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Nutritional Status of Children Under Six Years of Age at Industrial Area in Bangladesh

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In this study, nutritional status of children under six years have been investigated based on primary data and efforts have been made to find out the probable factors influencing the nutritional status of children. The study shows that the factors such as maternal education, family income, duration of breast feeding, age of child, family size have significant effect on nutritional status of children. Therefore, sustainable policy should be taken regarding the factors mentioned above to improve nutritional status of children of Bangladesh.

Key words: Child nutrition, Economic and Demographic factors relating to nutrition, Classification of nutritional status based on MUAC, Waterlow and Gomez classification, Multiple and Logistic regression

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Introduction

Bangladesh is one of the poorest countries in the world. The general health situation of people in this country is not good compared with international standards. The situation of malnutrition of children (under six years) is alarming in this country. About 59.7% of all the children aged 6-71 months are malnourished in terms of deficient height- for- age or weight or both (BBS'95-96). Thirty five to fifty percent of newly born babies is of low birth weight (weight less than 2500 gm.). There are 30,000-40,000 children become blind every year in this country suffer from vitamin 'A' deficiency. About 80% of children and mothers are from deficiency anemia (Talukder, 1993).

Nutrition is one of the most important factors that affect child health. It plays a vital role in prevention and control of many diseased conditions. There are many nutritional problems that affect large portions of our population. The major ones are low birth weight (LBW), protein-energy-malnutrition (PEM), xerophthalmia, diarrhoea, acute respiratory infection (ARI) etc. Determinants of good nutrition are food security, disease control and caring practices.

Many sociologists, demographers and epidemiologists in home and abroad have conducted various studies on nutritional status of under 5 or 6 children. (Ahmed and Islam, 1984; Ahmed, 1991; Bloem ***et al.***, 1995; Buchanan, 1975; Caldwell, 1979; Cochran ***et al.***, 1983; Chen and Taren, 1995; D.'Souza, 1986; Hassan and Ahmed, 1988; Hassan and Ahmed, 1991; Kabirullah ***et al.***, 1990; Kabir ***et al.***, 1995; Kamal ***et al.***, 1997; Monterio ***et al.***, 1992; Mojumder, 1989; Rana, 1984; Rahman ***et al.***, 1995; Winkoff Beverly, 1983;, Wyon and Gordon, 1971).

In this study, an analysis has been carried out based on some primary data collected from two industrial colonies (Ghorashal and Polash Urea Fertilizer Factories Ltd.) at Polash, Narsingdi, Bangladesh. And an attempt has been made to identify the probable socio-economic and demographic factors that are closely related to the nutritional status of children.

Materials and Methods

A sample of 339 children from 6-71 months age group have been collected from two industrial colonies (Ghorashal and Polash Urea Fertilizer Factories Ltd.) at Polash, Narsingdi, Bangladesh in 1996. The information relating to the socio-economic condition of the family, anthropometric indicators, knowledge, attitudes and practice of food have been collected from 300 mothers of the study children. Population of two factories may be broadly classified into three categories: officers, staffs and laborers. For this reason, each category was considered as a stratum. Sample size has been determined for each stratum under proportional allocation method. And the purposive sampling method has been used to fill up the quota for each stratum and for each factory.

Some frequency tables and contingency tables have been used to know the overall idea and association of variables of some socio-economic and demographic characteristics such as education, occupation, income of parents, total number of family members in a family, awareness of mothers like time of giving supplementary food to the children by mothers, time spend for child care, feeding colostrum, duration of breast feeding etc.

To assess the nutritional status of children height-for-weight, weight-for-age, weight-for -height and mid-upper arm circumference criteria were used. The values collected for these indices i.e., height and weight were expressed as percentage of the United States National Center for Health Statistics (NCHS) reference median using the NCHS/WHO reference table. To identify the determinants of the nutritional status of children multiple regression and logistic regression analysis have been performed.

Calculation of nutritional status indicators

Height-for-age

This is the height of a child expressed as a percentage of or as a standard deviation form, height of a 'reference' child of the same age and sex. Age must be in the nearest month. The calculation is as follows:

$$\text{Percent height-for-age} = \frac{\text{Child's height-for-age}}{\text{Reference height-for-age}} \times 100$$

Similarly,

$$\text{Percent weight-for-height} = \frac{\text{Child's weight-for-height}}{\text{Reference weight-for-height}} \times 100 \text{ and}$$

$$\text{Percent weight-for-age} = \frac{\text{Child's weight-for-age}}{\text{Reference weight-for-age}} \times 100$$

Multiple regression analysis

For the multiple regression analysis the following dependent and independent variables have been selected:

Dependent variables Y (nutritional status) = height-for-age percentage (HFAP)
= weight-for-age percentage (WFAP)
= weight-for-height percentage (WFHP)

Independent variables:
X_1= Family size (FAMSIZE)
1=3-5 members, 2=6-8 members, 3= 9 and more members.
X_2= Total family income (TOTFINC)
1= less than Tk. 4000, 2= Tk. 4001-7000, 3= Tk. 7001 and above.
X_3= Mothers level of education (EDNM)
1= illiterate to class V, 2= class VI to S.S.C., 3=HSC and above.

X_4 = Number of live births by mother (NOLBM)
1= 1-3 children, 2= 4-7 children
X_5 = Age of children (AGE)
1= 6-12 months, 2=13-24 months, 3=25-36 months, 4=37-48 months,
5=49- 60 months, 6= 61-71 months.
X_6 = Duration of breast feeding (DURBRF)
1= less than 6 months, 2= 6-12 months, 3= 13-18 months, 4= 19-24 months,
5= 25 months and above.
X_7 = Have the children been attacked by diarrhoea during last 3 months (DIARR3)
1= yes, 2= no

Logistic regression analysis

In this analysis, dependent variable is the nutritional status (stunting, wasting, under weight) of children which takes value 1 for those children who had nutritional problems i.e., who were stunted or wasted or under weight and 0 for those who were normal.

Here the explanatory variables are defined as follows:
X_1 = Family size (FAMSIZE)
0= 3-5 members, 1= 6-9 members
X_2 = Total family income (TOTFINC)
0= Tk. 4001 and above, 1= Tk. less than or equal to 4000
X_3 = Education level of mothers (EDNM)
1= Illiterate to class V, 2= class VI to S.S.C., 3= H.S.C. and above
X_4 = Number of live births by mothers (NOLBM)
0= 1-3 children, 1= 4-7 children
X_5 = Age of children (AGE)
1= 6-12 months, 2=13-24 months, 3=25-36 months, 4=37-48 months,
5=49- 60 months, 6= 61-71 months
X_6 = Duration of breast feeding (DURBRF)
0= less than or equal to 12 months, 1= 13 months and above
X_7 = Attacks of diarrhoea in the last 3 months (DIARR3)
0= no, 1= yes

Results and Discussion

Socio-economic condition

From the analysis it was found that about 72% family consists of 3-5 members, 27% consists of 6-8 members and the family with 9 or more members are very few. So the people of this study are conscious of keeping their family size small. Again number of children under six years of age were in good position, 88.33% family has only 1 child under six years, 10.33% family have 2 children and 1.33% family consists of 3 children under six years of age (Table 1).

Table 1: Percent distribution of children under six years

No. of children	No. of family	Percentage
1	265	88.33
2	31	10.33
3	4	1.33
Total	300	100.00

Table 2: Percent distribution of educational qualification of parents

	Father		Mother	
Education	No. of father	Percentage	No. of mother	Percentage
No schooling	06	2.00	15	5.00
Class I-V	21	7.00	36	12.00
Class VI-X	52	17.33	73	24.33
S.S.C.	61	20.33	51	17.00
H.S.C	46	15.33	64	21.33
Graduate and above	124	41.33	61	20.33
Total	300	100.00	300	100.00

Table 3: Percent distribution of occupation of parents

	Father			Mother	
Occupation	No. of father	Percentage	Occupation	No. of mother	Percentage
Officer	66	22.00	Officer	15	5.00
Staff	102	34.00	Doctor/Teacher	16	5.33
Labor	132	44.00	Sraff	04	1.33
			Health worker	15	5.00
			House wife	250	83.33
Total	300	100.00	Total	300	100.00

Table 4: Percent distribution of family income

Income level (in Tk.)	No. of family	Percentage
Less than 4,000	102	34.00
4,001-7,000	138	46.00
7,000 and above	60	20.00
Total	300	100.00

Educational level of parents is highly associated with nutritional status of children. The higher the level of education of parents the lower is the under nutrition of the children. It was found that among fathers 2% were illiterate, 17.33% were under S.S.C. level, 20.33% were S.S.C.

Table 5: Percent distribution of children fed colostrum by their mothers

Colostrum	No. of children	Percentage
Given	308	90.8
Non-given	31	9.2
Total	339	100.00

Table 6: Percent distribution of children according to the duration of breast feeding

Time (in month)	No. of children	Percentage
Less than 6	33	9.73
6-12	139	41.00
13-18	66	19.47
19-24	71	20.94
25 and above	30	08.55
Total	339	100.00

Table 7: Nutritional status of children by Waterlow classification by sex

	Both sex		Male		Female	
Nutritional status	N	%	N	%	N	%
Normal	177	52.11	101	52.33	76	52.05
Stunted but not Wasted	114	33.62	66	33.62	48	32.87
Wasted but not stunted	26	7.67	14	7.67	42	8.22
Stunted and wasted	22	6.45	12	6.45	10	6.85
Total	339	100.00	193	100.00	146	100.00

Table 8: Nutritional status of children by Gomez classification by sex

	Both sex		Male		Female	
Nutritional status	N	%	N	%	N	%
Normal	90	26.55	52	26.44	38	26.02
Mild (1st degree)	135	39.82	80	41.45	55	37.62
Moderate (2nd degree)	93	27.43	50	25.90	43	29.45
Severe (3rd degree)	21	6.19	11	5.70	10	6.84
Total	339	100.00	193	100.00	146	100.00

holder, 15.33% were H.S.C. holder and 41.33% had graduate and above degrees. Among mothers 5% were illiterate, 36.33% were under S.S.C. level, 17% were S.S.C. holder, 21.33% were H.S.C. holder and 20.33% had graduate and above degrees. It indicated that in this study area most of the parents are literate (Table 2).

Table 9: Nutritional status of children by (based on MUAC) by sex

	Both sex		Male		Female	
Nutritional status	N	%	N	%	N	%
Normal	213	62.83	121	62.70	92	63.01
Moderate	78	23.00	45	23.32	33	22.66
Severe	37	10.91	21	10.88	16	10.95
Very severe	11	3.24	0.6	3.51	05	3.42
Total	339	100.00	193	100.00	146	100.00

Table 10: Nutritional Status of Children by Sex According to Working Status of Mother (Waterlow Classification)

	Working mother			Non- working mother		
Nutritional status	Both sex (%)	Male (%)	Female (%)	Both sex (%)	Male (%)	Female (%)
Normal	34 (62.96)	20 (64.52)	14 (60.81)	143 (60.81)	81 (50.18)	62 (51.2)
Stunted	15 (27.78)	09 (29.03)	06 (26.09)	99 (26.09)	57 (34.79)	42 (34.15)
Wasted	04 (7.41)	02 (6.45)	02 (8.69)	22 (8.69)	12 (7.72)	10 (8.18)
Stunted and wasted	01 (1.85)	02 (8.69)	01 (4.35)	21 (4.35)	12 (7.37)	09 (7.31)
Total	54 (100.00)	31 (100.00)	23 (100.00)	285 (100.00)	162 (100.00)	123 (100.00)

Table 11a: Regression analysis using height-for-age percentage (HFAP) as dependent variable

Multiple R = 0.8359 R^2 =0.69874
Adjusted R^2 = 0.69968 Standard error = 6.89554

Variable	β	SE(β)	T	Sig T
FAMSIZE	-1.2017	2.2362	-0.537	0.5914
TOTFINC	1.1357	0.54339	2.092	0.0381
EDNM	1.37911	0.62467	2.208	0.0280
NOLBM	-0.50913	0.364725	-1.396	0.1637
AGE	-1.81668	0.24784	-7.330	0.0000
DURBRF	1.0645	0.54173	1.955	0.0499
DIARR3	-0.83185	0.89293	-0.932	0.3522
Constant	19.1769	3.14289	6.1017	0.0000

Occupation is specially related to the socio-economic condition of a family. The income of a family depends on the occupation of the father, mother and other family members. The income of father along with mothers income increase the standard of living in a family. We found that among fathers of the children under study, 22% were officers, 34% were staffs and 44% were laborers. And among mothers 5% were officers, 5.33% doctors/teachers, 5% health workers and

Table 11b: Regression analysis using weight-for-age percentage (WFAP) as dependent variable

Multiple R = 0.75654			R^2 = 0.57236	
Adjusted R^2 = 0.57218			Standard error = 6.56327	
Variable	β	SE(β)	T	Sig T
FAMSIZE	-3.0101	2.7105	-1.111	0.2676
TOTFINC	4.71037	1.8648	2.526	0.0120
EDNM	3.4093	1.347	2.531	0.0119
NOLBM	-1.0066	1.02011	-0.987	0.3245
AGE	-1.2400	0.3571	-3.472	0.0006
DURBRF	0.892211	0.907722	0.983	0.3264
DIARR3	-2.8569	0.5699	-5.1023	0.0000
Constant	12.8560	2.19641	5.854	0.0000

Table 11c: Regression analysis using weight-for-height percentage (WFHP) as dependent variable

Multiple R = 0.7895			R^2 = 0.62331	
Adjusted R^2 = 0.62302			Standard error = 7.7744	
Variable	β	SE(β)	T	Sig T
FAMSIZE	-1.3899	2.4589	-0.565	0.5723
TOTFINC	1.24008	0.7218	1.72	0.0847
EDNM	1.3012	0.64543	2.016	0.0452
NOLBM	-0.31102	0.946406	-0.329	0.7426
AGE	-3.40931	0.64311	-5.301	0.0000
DURBRF	2.22401	0.86546	2.570	0.0106
DIARR3	0.54497	2.31703	0.235	0.8142
Constant	21.39943	3.1553	6.782	0.0000

Table 12a: Linear Logistic regression analysis using stunting as a dependent variable

Variable	B	SE(B)	Sig T	Odds ratio
FAMSIZE	-1.2684	0.7318	0.0751	0.9720
TOTFINC	1.1395	0.3251	0.0013	2.8137
EDNM	1.5823	0.5943	0.0065	1.3155
NOLBM	-9.2E-05	0.1139	0.3994	0.9999
AGE	-0.2710	0.0844	0.0013	0.7626
DURBRF	0.7084	0.3568	0.047	1.2596
DIARR3	0.2338	0.3038	0.4415	1.2635
Constant	0.5596	0.9484	0.5551	

Table 12b: Linear Logistic regression analysis using wasting as a dependent variable

Variable	B	SE(B)	Sig T	Odds ratio
FAMSIZE	-1.3120	1.1387	0.178	3.7134
TOTFINC	1.5152	0.8950	0.0176	0.6943
EDNM	1.4981	0.6635	0.0258	1.124
NOLBM	-0.0873	0.2192	0.6905	0.9164
AGE	-1.1206	0.2105	0.0000	3.066
DURBRF	0.2724	0.4164	0.2109	0.8417
DIARR3	-0.5246	0.2582	0.0429	0.6575
Constant	1.1376	1.5769	0.4707	

Table 12c: Linear Logistic regression analysis using under-weight as a dependent variable

Variable	B	SE(B)	Sig T	Odds ratio
FAMSIZE	-0.3935	0.4251	0.3177	0.7092
TOTFINC	0.7084	0.3569	0.0471	0.4924
EDNM	3.3581	1.9281	0.0821	0.8939
NOLBM	-2.6923	0.8834	0.0025	1.1465
AGE	-2.4589	0.7771	0.0018	1.0405
DURBRF	1.2167	0.9874	0.2023	1.0058
DIARR3	-0.8184	0.3156	0.0102	0.9192
Constant	1.1790	1.0772	0.2737	

83.33% were housewives (Table 3). In this study area, it was found that many graduates and post-graduate women are not in service. When they were questioned, why they did not do jobs, they replied that their husbands are not interested or they do not get suitable jobs.

The income of a family is the indirect measure of household food security that is an important factor in determining nutritional status of children. The monthly income of 46% family is between Tk. 4,001-7,000, 34% family has income less than or equal to Tk. 4,000 and 20% family has income more than Tk. 7,000 and above (Table 4).

Nutritional status of children of a family varies according to the place of residence. This study area comprising different types of buildings accommodated officers, staffs and employees. All the residents use supplied water and enjoyed sanitary latrine facilities. So, same answer was derived from all respondents. Finally, it can be concluded that the socio-economic condition of the people of our study area is better than that of the general people of our Bangladesh.

Awareness of mothers about nutrition

In this study, we try to get information relating to the awareness of mothers on nutrition such as kind of food was given to the baby to make them healthy, whether the baby was given breast milk and colostrum, duration of breast feeding, type of treatment received by children during illness, use of contraceptive by mothers etc.

About 80% mothers gave supplementary food for their children at age 5-7 months and 15.7% gave at age 2-4 months. From relevant studies it was found that supplementary food should be introduced not either than 4 months or later than 6 months of age of children. So, it can be concluded that in this study area, most of the mothers are aware of time of giving supplementary food to their children.

It was found that 83% mothers used contraceptive to control birth. It can be said that in this study area, most of the mothers are aware of keeping their family size small. The mothers bear the knowledge on the benefit of family planning for them and for their children.

A mother plays central role in taking primary care of her children. About 56% mothers spend 6.5-8 h of time for taking care of their children and 40% mothers spend 4.5-6 h and only 3.3% mothers spend 1-4 h of time. On an average the mothers spend 6 h time for child's care.

Colostrum is very essential for the children to prevent various kinds of diseases. Its nutritious value is more as compared to that of normal breast milk. We found that 90.8% children were given colostrum after birth while 9.2% were not given (Table 5). Therefore, the mothers of study area know the benefit of feeding colostrum to their children.

Breast feeding is one of the most powerful forces for enhancing child survival because it has more nutritional value and anti- infective properties. Breast feeding has a significant impact in promoting healthful birth spacing. It is seen that 9.73% children were given breast feeding for less than 6 months, 41% children were given for 6-12 months, 19.47% given for 13-18 months and 20.94% were given up to 24 months (Table 6). It was indicated that in our study area, maximum mothers bear the knowledge on how long the child should be breast-fed.

The infant mortality rate is 78 per thousand live births in Bangladesh (BBS'95). Newly born babies are attacked by various serious diseases like measles, diarrhoea, dyptheria, polio, T.B etc. We can prevent these diseases by immunizing the children. It was found that 96.15% children are immunized. It may be mentioned that, in our study place, the children under six are immunized on the 1st and 3rd Tuesday of every month through BRAC (Bangladesh Rural Advancement Committee). So, almost all mothers get their children immunized.

Nutritional status of children

Results showed the Waterlow classification of nutritional status of children by sex, which takes into account height-for-age as well as weight-for-height. From this data, it was found that in this study place, 52.11% children were normal, 33.62% were stunted and 7.67% were wasted (Table 7). The percentage of normal, stunted and wasted children according to sex was not so much different.

According to Gomez classification of nutritional status of children by sex, it was found that the prevalence of normal, mild, moderate and severe malnutrition were 26.55, 39.82, 27.43 and 6.19% respectively (Table 8).

It was found that according to classification based on MUAC, 62.83% children were normal and only 3.24% children were very severe under nourished. The percentage of moderate and severe under nutrition was found 23 and 10.91% respectively among the children under study (Table 9).

Again from Waterlow classification of nutritional status of children by sex according to working status of mother, it was found that 62.96% children were normal for working mother while 50.18% children were for non-working mother. Similarly, stunted were 27.78 and 34.79%, wasted 7.41 and 7.72 respectively (Table 10). From binomial proportion test we see that there was no significance difference between working and non-working mothers with respect to the proportion of stunted, wasted and under weight children in our study.

In order to investigate the association between the nutritional status of children and factors affecting this, test of independence in a contingency table has been performed. It has been found that occupation of fathers, education level of mothers, total family income, duration of breast feeding and attacks of diarrhoea in the last 3 months are associated with the nutritional status of children.

Multiple regression analysis

Analysis showed that total family income, education level of mother and duration of breast feeding have positive relationship with HFAP. Family size and age of children have negative relation with HFAP (Table 11a). The results of regression analysis using weight-for-age (WFAP) as the dependent variable indicated that total family income and mothers level of education have positive impact on WFAP. Age of children and attacks of diarrhoea in the last three months have negative impact on WFAP (Table 11b).

From the results of regression analysis using weight-for-height percentage (WFHP) as the dependent variable, we see that total family income, education level of mothers and duration of breast feeding have positive relationship with WFHP. Age of child has negative relationship with WFHP (Table 11c).

Logistic linear regression analysis

From the results it was found that total family income, education level of mothers and duration of breast feeding have positive impact on nutritional status (stunting) of children (Table 12a). On the other hand the family size and age of children have negative impact. Total family income and education level of mothers have positive effect on nutritional status (wasting) of children while age of children and attacks of diarrhoea in the last three months have negative effect (Table 12b).

Again from the data, we found that total family income and education level of mothers have positive relationship with nutritional status (under weight) of children and attacks of diarrhoea in the last 3 months has negative relationship (Table 12c).

The results of the analysis indicated that parental education (especially maternal education), family size, number of live births, working status of mother have significant impact on child nutrition. Therefore priority should be given for universal female education. So, the present incentive given by the government for female education up to higher secondary level should be increased. People should be encouraged to keep their family size small. To increase nutritional knowledge of the people effective propaganda and motivational program should be accelerated. Mass media like radio, television and newspapers should be used for this purpose. Consideration should be given to create more employment opportunities with suitable working hours and to establish day care center for the welfare of the working mothers as well as their children.

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