Women's involvement in BRAC development activities and child nutrition

Masuma Khatun
Abbas Bhuiya
Mushtaque Chowdhury

Working Paper No. 30

BRAC-ICDDR,B Joint Research Project
Dhaka, Bangladesh

1998

FOREWORD

Empirical evidence points to a causal relationship between the socioeconomic status of individuals and communities and their health. Indeed improvement in health is expected to follow socioeconomic development. Yet this hypothesis has rarely been tested; at least it has not undergone the scrutiny of scientific inquiry. Even less understood are the processes and mechanisms by which the changes are brought about.

The Rural Development Programme (RDP) of BRAC is a multisectoral integrated programme for poverty alleviation directed at women and the landless poor. It consists of mobilization of the poor, provision of non-formal education, skill training and income generation opportunities and credit facilities. The programme is the result of 20 years of experience through trial and error. However evaluation of its impact on human well-being including health has not been convincingly undertaken.

The Matlab field station of ICDDR,B is an area with a population of 200,000, half of whom are recipients of an intensive maternal and child health and family planning services. The entire population is part of the Center's Demographic Surveillance system where health and occasionally socioeconomic indicators have been collected prospectively since 1966.

A unique opportunity arose when BRAC decided to extent its field operations (RDP) to Matlab. ICDDR,B and BRAC joined hands to seize this golden occasion. A joint research project was designed to study the impact of BRAC's socioeconomic interventions on the well-being of the rural poor, especially of women and children, and to study the mechanism through which this impact is mediated.

In order to share the progress of the project and its early results, a working paper series has been initiated. This paper is an important addition in this endeavour. The project staff will appreciate critical comments from the readers.

Fazle Hasan Abed
Executive Director, BRAC

Robert M. Suskind
Director, ICDDR,B

ACKNOWLEDGMENTS

This study was done under the auspices of the BRAC-ICDDR,B joint research project, Matlab. The project is currently supported by the Aga Khan Foundation and the Ford Foundation. The BRAC and ICDDR,B are supported by countries and agencies which share their concern for health and development problems of developing countries. Current ICDDR,B and BRAC donors include: the aid agencies of the governments of Australia, Bangladesh, Belgium, Canada, China, Germany, Japan, the Netherlands, Norway, Republic of Korea, Saudi Arabia, Sweden, Switzerland, the United Kingdom and the United States; international organizations including Arab Gulf Fund, Asian Development Bank, European Union, International Atomic Energy Centre, the United Nation's Children's Fund (UNICEF), the United Nations Development Programme (UNDP), the United Nations Population Fund (UNFPA) and the World Health Organization; private foundations including Aga Khan Foundation, Child Health Foundation, Ford Foundation, Population Council, Rockefeller Foundation, NORAD, OXFAM, Pathfinder International, and the Sasakawa Foundation; and private organizations including American Express Bank, Bayer A.G., CARE, Family Health International, Helen Keller International, the John Hopkins University, Procter Gamble, Rand Corporation, SANDOZ, Swiss Red Cross, the University of California Davis, and others.

The authors highly acknowledge the contribution of all the researchers and consultants involved in the joint research team since beginning of the project for their valuable inputs in designing the research, planning and implementing the field work and data analyses. Nevertheless, special thanks go to the interviewers and inhabitants of Matlab whose active and honest participation made this research project a success.

Contents

Abstract

This study explores the effect of women's involvement in BRAC's income and health development activities on the nutritional status of their children aged 6-72 months. MUAC measurements of 1,518 children aged 6-72 months (using TALC) were taken between April-August 1995 under the BRAC-ICDDR,B joint research project in Matlab using a four-cell-study design. Data analysis consisted of both bivariate and multivariate analysis, along with comparison with similar data from a baseline survey done in 1992. Findings reveal that prevalence of severe PEM has decreased significantly from 23.2% to 14.1% among children of BRAC member households ($p<0.05$) during the period between 1992 and 1995. However, among non-member households, the prevalence remained almost unchanged (21.2%). The positive effect of women's involvement in BRAC development activities on their child's nutritional status remained significant even after controlling for age and sex of the child; age, year of schooling and number of living children of the mother; per capita monthly expenditure; MCHFP area; and four study cells during regression procedure. The children, whose mothers were participating in BRAC development activities, were 41% less likely to suffer from severe malnutrition compared to those of non-member ($p<0.05$). However, gender differential in the prevalence of severe malnutrition was very pronounced among the children of BRAC member households ($p<0.05$). This may, in part, be explained by the fact that BRAC does not have gender focused component in its programme. Programmatic implications of these findings are discussed.

Introduction

Nutritional deficiency remains one of the principal health problems in developing countries. In Bangladesh children suffer the worst form of malnutrition. According to World Bank report, four out of ten Bangladeshi babies are born with low birth weight; by the time of their second birthday, nine out ten children become malnourished and six out of ten children under five suffer from moderate to severe malnutrition[1]. It is widely recognised that the immediate determinants of child development and nutrition are food intake and health status[2]. Since women in all parts of the world traditionally have major responsibility for feeding and caring for children, their socio-economic condition is a vital determinant of food intake, health and nutrition of the children[3]. There are some evidences that the income earned by a woman and her control over household resources greatly ensure adequate food consumption and use of available funds for the direct benefit of her children[4,5]. The present study aims at evaluating the impact of women's involvement in BRAC's income and health development activities on their children's nutritional status.

BRAC's development programmes in brief

BRAC is one of the largest non-governmental organizations (NGO) with its multisectoral programmes targeted to the poorest of the poor with special emphasis on women and children. RDP (Rural Development Programme) is a major integrated development programme of BRAC aiming at poverty alleviation and empowerment of the rural poor. Different development interventions of RDP include institution building (village based organization), provision of credit and savings, small holder of livestock and fisheries, income generation for vulnerable group development (IGVGD) and the rural enterprise project. RDP has organized over 2.2 million poor landless people into 62,000 groups called village organization (VO). Currently 95% these VOs are women. RDP also provides functional education, skill and human development training, Human Rights and Legal Education (HRLE) for female participants to make them aware of their own social problems and increase their capability to secure their legal and civil rights. BRAC also provides Non Formal Primary Education (NFPE) for those children, who do not attend or have dropped out from government schools. Currently there are 35,000 NFPE schools run by BRAC and 70% of these school children are girls and 96% of the teachers are women recruited from the perspective villages. Another major component of RDP is Essential Health Care Service (ESC), through which BRAC promotes the use of safe water, sanitation, and health and nutrition education in addition to immunization facilities, family planning and basic curative services for common diseases. These services are delivered by the community female health workers through home visits[6,7].

Inception of BRAC in Matlab

During early 1992, BRAC extended its comprehensive Rural Development Programme (RDP) to 100 villages of Matlab where ICDDR,B has been involved in demographic monitoring and health interventions since 1960s. The availability of ICDDR,B baseline data on the population provides a unique opportunity for longitudinal research on the relationships between socio-economic development and health and well being. ICDDR,B and BRAC decided to avail this opportunity and carried out a collaborative research project in Matlab. As a part of this joint undertaking, BRAC aimed to study the impact of RDP on health and well-being, particularly of women and children and the mechanism of changes, if any (BRAC & ICDDR,B, 1994:5-6). Using this research project data, this paper aimed to assess the extent to which RDP of BRAC has been successful in improving nutritional status of the children whose mothers participated in the development programmes of BRAC. It is important to note that, this study will assess 3 years impact of RDP activities from the start of the programme in 1992 to the date of data collection in 1995. During this 3 year period, except for Human Rights and Legal Education (HRLE) all other component of RDP was in operation.

Methodology

The BRAC-ICDDR,B joint research project in Matlab

The project began with a baseline survey in 60 villages in 1992 (before inception of BRAC in Matlab) and information on health, nutrition, income, employment, women status, literacy and other variables were collected. In 1995, three years after the initiation of the project, three rounds of seasonal surveys were carried out to monitor changes in selected indicators including nutritional status of the programme participants. A four-cell study design was instituted for these seasonal surveys. 14 villages were purposively sampled from the 60 villages. Out of 14 villages, five had both BRAC-ICDDR,B interventions, five had only BRAC, two had only ICDDR,B and two had neither. In Matlab, an embankment (the Meghna-Dhonagoda) was constructed to protect the area from seasonal floods, which categorized the study population according to the location of the villages inside or outside the embankment. The household survey covered approximately 3500 households in each round. For Anthropometrics survey, only a sub-sample of 2076 was randomly selected (approximately 520 from each cell). This study used both the baseline and 1st round of seasonal survey data in order to measure the changes during pre and post intervention period.

The Anthropometrics measurements were taken on all household members aged 6 months and above. The individual who had deformities in leg or spine was excluded from the Anthropometrical survey. Body weight was measured to the nearest 100g using saltier scale for children. Standing height was measured using a special wooden height board made by ICDDR,B. Mid Upper Arm Circumference (MUAC) was measured using MUAC tape (TALC, Teaching Aids Low Cost, St. Albans, England).

Several measures were taken to ensure the quality of the data. The instruments were checked each day before going to the field by the interviewers and team supervisor to ensure the corrections of the data. A separate quality control team resurveyed 5% of the households and the main survey data were cross-checked with the re-survey teams' findings in order to determine the validity of the large survey.

The subjects of this study were children aged 6 to 72 months. Data of 1,518 children were available for analysis. However, when nutrition data were merged with other data from household economic survey, total sample of some variables varied due to missing data.

In this study, MUAC of these children was chosen as a dependent variable. Per capita (adult equivalent) monthly total expenditure and sex of the household head were used as a proxy of socio-economic indicators. Maternal age, year of schooling, along with mothers parity[1] were used as maternal factors; and sex and age of the child were used as individual characteristics which are likely to be associated with the state of a child's nutrition[8,9].

[1] Total number of living children was taken as a proxy indicator of mothers' parity.

Women's involvement in BRAC development activities was expressed as BRAC membership. Length of membership in month; loan size; type of membership categorized as, members who have only savings, members who have both savings and credit and who have savings, credit and training were used as development input variables which are expected to have influence on the nutritional status.

Strength of MUAC measurement to determine nutritional status

The mid-upper arm circumference (MUAC) gives rough estimates of protein (muscle) and energy (subcutaneous fat) stores, which correlate approximately with changes in body weight in malnourished children [10]. MUAC was chosen as the indicator of nutritional status because it compares favourably with other Anthropometrics indices for the assessment of the risk of mortality among children. A recent report suggests that nutritional screening is more accurate when the risk of death is assessed over a short period of time. It was concluded that children who would die within one month of screening could be identified with 94% specificity and 56% sensitivity-- almost twice the sensitivity achieved by the other Anthropometrics indicators for this level of specificity[11]. MUAC is now being increasingly used in identifying children with protein energy malnutrition (PEM)[12]. Also, from Matlab data, MUAC measurements were found more precise and accurate at a field setting compared to other Anthropometrics measurements.

To measure the nutritional status, children were classified into the following levels of nutritional status: severe or third degree PEM represented by MUAC less than 125 mm; moderate or second degree PEM as 125-135 mm; and normal as above 135 mm. The nutritional reference population used here is the US standard adapted for use in developing countries by WHO[13].

Data analysis

The analysis consisted of a simple comparison between groups as to the prevalence of PEM at different levels. First, comparison was made between the children of December 1992 baseline survey (matched with 14 villages out of 60 villages) with December 1995 survey according to BRAC eligibility and four study cells. Second, comparison was made between the children of the BRAC member and non-member households in 1995 and differences (if any) were also assessed by different RDP inputs, such as, length, loan size and depth of membership. Third, comparison was made of the severe PEM among the children of the eligible household (excluding non-eligible households) by BRAC membership status between 1992 (pre-intervention) and 1995 (post-intervention).

Association between malnutrition level (% PEM) and each of the independent variables was examined by bivariate analysis and statistical significance of association was assessed by chi squire tests. A backward stepwise logistic regression was run in order to assess the influence of women's involvement in BRAC development activities on the prevalence of severe PEM of their children by controlling for age and sex of the child; sex of the household head; age, year of schooling and parity of the mother; MCH-FP area; and monthly per capita total expenditure. The SPSS 7.5 software package was used for analysis.

Results

Baseline characteristics of study children

Table 1 summarizes a number of socio-demographic and other factors of the study children. The children were aged between 6 and 72 months, of them 50% were females and 50% were males. 16.1% of the children were severely malnourished. More female children (18.7%) were likely to suffer from severe malnutrition compared to male children (13.6%). 14.1% of the children were from the household headed by female. Majority of the mothers was aged between 26-35 years (49%); of them, 69.2% had no formal education, 22.1% attended primary school. 8.7% had post primary education (two mothers completed graduation). Approximately 68% of the families had 3 and more children. Nearly half (48.6%) of the households' monthly total expenditure was Tk. 500 and above, and as much as 27.3% households monthly expenditure was less then Tk. 400.

The majority of the children, 53.8% were residing inside the embankment, while 44.8% lived within MCH-FP area. 22.5% families of the children were from the BRAC-ICDDR,B cell, 26.1% from BRAC cell, 22.3% from ICDDR,B and 29.1% from Comparison cell.

Statistically significant univariate associations were found between malnutrition level and sex and age of the child; age and year of schooling of the mother; per capita monthly total expenditure; residence in any of the four cells, MCH-FP or non-MCH-FP area and inside or outside embankment. However, sex of the household head and mothers parity did not show any significant association with child malnutrition.

Baseline comparison of PEM (MUAC <135mm.) by intervention area

The trend in prevalence of PEM according to BRAC eligibility during December 1992 to December 1995 of the children from same 14 villages is shown in Table 2. There was an overall trend of reduction in the prevalence of PEM among children in all four cells. There were sharp drop in the prevalence of PEM between 1992 and 1995 ($p<0.05$) only in the BRAC+ICDDR,B and BRAC cells, specifically, among BRAC eligible households. In other words, nutritional status of the children has significantly improved in BRAC villages. Though prevalence was little lower in the ICDDR,B and comparison cell compared to baseline but the difference was not statistically significant.

BRAC 's development activities and child nutrition

Tables 3 and 4 present the mean MUAC and the prevalence of severe PEM of the children by BRAC membership status and length of membership respectively. Results show that the prevalence of severe PEM was significantly lower among children of the BRAC members (12.1%) compared to TG non members (21.7) ($p<0.05$) and there were no differences between BRAC members and NTG non members. Interestingly, nutritional status of the children of the older members, participating for more than 25 months were better (9.4%) compared to the children of those who joined recently, i.e. for less than 12 months and 13-24 months respectively (19.0% and 16.1%) ($p<0.001$). However, according to cumulative loan size and type of membership, no consistent difference were observed (Annex 1 and 2).

Table 5. presents the results of comparison of the severe PEM among the children of the eligible household by BRAC membership status between 1992 (pre-intervention) and 1995 (post-intervention). The prevalence decreased significantly within these 3 years from 23.2% to 14.1% ($p <0.05$) of the children whose mothers became BRAC member. In case of children of non-member households, malnutrition remained almost at same level.

The results for women's involvement in BRAC development activities expressed as BRAC membership and its effect on the prevalence of severe PEM among their children are presented in Table 6. After controlling for confounding variables, BRAC membership was consistently and positively related to child nutrition during the stepwise procedure. The children, whose mothers were participating in BRAC development activities, were 41% less likely to suffer from severe malnutrition compared to those of non-members ($p<0.05$). However, a significant gender differential in the prevalence of severe PEM was found to exist among the children of BRAC member as well as TG non member households ($p<0.05$) but not among NTG non member households (Table 7)

Discussion

This study has shown that the nutritional status of the children of BRAC villages improved significantly between 1992 and 1995. The findings were consistent with a study carried out by BIDS (Bangladesh Institute of Development Studies), where nutritional status was found to be better in BRAC villages compared to BRDB (Bangladesh Rural Development Board) and Grameen Bank. The BIDS study concluded that, since BRAC has both credit and health interventions whereas Grameen Bank and BRDP have only credit interventions, thus improvement of outcome-based nutritional status of the poor may require both income generation opportunities and health interventions[5].

Our study also indicated that the prevalence of malnutrition was significantly lower among children whose mothers participated in BRAC development activities, this was observed even after controlling for other background factors. Now, it is important to provide an understanding of the mechanism that led to improve nutritional status of these children. Since the mothers had direct access to BRAC's credit and income generation activities, the positive effect of BRAC membership may be related to the income, the mother is contributing to the household. A positive effect of maternal income on household food expenditure is the likely cause of increased dietary intake among children. It also may be argued that, programme participation may help to improve a woman's control over resources and consequently her participation in decisions making about household resources. There is some evidence that income earned by women and their control over household resources demonstrate a preference for ensuring adequate food consumption and using available funds for the direct benefit of children [4]. Thus, women's ability to create income and to control resource allocation directly affects the nutritional status of children throughout their growth. Earlier studies conducted using same source of data (BRAC-ICDDR,B joint research project) also reported that the income was increased, women had better control over resources and decision making, and consequently per capita calorie consumption was increased among programme participants compare to non participant households 14,15,16.

However, better food intake alone does not necessarily improve nutritional outcomes, because of the influence of the health environment. The importance of water and sanitary condition, health seeking behaviour and morbidity pattern in relation to nutritional status of the children has been well-documented [8.9]. The Matlab study reported lower morbidity, better hygiene and sanitation practices and health seeking behaviour among participant households compared to non-participants 17. These positive health practices may be related to the fact that these target households are the direct beneficiaries of preventive health inputs along with credit of RDP-EHC of BRAC. Thus, provision of income earning and health services for the poor and it's positive impact on the immediate factors of improved nutritional status, such as food intake and health-seeking behaviour is well evident. This might imply that, the inclusion of women in the process of BRAC's income development activities with the provision of basic health services are the critical factors in the improvement of the health and nutritional status of their children under 6 years of age. However, a high disparity in PEM prevalence among male and female children exists among BRAC member households, the girls being about twice as severely malnourished as the boys. This reflects to a persistent preferential treatment by mothers and other household members in favour of boys. This may, in part, be explained by the fact that BRAC does not have gender focused component in its programme. Thus, it is recommended to incorporate intensive gender focused education component in BRAC programmes to lift up the girls from their very low state of nutrition compared to their male counterparts.

Table 1: Percentage distribution of malnourished children by background characteristics

Variables	Total		Malnutrition Level	
	No. of child	%	Mean MUAC (mm)	% of Severe PEM (MUAC <125 mm)
All children	1518		137.5	16.1
Sex of the child			*p<0.05*	*p<0.01*
Male	759	50.0	138.2	13.6
Female	759	50.0	136.7	18.7
Age of the child (year)			*p<0.001*	*p<0.001*
1	247	16.3	127.8	42.5
2	211	13.8	130.3	30.3
3	262	17.3	135.6	16.8
4	233	15.3	140.5	8.2
5	291	19.2	142.8	2.7
6	274	18.1	145.2	1.8
Sex of the household head			*p<0.32*	*p<0.56*
Male	1306	86.0	137.2	16.2
Female	212	14.0	139.0	15.6
Age of the mother			*p<.08*	*p<0.01*
<25	192	13.8	136.0	22.9
26-30	336	24.1	136.8	19.6
31-35	349	25.0	136.5	16.6
36-40	165	11.8	137.8	13.3
41+	354	25.4	138.8	12.4
Year of schooling of the mother			*p<0.001*	*p<0.05*
No schooling	953	69.2	136.3	18.2
1-5 years	304	22.1	138.2	15.8
5+ years†	120	8.7	141.7	8.3
Mothers parity			*p<0.09*	*p<0.12*
1-2	396	32.1	137.0	18.7
3-6	741	60.1	137.5	15.7
>6	96	7.8	137.2	14.6
Total expenditure (Tk)/capita/month			*p<0.001*	*p<0.05*
<400	368	27.3	135.7	19.0
400-499	324	24.1	136.3	18.8
500+	654	48.6	138.8	14.1
Four study Cells			*p<0.01*	*p<0.001*
BRAC+ICDDR,B	341	22.5	140.1	10.3
Only BRAC	396	26.1	139.1	10.6
Only ICDDR,B	339	22.3	136.6	18.0
Comparison	442	29.1	134.6	24.2
MCH-FP area			*p<0.05*	*p<0.05*
Yes	680	44.8	138.4	14.1
No	838	55.2	136.7	17.8
Embankment			*p<0.01*	*p<0.05*
Inside	816	53.8	136.4	18.0
Outside	702	46.2	138.7	14.0

†Includes two mothers who were graduates.

Note: Total sample of some variables may vary due to missing data.

Table 2: Percentage distribution of malnourished (MUAC<135 mm.) children by programme are and BRAC eligibility in 1992 and 1995

BRAC Eligibility	BRAC-ICDDR,B		BRAC		ICDDR,B		COMPARISON	
	1992	**1995**	**1992**	**1995**	**1992**	**1995**	**1992**	**1995**
Eligible	55.2	29.5*	49.6	25.5*	55.6	40.6ns	56.5	48.0ns
	(289)	(44)	(115)	(102)	(147)	(143)	(376)	(229)
Non-eligible	43.8	26.4*	37.8	27.6*	48.6	47.2ns	47.5	40.2ns
	(155)	(125)	(102)	(195)	(89)	(127)	(215)	(97)
Total (N)	**444**	**169**	**217**	**297**	**236**	**270**	**591**	**326**

** Statistical differences between 1992 and 1995 in each cell, p<0.05; NS=Not significant*

Table 3: Nutritional status of children (6-72 mo.) by BRAC membership status

Indicators	BRAC Eligibility and membership		
	BRAC member (n=273)	TG non-member (n=707)	NTG no-member (n=538)
Mean MUAC	138.5	153.3†	139.8*
% of Severe PEM (MUAC <125 mm)	12.1	21.2	11.5

† Between BRAC member and TG non member p=<0.001,
** Between BRAC member and NTG non member p=NS*

Table 4: Nutritional status of children (6 mo.-72 mo.) by length of membership

Indicators	Length of membership (in month)			
	<12 mo. (n=21)	12-24 mo. (n=62)	25+ mo. (n=139)	TG non-member (n=707)
Mean MUAC	133.5†	136.9*	139.3⌛	135.3
% of Severe PEM (MUAC <125mm)	19.0	16.1	9.4	21.2

† Between <12 mo. and TG non member p=NS
** Between 12-24 mo. and TG non member p=NS*
⌛ Between 25+ mo. @ TG non-member p=<0.001

Table 5: Prevalence of severe PEM among eligible households by BRAC membership status during pre (1992) and post (1995) intervention period

Malnutrition	Year of Survey		
	1992 BRAC Eligible (n=827)	**1995** BRAC Eligible Member (n=184)	**1995** BRAC Eligible Non Member (n=707)
Severe PEM (MUAC<125mm)	23.2	14.1†	21.2*

† Between BRAC Eligible in 1992 and BRAC Eligible Member in 1995 p=<0.01,
** Between BRAC Eligible in 1992 and BRAC Eligible Non Member in 1995 p=<0.01,*

Table 6: Effect of BRAC membership on the prevalence of severe malnutrition among children

Variables	Beta coefficient	Odds ratio	P value
BRAC membership			
TG non member	0.00	1.00	
BRAC Member	-0.53	0.59	0.05
NTG non Member	-0.65	0.52	0.01
Sex			
Female	0.00	1.00	
Male	-0.56	0.57	0.001
Age of the child in month	-0.80	0.45	0.001
Total expenditure/capita/month	-0.001	0.99	0.01
Constant	*1.80*		*0.000*

Note: Table showing only those variables that had significant influence during stepwise regression procedure

Table 7: Gender differential of children in the prevalence of severe malnutrition by BRAC membership status

Sex	BRAC member	TG non member	NTG non member
Male	7.7*	17.7*	11.1NS
Female	16.1	26.4	12.0
All	12.1	21.2	11.5

p value of Male vs. Female, * =p<0.05, NS =Not Significant

Annexes

Annex 1: Nutritional status of children (6 mo.-72 mo.) by cumulative loan size

Indicators	Sex	Cumulative loan size				Statistical test		
		Zero loan (n=39)	Tk. <7500 (n=147)	Tk. >7500 (n=36)	TG non-member (n=538)	1 vs. 4	2 vs. 4	3 vs. 4
		1	2	3	4			
Mean MUAC (mm)	M	139.6	139.2	140.5	136.2	NS	.05	NS
	F	138.0	136.0	138.9	134.4	NS	.05	NS
	All	138.8	137.5	139.8	135.3	NS	.05	.01
% of Severe PEM (MUAC <125 mm)	M	5.0	7.2	10.0	17.7	NS	.05	NS
	F	15.8	10.9	6.3	24.6	NS	NS	NS
	All	10.3	13.6	8.3	21.2	NS	.05	NS

Annex 2: Nutritional status of children (6 mo.-72 mo.) by type of membership.

Indicators	Sex	Type of membership				Statistical test		
		Only savings (n=39)	Savings+ Credit (n=123)	Savings+ Credit+ Training (n=60)	TG non-member (n=707)	1 vs. 4	2 vs. 4	3 vs. 4
		1	2	3	4			
Mean MUAC (mm)	M	139.6	139.3	139.9	136.2	NS	.05	.05
	F	138.0	135.9	137.5	134.4	NS	NS	NS
	All	138.8	137.7	138.6	135.3	NS	.05	.05
% of Severe PEM (MUAC <125mm)	M	5.0	8.1	7.4	17.7	NS	NS	NS
	F	15.8	19.7	12.1	24.6	NS	NS	NS
	All	10.3	13.8	10.0	21.2	NS	NS	NS

References

1. **World Bank Report,** 1995.
2. **UNICEF.** State of world children, 1998.
3. **Roger BL, Youssef N.** The importance of women's involvement in economic activities in the improvement of child nutrition and health. Food Nutr Bull 1988;10:33-41.
4. **Johnson FC, Roger BL.** Children's nutritional status in female-headed households in the Dominican Republic. Soc Sci Med 1993; 37:1293-1301.
5. **Chowdhury OH, Khandkar SR.** Do targeted credit programmes improve the nutritional status of the poor? Dhaka: Bangladesh Institute of Development Studies and Education and Social Policy Department and World Bank, Dhaka, 1995.
6. **Ahmed HS,** editor. BRAC Research 1997. Dhaka: Research and Evaluation Division, BRAC. 1998. 88p.
7. **Bhuiya A, Chowdhury AMR.** The impact of social and economic development programme on health and well-being: a BRAC-ICDDR,B collaborative project in Matlab, Dhaka: BRAC-ICDDR,B joint Research Project, 1995. (Working paper no. 1).
8. **BRAC** & **ICDDR,B.** Socio-economic development and health: a joint BRAC-ICDDR,B research project. Baseline survey – Matlab, 1992. Final report. Dhaka: BRAC-ICDDR,B joint Research Project, 1994.
9. **Yasoda P.** Determinants of nutrition status of pre-school children in Andhra Pradesh, India. Food Nutr Bull 1994; 15:335-42.
10. **Ighogboja SI.** Some factors contributing to protein-energy malnutrition in the middle belt of Nigeria. East Afr Med J 1992; 69:566-71.
11. **Briend A, Wojtynaik B, Rowland MGM.** Arm circumference and other factors in children at high risk of death in rural Bangladesh. Lancet 1987;2:725-7.
12. **Briend A.** Nutritional status, age and survival: the muscle mass hypothesis. Eur J Clin Nutr 1989;43:715-26.
13. **Begin I.** A guide to nutritional assessment. New Delhi: World Health Organization, 1990.
14. **Hussain S.** Socio-economic development and human well-being: BRAC-ICDDR,B joint research project, Matlab. Report of the first round survey: household economy. Dhaka: BRAC Research and Evaluation Division, 1996.
15. **Huda S.** Effects of credit based development intervention on household decision making, 1998 (unpublished).
16. **Khatun M, M Chowdhury, Abbas Bhuiya.** Effect of BRAC's rural development programme on calorie consumption: evidence from Matlab. Dhaka: BRAC-ICDDR,B joint Research Project; 1998 (Working paper no. 26)
17. **Ahmed SM, Chowdhury M, Bhuiya A.** Two studies on health care–seeking behaviour and household sanitation and hygiene practices of BRAC member and non-member households in Matlab, Bangladesh. Dhaka: BRAC-ICDDR,B joint Research Project; 1998. (Working paper no. 22)

Working Papers of the
BRAC-ICDDR,B Joint Research Project at Matlab

1. The impact of social and economic development programme on health and well-being: a BRAC-ICDDR,B collaborative project in Matlab -- *Abbas Bhuiya and Mushtaque Chowdhury*, 1995
2. Assessing change in women's lives: a conceptual framework -- *Marty Chen and Simeen Mahmud, 1995*
3. Unpacking the black box: studying the relationship between socioeconomic development and health -- *Ian Scott, Tim Evans and Richard Cash, 1995*
4. Formation of village organizations: the first three months -- *Manzurul Mannan, Mushtaque Chowdhury, Abbas Bhuiya and Masud Rana, 1995*
5. Participatory methods to assess change in health and women's lives: an exploratory study --*Alayne Adams, Rita Das Roy and Amina Mahbub, 1995*
6. Effects of socioeconomic development on health status and human well-being: determining impact and exploring pathways of change: proposals for phase II of the BRAC-ICCDR,B Matlab joint project 1996-2000 AD - *Mushtaque Chowdhury, Abbas Bhuiya, Partrick Vaughan, Alayne Adams and Simeen Mahmud, 1995*
7. Profitability of BRAC-financed projects: a study of seven microenterprises in Matlab --*Hassan Zaman, Saima Rahman, Shahed Hussain and Masud Rana, 1995*
8. An inside look at two BRAC schools in Matlab -- *Sabina Rashid, Mushtaque Chowdhury and Abbas Bhuiya, 1995*
9. Problems of women-headed households -- *Naomi Hossain and Samiha Huda, 1995*
10. A qualitative exploration of some socioeconomic issues in south Uddomdi, Matlab -- *Amina Mahbub, Maliha Mayeed and Rita Das Roy, 1995*
11. Vulnerable of the vulnerables: the situation of divorced, abandoned and widowed women in a rural area of Bangladesh -- *Mehnaaz Momen, Abbas Bhuiya and Mushtaque Chowdhury, 1995*
12. Microcredit programmes: who participates and to what extent?-- *Hassan Zaman, 1996*
13. An assessment of client's knowledge of family planning in Matlab -- *Hashima-E-Nasreen, Mushtaque Chowdhury, Abbas Bhuiya, AKM Masud Rana and Indrani Pieris-caldwell, 1996*
14. Cultural construction of health and the institutional measures of change in rural Bangladesh:
15. the cases of the BRAC village organization and the ICDDR,B MCH-FP programmes in the selected villages of Matlab --*Monirul Islam Khan, Abbas Bhuiya and Mushtaque Chowdhury, 1996*
16. Studies on the inputs of BRAC in Matlab: sanitary latrines, training, monthly meetings, legal awareness and credit -- *Sadhana Biswas, Syed Masud Ahmed, Sharmin Mahbub, Manzurul Mannan, Shahriar R Khan, Mahmuda Rahman Khan, Masud Rana, Samiha Huda, ShahedHussain and Karen Moore, 1996*Perspective of women about their own illness -- *Amina Mahbub, Syed Masud Ahmed, 1997*
17. An inventory of the development programmes in the selected unions of Matlab by Governmentand non-Govornent organizations (excluding BRAC and ICDDR,B) -- *Monirul Islam Khan, Mushtaque Chowdhury and Abbas Bhuiya, 1997*

18. Poverty and BRAC's Microcredit Programme: Exploring some linkages – *Hassan Zaman, 1997*

19. Two studies on the impact of Meghna-Dhonagoda flood control, drainage and irrigation project, 1997

20. An Ernie towards well-being –Amrin *Mahbub, Rita Das Roy, 1997*

21. Three studies on HIV/AIDS, 1998

22. Two studies on Health care-seeking behaviour and Household sanitation practices of BRAC member and non-member households in Matlab, Bangladesh – *Syed Masud Ahmed, Mushtaque Chowdhury, Abbas Bhuiya, 1998*

23. Psychological well-being of rural women: developing measurement tools – *Mohsina Khatun, Nasreen Wadud, Abbas Bhuiya, Mushtaque Chowdhury 1998*

24. Participation in BRAC's Rural Development Programme and the impact of group dynamics on individual outcomes – *Simeen Mahmud, Samiha Huda, 1998*

25. Does involvement of women in BRAC influence sex bias in intra-household food distribution? *–Rita Das Roy, SM Ziauddin Hyder, Mushtaque Chowdhury, Alayne Adams, 1998*

26. Two studies on nutrition, 1998.

27. Pre-lacteal feeding practices in a rural area of Bangladesh – *Sabah Tarannum, SMZiauddin Hyder, 1998.*

28. Three studies on the effect of BRAC interventions on the lives of the poor women,1998

29. Assailing poverty and patriarchy: how does small money fare? – *Monirul Islam Khan, Mushtaque Chowdhury, Abbas Bhuiya, Masud Rana, 1998*