0.54-1.65	0.85	0.82	0.44-1.51	0.52	1.89	0.84-4.27	0.13	1.92	0.80-4.62	0.14
Farmer	0.87	0.46-1.65	0.68	1.13	0.57-2.24	0.73	0.96	0.52-1.78	0.89	1.21	0.62-2.33	0.57	1.87	0.77-4.53	0.16	2.18	0.88-5.45	0.09
Professional/Others (R)	1			1			1			1			1			1		
Income																		
Lower (≤ 11500 BDT)	1.62	1.06-2.47	*0.03**	1.34	0.83-2.16	0.23	1.64	1.06-2.51	*0.03**	1.87	1.15-3.03	0.11	1.01	0.59-1.74	0.95	0.95	0.51-1.75	0.87
Higher (>11500 BDT) (R)	1			1			1			1			1			1		
Family Size																		
Large (≥6 members)	1.13	0.74-1.73	0.58	0.98	0.82-1.55	0.92	1.19	0.78-1.84	0.41	0.85	0.54-1.35	0.49	1.00	0.58-1.73	0.98	1.16	0.64-2.09	0.62
Small (0-5) (ROR)	1			1			1			1			1			1		

Data was collected from 404 U-5 children. Statistically significant values (*$p<0.05$*) were shown in italic form with an added asterisk*. AOR; Adjusted odd ratio, (R); Reference category, CI; Confidence Interval.

***Table 3*: Estimates of paths between nutritional status and demographic variables (Default model)**

Paths			Estimate	Composite Reliability (C.R.)	*p-value*
Underweight	<---	Demographic variable	-2.396	-2.742	.006
Stunting	<---	Demographic variable	-1.045	-2.703	.007
Wasting	<---	Demographic variable	-1.172	-2.876	.004