Original Article

Economic Disparity and Child Nutrition in Bangladesh

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Abstract. ***Objective:*** The aim of this study was to assess the economic difference in nutrition of under-five children. ***Methods:*** Bangladesh Demographic Health Survey data 1999-2000 were used for this study. In this study, quintiles were calculated on the basis of asset and wealth score by use of principal component analysis. To understand the nutrition status and health inequality concentration index was also calculated. ***Results:*** The ratio of poorest to the richest indicates that stunting and underweight of the rural under-five children was almost two times higher than that of the richest children. The negative concentration index shows that higher rate of malnutrition among the under-five children from the poorest class. This inequality in health situation of the children can be explained in terms of income inequality. In Bangladesh, about 40% wealth is concentrated to 10% of the families. The results are discussed in terms of policy consideration. ***Conclusion:*** It is expected that the findings will lead to consider alternative program strategies for the reduction of poor nutritional status of the children and their mothers. **[Indian J Pediatr 2005; 72 (6) : 481-487]** *E-mail : giash16@yahoo.com*

Key words: *Economic inequality; Child nutrition; Concentration index; Tangible wealth; Factor score; Principal component analysis*

Almost everywhere the poor suffer poor health and the very poor suffer appallingly. In addition, the gap in health between rich and poor remains very wide – as it does also between other advantaged and disadvantaged groups. Poor health is a common consequence of poverty and poverty can be a consequence of poor health. This vicious cycle takes its inexorable toll. Analysis of the Bangladesh Household Income Expenditure Survey data of 2000[1] suggests that about 45% of the population lives below poverty line and per capita income was 370 US dollars in 2001.[2] This is also supported by the landless statistics. The Household Income Expenditure Survey of 2000 showed that overall 61% of the households have less than 0.50 acres of land[1]. The indepth analysis of Household Income Expenditure Survey data by the Sustainable Development Unit of Planning Commission showed that about one fifth the population is socially integrated i.e. have met the basic needs adequately.[3] By urban and rural the percentages of people who met basic needs adequately are about 40% and 12% respectively. Per capita income by self related poverty index estimated by Sen indicated that about 31% of the households were self-sufficient and little over 19% were surplus.[4] The income inequality is highly skewed since 10% of the population owned about 40% wealth while poorest 20% of the population owned 6% wealth.[2]

In the context of above economic situation, the purpose of the present study is to investigate the inequality in nutritional status of the under-five children. Available information suggests that prevalence of underweight, stunting and wasting in children and mothers are still 'very high', 'serious' and even 'critical' according to WHO criteria. Anemia is a 'serious' problem in children and moderate problem in non-pregnant mothers. About one quarter of the rural population and up to one-half of the urban slum residents have an energy intake < 1805 kcal/person/day, an indicator of 'extreme' poverty.[5] Health inequality and poverty nutrition has emerged as one of the most important prerequisites for national development. The varying degrees of malnutrition among children determine the child morbidity and mortality rates in the country. The nutritional status of under five children is of particular concern, since the early years of life are crucial for future growth and development. In Bangladesh, national nutrition survey showed a slow decline in the prevalence of stunting among under five children: from 65.5% (<-2 HAZ from the NCHS standard) in 89-90 to 48.8 in 2000.[6,7]

Although numerous studies have established the association between child nutrition and socioeconomic factors in developing counties, little has been said about the socioeconomic inequality and child nutrition. It is well established that there are socioeconomic inequalities in health.[8-10] Malnutrition is highly associated with poverty.[11] Rates of malnutrition are higher in poor countries than better-off countries. Within countries, poor children suffer from higher rates of malnutrition than better-off children do.[12]

The aim of this paper was to investigate the economic differences of malnutrition of the under-five children in Bangladesh. Socio-economic differentials were also

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presented to understand the nutrition status of the children.

MATERIALS AND METHODS

Data sources

The data for the article were derived from the Bangladesh Demographic and Health Survey (BDHS) 1999-2000[7]. A total of 5419 children aged under-five years were included in the analysis. Anthropometric measures for each child were obtained in the survey.

Variables used in the analysis:

A. Anthropometrical. *Child weight in kilogram, Height-for-age Z-score, Weight-for-age Z-score.*

B. Morbidity. *Fever, diarrhea, cough and short and rapid breathe within last two weeks*

C. Socioeconomic and Demographic. *Mother's age at birth, Child age in months, Sex of the child, Type of residence*

D. Environmental. *Type of housing, source of drinking water and type of latrine used by household*

E. Reproductive dynamics. *Birth order and preceding birth interval of the index child*

F. Breastfeeding. *Time of initiation of breastfeeding, whether gave child plain water, sugar water, baby formula, fresh milk etc.*

G. Tangible wealth. *Television, Radio, Bicycle, Motorcycle and Electricity*

H. Mass Media Access. *Reads newspaper once in a week, Watches TV every week, listen to radio every week*

Measurement of Inequality

This study used a proxy measure of socioeconomic status of women in terms of assets or wealth (Poorest, Second, Middle, Fourth, Richest) rather than in terms of income or consumption.[13,14] Information regarding the household items (i.e. television, radio or car) and dwelling characteristics such as floor materials, sources of drinking water was assigned a weight or factor score generated through principle component analysis (Appendix-A). The resulting scores were distributed normally with mean zero and standard deviation one. Each household was assigned a standard scores for each asset. Standard household score were added up for each household, and each woman was assigned the total household asset score for her household. Women were ranked according to their total scores and divided five quintiles to understand the nutrition and health inequality.

Measurements of stunting and underweight inequality

Nutritional status of the children and inequality were measured in terms of quintiles. The stunting rate of poorest quintile (Q_1) was expressed as a ratio of richest quintile (Q_5). The inequality in malnutrition was explained with the help of concentration curve. The curve labeled L(p) in Fig. 1 is a malnutrition (stunting) concentration curve. It plots the cumulative proportion of malnourished children (on the y-axis) against the cumulative proportion of children (on the x-axis), ranked by equivalent household wealth score, beginning with the most disadvantaged child. The numerical measure of inequality in malnutrition was measured by the *concentration index* [15-17] defined as twice the area between L (p) and the diagonal. So, in the case where there is no income related inequality the concentration index is zero. The convention is that the index takes a negative value when the curve takes above the line of equality.

The concentration index is similar to the Gini's coefficient frequently used in the study of income inequalities and health status of a population. The closer is the index to zero for any health indicator, the less is the concentration of wealth inequality for that indicator. One the other hand if the index is away from zero, it means the greater is the inequality in the nutritional status of the children. The concentration curve shows inequality in nutritional status of the children as supported by the quintiles of ratio of richest to the poorest quintile. To assess the nutritional inequality, greatest weight was given to the concentration indices, as it reflects the degree of inequality across all socioeconomic quintiles. It also provides a means of testing the significance of inequalities in malnutrition.

RESULTS

Malnutrition (Stunting and Underweight) rate for under-five children by different characteristics in the first, third and fifth quintiles (referred to low, middle and high socioeconomic status) of assets index is shown in table 1. Due to shortage of space two intermediate quintiles (second and fourth) are not shown in the table. The malnutrition rate was consistently highest for those living in the poor family (first quintile). For example, a poor-rich ratio of 1.88 for urban children implies that stunting rate in the poorest quintile is about twice the rate of the richest. In the rural area the ratio poorest to the richest in stunting is 1.95 suggesting there is no much difference in stunting between rural and urban children. This information indicates that nutrition situation for the urban poor children would be worse in the future because of rapid urbanisation and urban poverty would increase particularly in the urban slums where the quality of life is extremely poor.

The pattern was almost similar in the case of stunting and underweight. Table 1 shows not only malnutrition declines with living standard but it also shows that how much the poor suffer from malnutrition than the better off. For example, in rural area rate of stunting among the lowest quintile was about 55% as opposed to about 49% and 28% in the third and fifth quintile respectively. Similarly, inequality in other indicators is shown in Table 1.

The quintiles for stunting declined to about 28% for the richest class. The quintiles among various characteristics such as the first and the fifth quintiles simply reflected the

TABLE 1. Nutritional Inequality by Socio-economic and Demographic Characteristics

Background Characteristics			Stunting					Under-weight				
			Q_1	Q_3	Q_5	Total	Q_1 / Q_5	Q_1	Q_3	Q_5	Total	Q_1 / Q_5
Place of residence		n										
	Urban	893	51.4	45.2	27.4	35.5	1.88	64.7	54.0	29.4	40.1	2.20
	Rural	4526	54.5	48.8	27.9	46.8	1.95	57.8	51.3	33.7	49.6	1.72
Child sex												
	Male	2751	54.1	46.4	28.0	43.9	1.93	57.4	48.6	29.8	46.1	1.93
	Female	2668	54.7	50.7	27.4	45.8	2.00	58.7	54.7	33.0	50.0	1.78
Put breast milk												
	<1 hr	1908	51.5	47.3	23.5	41.4	2.19	55.3	48.6	28.9	44.1	1.91
	≥1 hr	3464	55.4	49.2	31.3	47.0	1.77	59.4	52.8	33.0	50.2	1.80
Birth order												
	1	1524	61.4	49.6	28.2	43.9	2.18	63.3	54.9	31.9	47.8	1.98
	2-3	2301	49.1	42.8	25.5	41.5	1.93	54.6	47.9	27.9	44.5	1.96
	≥ 4	1594	55.6	54.6	32.6	50.8	1.71	58.5	53.2	39.1	53.4	1.50
Birth interval (months)*												
	<24	616	54.8	55.6	30.7	52.8	1.79	59.7	58.3	33.3	54.8	1.79
	24-35	1030	56.8	54.0	30.9	50.4	1.84	54.9	55.8	36.4	51.2	1.51
	36-47	926	48.7	45.8	28.7	45.8	1.70	53.8	45.8	36.6	47.8	1.47
	≥ 48	1316	49.4	40.8	24.2	37.6	2.04	56.3	45.2	26.6	44.8	2.12
Breastfeeding type												
	Exclusive	333	22.5	16.5	8.6	14.5	2.62	18.1	13.4	5.2	11.1	3.48
	Supplementary	1709	50.8	43.7	21.4	36.0	2.37	54.1	51.4	26.6	42.1	2.03
	Water/others	3345	55.9	50.8	38.3	50.4	1.46	64.3	55.8	42.7	55.9	1.51
Mothers age at birth												
	<25 yrs	2528	54.0	46.5	29.5	44.5	1.83	57.9	51.8	32.9	47.7	1.76
	≥25 yrs	2891	54.7	50.4	26.4	45.2	2.07	58.1	51.2	30.0	48.2	1.94
Morbidity												
	No	4400	54.0	49.5	26.9	44.4	2.01	57.2	51.6	29.9	46.9	1.91
	Yes	1017	55.8	44.5	32.2	47.1	1.73	60.6	51.2	39.6	52.9	1.53
Mass media access												
	No	3030	55.4	49.8	41.0	51.0	1.35	59.3	51.8	41.6	53.6	1.43
	Yes	2386	49.5	46.2	25.0	37.1	1.98	51.7	51.1	29.3	40.8	1.76
	Total	5419	53.4	48.0	25.3	44.9	2.11	58.0	51.5	31.4	48.0	1.85

"*Sample size of first-born is not shown here."

magnitude of the gap existing between the poorest and the richest. The results showed that there were differences in nutritional inequality for all demographic and socioeconomic variables. Nutritional inequality was higher among the children of mothers whose preceding birth interval was greater than and equal to 48 months; for first birth order and for the exclusive breastfeeding children.

Appendix table A shows the assets and factors score. As evident from the appendix table A 32.0% of the households had access to electricity. 89.9% of the rich households had access to electricity respectively. Similarly, 62.6% and 67.2% of rich had the radio and television. An overall of 4.6% household had the pipe drinking water. It was observed that 23.0% rich had access to piped drinking water whereas poor had no access. 100.0% poor people were using tube well water. 10.1% of the households had sanitary latrine. Most of the poor were using pit and open place for their defecation. About 15.4% of the households floors and 9.0% roofs were made of cement which belonged to the rich. In terms of quintile there are significant variations among households belonging to different quintiles. For instance, none of the household had access to electricity and television while only about 13% had access to radio in the first two quintiles (Q_1 and Q_2) indicating magnitude of the poverty in the poorest households. Similarly, asset and factor score for other characteristics of the households can be found from this table.

Fig. 1 presents the concentration curve, where health variable is stunting (percentage of height-for-age z-score) status of all children. Since the curve lies above the

diagonal line it is indicative of stunting favored among the poor children than amongst the better off.

Table 2 reveals concentration indices alongwith standard error for stunting and underweight among the children by wealth score. Negative concentration index shows that there was higher rate of malnutrition among the poor. Concentration index for stunting children was -.155 which implied that better off children had a tendency to be taller (better nourished) than poor children. For the statistical significance t-statistics had been used. The statistical test of significance suggested that inequalities in stunting and underweight in all covariates were statistically significant except for preceding birth interval.

Fig 2 and 3 shows the comparison of 10th, 50th and 90th percentiles of observed weights at different ages of children with those of the NCHS standard. The figures for both boys and girls revealed that Bangladeshi children upto 3 months of age had achieved levels of growth

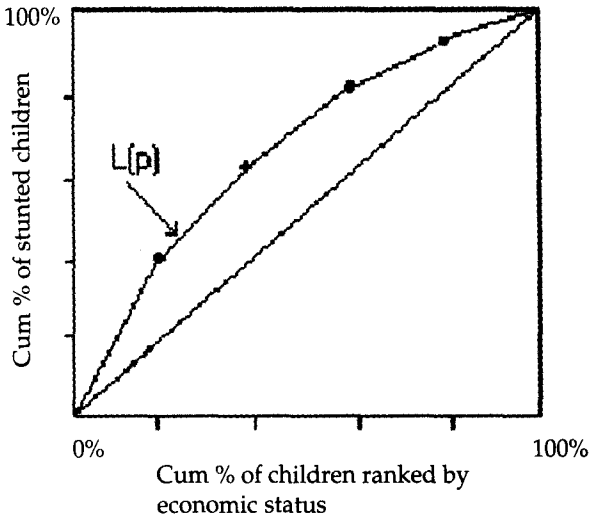

Fig. 1. Malnutrition (stunted) Concentration curve

TABLE 2. Nutritional Inequality in Stunting and Underweight Measured in Terms of Concentration Index

Background Characteristics		Stunting			Under-weight		
		Con. Index	St. error of CI	t-value	Con. Index	St. error of CI	t-value
Place of residence							
	Urban	-.142*	.039	-3.66	-.175	.067	-2.61
	Rural	-.139**	.026	-5.31	-.129**	.018	-7.01
Child sex							
	Male	-.136**	.024	-5.73	-.142**	.022	-6.39
	Female	-.145*	.033	-4.35	-.135*	.019	-4.69
Put breast milk							
	<1 hr	-.165*	.039	-4.25	-.155**	.024	-6.52
	≥1 hr	-.120**	.022	-5.39	-.128**	.023	-5.48
Birth order							
	1	-.166*	.036	-4.56	-.157**	.031	-5.11
	2-3	-.150*	.037	-4.03	-.152**	.027	-5.17
	≥4	-.098	.036	-2.77	-.092**	.028	-5.06
Birth interval (months)							
	<24	-.096	.064	-1.50	-.125	.04	-2.71
	24-35	-.117	.033	-1.58	-.086	.033	-2.39
	36-47	-.108	.042	-2.57	-.110*	.023	-4.78
	≥48	-.175**	.019	-9.36	-.160**	.031	-5.18
Breastfeeding type							
	Exclusive	-.283*	.075	-3.75	-.130**	.022	-5.83
	Supplementary	-.188**	.035	-5.15	-.146**	.029	-5.08
	Water/others	-.086	.013	-6.76	-.371*	.102	-3.62
Mothers age at birth							
	<25 yrs	-.121**	.024	-5.01	-.154*	.044	-3.69
	≥25 yrs	-.157*	.035	-4.46	-.101***	.007	-14.0
Morbidity							
	No	-.143*	.033	-4.35	-.088***	.006	-14.0
	Yes	-.123**	.018	-6.69	-.137*	.041	-3.33
Mass media access							
	No	-.071**	.005	-13.5	-.108**	.016	-6.64
	Yes	-.156*	.039	-3.99	-.144**	.028	-5.14
Total	-.155**	.030	-5.11	-.138**	.023	-5.89	

*p<.05, **p<.01, ***p<.001; CI= Concentration Index

roughly corresponding to (NCHS) growth standard. The better growth of the children up to three months of age may be attributed to exclusive breastfeeding campaign over the last one decade. After three months of age, the growth of children declined sharply because the poor households fail to maintain growth of the children due to poverty.

DISCUSSION

Inequality in nutrition status of the under-five children by using the wealth index developed by the World Bank was investigated. In addition, traditional measure of

Appendix A. Asset and Factor Score

1. List of asset and factor score

Asset variables	Mean	S.D.	Q_1	Q_2	Q_3	Q_4	Q_5	Total	Asset factor score	Asset has	Asset doesn't have
Household Items											
Has electricity	0.3198	0.4664	-	0.4	16.9	51.5	89.9	32.0	0.1229	0.1792	–0.0843
Has radio	0.3165	0.4651	2.8	10.7	26.7	54.7	62.3	31.7	0.0736	0.1082	–0.0501
Has television	0.1749	0.3799	-	-	0.9	19.8	67.2	17.5	0.1272	0.2763	–0.0586
Has bicycle	0.2029	0.4021	3.4	17.9	16.6	34.1	30.7	20.3	0.0269	0.0533	–0.0136
Sources of drinking water											
Pipe drinking water inside	0.0465	0.2104	-	-	-	0.1	23.0	4.6	0.1055	0.4781	–0.0233
Piped drinking water outside	0.0146	0.1198	-	-	-	2.2	5.1	1.5	0.0291	0.2394	–0.0035
Tube well	0.9027	0.2963	100.0	97.1	92.6	92.1	70.3	90.3	–.0818	–0.0269	0.2492
Surface water	0.0098	0.0984	-	2.0	2.0	0.7	0.2	1.0	–.0071	–0.0714	0.0007
Rain/river water	0.0261	0.1595	-	0.9	5.3	4.9	1.4	2.6	–.0048	–0.0293	0.0008
Other source of drinking water	0.0004	0.0188	-	-	0.1	-	0.1	-	.0015	0.0798	0.0000
Toilet facility											
Septic tank	0.1012	0.3013	-	-	-	5.5	45.2	10.1	.1217	0.3630	–0.0409
Pit latrine	0.1829	0.3862	10.6	33.1	19.5	22.5	8.4	18.3	–.0251	–0.0531	0.0119
Water-sealed/slab	0.2575	0.4369	-	9.1	39.6	43.8	32.2	25.7	.0159	0.0270	–0.0094
Open place	0.2261	0.4180	16.7	40.5	25.1	20.2	13.3	22.6	–.0206	–0.0381	0.0111
Hanging latrine	0.0325	0.1772	7.7	1.3	4.4	1.7	0.4	3.2	–.0158	–0.0863	0.0029
Bush	0.1991	0.3990	64.8	16.0	11.2	6.4	0.6	19.9	–.0562	–0.1128	0.0280
Other type latrine	0.0008	0.0280	0.2	-	0.1	-	-	0.1	–.0030	–0.1071	0.0001
Floor material of houses											
Floor bamboo	0.8421	0.3646	100.0	100.0	100.0	99.4	22.0	84.2	–.1595	–0.0691	0.3684
Floor wood	0.0040	0.0628	-	-	-	0.5	1.5	0.4	.0076	0.1205	–0.0005
Floor cement	0.1539	0.3608	-	-	-	0.1	76.4	15.4	.1599	0.3750	–0.0682
Wall material of Houses											
Wall cane	0.6129	0.4870	99.6	98.8	64.6	40.1	7.6	61.3	–.1110	–0.0882	0.1397
Wall rudimentary	0.0282	0.1655	-	0.2	6.0	5.9	1.3	2.8	–.0049	–0.0288	0.0008
Wall brick	0.1693	0.3750	-	-	-	8.0	76.6	16.9	.1508	0.3341	–0.0681
Wall tin	0.1856	0.3888	-	.2	28.9	45.8	14.4	18.6	–.0034	–0.0071	0.0016
Wall others	0.0042	0.0643	0.4	0.7	0.6	0.3	0.1	0.4	–.0052	–0.0805	0.0003
Roof materials of Houses											
Roof bamboo	0.2046	0.4034	64.1	19.1	12.3	5.6	1.0	20.5	–.0567	–0.1118	0.0288
Roof tin	0.7044	0.4563	35.7	80.8	87.0	86.7	62.2	70.4	–.0203	–0.0132	0.0313
Roof cement	0.0902	0.2864	-	-	0.7	7.7	36.7	9.0	.1124	0.3571	–0.0354
Roof others	0.0007	0.0258	0.2	0.1	-	-	0.1	0.1	–.0024	–0.0930	0.0001

2. Cut off point for wealth quintiles

Quintiles	Cut-off points
Poorest	Lowest to –0.6447099
Second	–0.6447099 to –0.5296387
Middle	–0.5296387 to –0.2660264
Fourth	–0.2660264 to 0.3451856
Richest	.3451856 to Highest

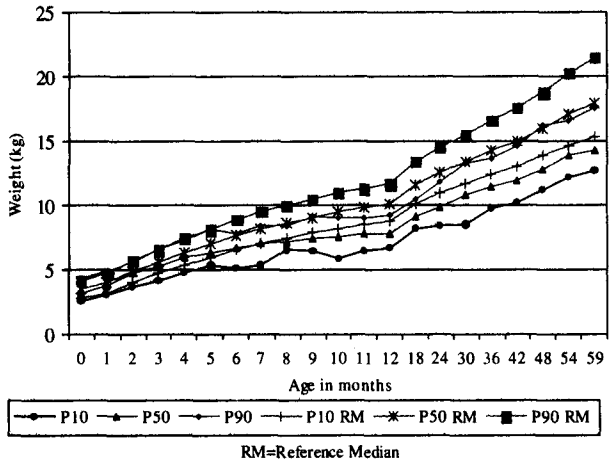

Fig. 2. Comparison of weight with NCHS standard of Bangladeshi boys

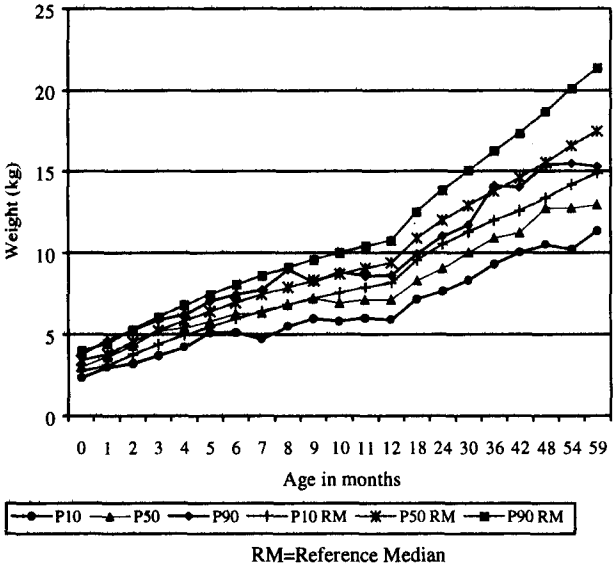

Fig. 3. Comparison of weight with NCHS standard of Bangladeshi Girls

concentration index was also applied to measure the extent of income inequality. The quintiles show the inequality in nutrition status between the richest and the poorest which was statistically significant. The malnutrition rate is two times higher among the poorest than that of the richest. This result was similar to that of Gwatkin *et al.*[13] Previous study showed that children living in poverty (i.e. lower family income) were more likely to be malnourished than the children of higher income families.[18] The concentration index showed the degree of inequality across the socioeconomic quintiles. The results demonstrated the gap existed in health status between the poorest and the richest. For instance, underweight of the rural poor male children was almost double of the richest group. The sex differential suggested that female children were better off than the male children in terms of nutritional status of underweight. The concentration index also supported high negative concentration for male children indicating higher underweight for male children than the female children.

CONCLUSION

The findings indicate the prevalence of high malnutrition among the Bangladeshi children. Direct nutrition interventions are needed to assist those affected by malnutrition, including nutritional rehabilitation and direct feeding program for severely malnourished children. In addition, micronutrient supplementation to prevent and control anemia and vitamin A deficiency among those who are at high risk would help to reduce malnutrition among the children from poorest households. The interventions should be complemented with poverty alleviation strategies including the empowerment of women.

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