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BRAC initiative towards promoting gender and social equity in health: a longitudinal study of child growth in Matlab, Bangladesh

Masuma Khatun[1,*], Hans Stenlund[2] and Agneta Hörnell[3]
[1]Family Medicine, Department of Public Health and Clinical Medicine, Umeå University, SE-901 85 Umeå, Sweden: [2]Epidemiology, Department of Public Health and Clinical Medicine, Umeå University, Umeå, Sweden: [3]Department of Food and Nutrition, Umeå University, Umeå, Sweden

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Abstract

Objective: To explore the effect of BRAC (formerly Bangladesh Rural Advancement Committee) initiatives towards promoting gender and social equity in health among children of poor mothers who are BRAC members.
Design: A cohort of 576 children from the prospective study of a BRAC– International Centre for Diarrhoeal Disease Research, Bangladesh joint research project was analysed. Data were collected three times during 1995–1996 with approximately 4-month intervals. Stunting, defined as height-for-age below minus two standard deviations from the reference median, was the outcome health measure. The study children were stratified into three groups according to their mother's social and BRAC membership status: poor and BRAC member (BM), poor non-member (TG) and non-poor non-member (NTG).
Setting: Matlab, rural area of Bangladesh.
Subjects: Children aged 6–72 months.
Results: The overall prevalence of stunting was 76%; the highest prevalence was found among TG (84.6%) children and no significant difference was observed between BM and NTG children (67.3% and 69.4%, respectively). In all groups, a significantly larger proportion of girls was stunted compared with boys in the first round. Group-level analysis showed that stunting decreased among all children except BM boys at the end of third round, with the largest decline among BM girls. In contrast, stunting prevalence increased among BM boys. A similar trend was found in the individual-level analysis, where a larger proportion of BM girls recovered from stunting compared with other groups and no recovery was observed among BM boys. At the end of the third round, the nutritional status of BM girls was almost equal to that of the BM boys, while gender inequity remained large among TG and NTG children.
Conclusion: The BRAC initiative appeared to contribute to a significant equity gain in health for girls, as well as to decreased differences in ill health between the poor and the non-poor.

Keywords
Gender
Social equity
Stunting
Longitudinal study
Development intervention
Embankment
Matlab

The term *gender* refers to societies' perceptions of and expectations on the social and cultural roles, values and behaviours of men and boys, girls and women, in contrast to the term *sex*, which refers to the biological differences between male and female[1]. Thus, gender is a social construction of the biological sex and therefore varies across cultures. Gender is also a key social stratifier through which the distribution of power, privileges and resources is systematically discriminated between men and women, which in turn affects their exposure to different health risks. The term 'gender and social equity in health' implies that health inequalities are arising from the unfair distribution of resources and benefits and not from the biological differences between sexes[2].

By social custom, rural women in Bangladesh are discriminated against in almost every aspect of their lives: privileges and resources are distributed enormously unequally between men and women, and poor women are the most disadvantaged of all[3]. For instance, the adult literacy rate among females is 29% compared with 52% among males[4]. Like in most other societies, women in Bangladesh are the principal caregivers during the most crucial periods of children's development. However, caring practices, vital to children's nutritional well-being,

*Corresponding author: Email masuma.khatun@fammed.umu.se

invariably suffer when women face discrimination and are dominated by men in every sphere of their lives from birth[5].

Since 1972, BRAC (formerly Bangladesh Rural Advancement Committee) has been initiating programmes aimed at promoting gender and socio-economic equity in health by targeting the poor population. The main initiative is integrated into a poverty alleviation project focused on the empowerment of poor women by provision of women's micro credit to strengthen their economic opportunities, and by provision of female education and health services[6,7]. Previous studies have shown a positive impact of BRAC initiatives on women's empowerment by, for example, decreasing economic dependence on male kin, enhancing the role in household decision-making, increasing ownership and control over assets, acquiring positive self-perceptions of their own personal interest and increasing mobility to some extent[8–10]. The assumption is that these positive impacts on women will also lead to improved health status of their children. The purpose of the present study was to explore the effect of BRAC initiatives towards gender and socio-economic equity in health among children of poor mothers who were members of BRAC, compared with non-members.

Methodology

Sampling and data

The analysis was based on existing research data from a BRAC–ICDDR,B (International Centre for Diarrhoeal Disease Research, Bangladesh) joint research project in Matlab, Bangladesh[6,11,12]. Matlab is a sub-district situated about 55 km south-east of the capital city, Dhaka. In Matlab, ICDDR,B has been recording vital events of the population through its Demographic Surveillance System (DSS) since 1966. The DSS is probably the largest longitudinal demographic data collection system maintained in a developing country, covering 149 villages with a population of 210 000. ICDDR,B has divided the Matlab DSS field into two: the Maternal and Child Health and Family Planning Programme (MCH-FP) area (70 villages) and a comparison area (79 villages). In the MCH-FP area, the female community health worker (CHW) visits each household every 2 weeks providing intensive health-care services (e.g. family planning counselling, immunisation, distribution of a variety of contraceptives, vitamin A capsules and safe delivery kits). The CHWs also treat mothers and children under 5 years of age for infectious diseases and refer severely malnourished children to the centre for treatment and rehabilitation. In the comparison area, the government provides family planning and basic health-care services. In addition, the CHWs of ICDDR,B collect demographic data and provide free oral rehydration solution packets and limited advice on family planning. During 1992, BRAC extended its development programmes in Matlab area in the normal course of expansion. Because of the presence of the DSS, BRAC and ICDDR,B decided to join together in Matlab to explore the impact of development programmes on health and well-being, particularly of women and children. The joint project began with a baseline survey in 1992 where information on health, nutrition, income, employment, women's status, literacy, etc. was collected. The baseline survey included all BRAC-eligible households, i.e. target group (TG), and 50% of the non-eligible households, i.e. non-target group (NTG), in 60 villages (Fig. 1). BRAC eligibility criteria include households owning less than 0.50 acre of land including homestead and households where the main income earner sells manual labour for at least 100 days a year for living. After the baseline survey, TG households could become BRAC members (BM). The aim of BRAC is that all TGs will eventually become BMs to benefit from development interventions directly.

In 1995, 3 years after initiation of the project, a three-round seasonal survey was started to monitor change in selected indicators including nutritional status. Fourteen of the 60 villages were included in this seasonal survey (Fig. 1). Ten villages were purposively selected because of the presence of BRAC interventions and the remaining four villages were randomly selected. These 14 villages were categorised into four groups, i.e. study cells, according to presence of BRAC/ICDDR,B interventions. Cell 1 included five villages having both BRAC and ICDDR,B interventions; cell 2 included five villages having only BRAC interventions; cell 3 included two villages with only ICDDR,B interventions; and cell 4 included two villages with no interventions (comparison area). All study households were selected randomly within each village. The main data collections of these three surveys were cross-sectional in design, and data were collected for 1 year at about 4-month intervals from the same villages. The first, second and third rounds of the survey were conducted during June–August 1995, September–December 1995 and January–May 1996, respectively. Virtually all children (99%) had 6–8 months between the first and last survey.

In Matlab area, an embankment was constructed between 1982 and 1989 on the banks of the rivers Meghna and Dhonagoda to protect the area from seasonal floods. The study villages are therefore also categorised in relation to whether they are situated inside or outside the embankment. This embankment has a great impact on the pattern and production of major crops and fishes on both sides and is believed to have an effect on food availability and consumption, which in turn could lead to effects on nutritional status.

The three survey rounds included household information, e.g. economy, women's status and health, using three separate questionnaires. The household survey covered approximately 3500 households in each round. A food consumption and anthropometric survey, covering a sub-sample of 2076 households, was conducted in the

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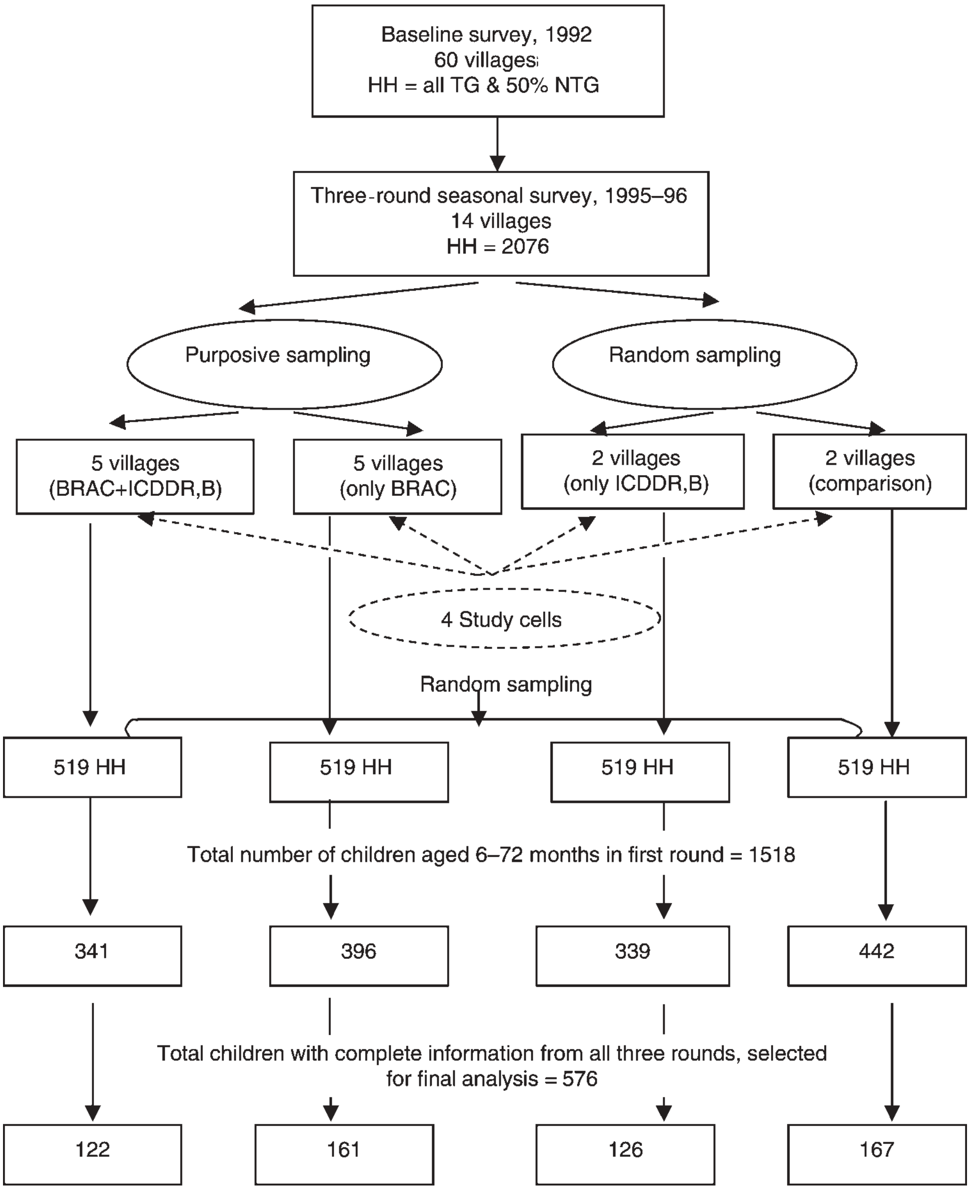

Fig. 1 Diagram of the sampling procedure. HH – household; TG – target group; NTG – non-target group; BRAC – formerly Bangladesh Rural Advancement Committee; ICDDR,B – International Centre for Diarrhoeal Disease Research, Bangladesh

same area during the same time (519 from each cell). Details of the data collection methods on the sub-sample are given elsewhere[13]. Body weight was measured to the nearest 100 g using a Salter scale for children and standing height was measured in centimetres using a special wooden height stick made by ICDDR,B. Any children with deformities of the leg or spine were excluded from the anthropometric part of the survey.

Data collection was done by trained female interviewers with a minimum of 12 years of education. Several measures were taken to ensure the quality of the data. The interviewer and the team supervisor checked the instruments each day before going to the field, a separate quality-control team re-surveyed 5% of the households and the main survey data were cross-checked with the re-survey teams' findings in order to ascertain the validity of the large survey.

For the purposes of this study, only data on children aged 6–72 months for whom height measurements from all three rounds of the survey were available, were analysed (Fig. 1). The total number of children in the first round was 1518, of whom only 596 had complete anthropometric data in the second and third rounds. Of these, 20 cases were excluded owing to faulty values of age, weight and/or height. Thus, our final sample was a cohort of 576 children. Other than these 20 cases, the remaining two-thirds of the children were excluded due to missing height data in either the second or the third round.

Most of the background characteristics, as well as the proportion in BM, TG and NTG households, were similar between children with and without missing data. However, children with missing data were significantly younger, and their parents were older and had a lower number of living children compared with the children without missing data (data not presented).

It should be noted that this study only assessed growth during a 1-year period (1995–96) of children whose mothers had already received 3 years of BRAC interventions.

Data analysis

Stunting was used as an outcome health measure. The height measurements were converted to height-for-age *Z*-scores (HAZ) according to an international reference population (National Center for Health Statistics)[14,15]. A child was defined as stunted if he/she had HAZ below −2; i.e. height-for-age below minus two standard deviations (< −2SD) from the median of the reference population.

The data analyses were carried out in five steps using SPSS version 11 (SPSS Inc., Chicago, IL, USA). Comparisons were made between the three groups: NTG, BM and TG, and *P*-value <0.05 was considered significant.

The first step in the analysis was to study the differences in baseline characteristics using analysis of variance, the Pearson chi-square test and the Kruskal–Wallis test.

In the second step, group-level changes in stunting during the three rounds were analysed by gender and the chi-square test was used to assess their significance.

In the third step, individual changes in stunting over time, i.e. between the first and the third rounds, were analysed by gender. Children were grouped into four categories:

1. children who were stunted both in the first and the third rounds;
2. children who were not stunted in the first round but became stunted in the third;
3. children who were stunted in first round but became not stunted in the third; and
4. children who were not stunted in either period.

Differences between the groups were tested with the chi-square test.

In the fourth step, logistic regression models were constructed for each survey to determine if BRAC membership status had any effect on the prevalence of stunting after controlling for other confounding variables. Only those variables that had shown association ($P < 0.05$) with stunting during bivariate analysis were included in the models (table not shown). Thus variables included in the final model were stunting as a binary and dependent variable, and – as independent variables – BRAC membership status, sex of the child, health status of the child (as perceived by the mother), literacy of the mother, number of living children, literacy of the household head, per capita monthly household income, per capita daily energy intake, study cell and embankment. The study cell variable was included in the model to control for the effect of ICDDR,B health interventions. TG households were not completely without intervention (28.3% of them received ICDDR,B interventions), so this was a potential confounder. An alternative analysis approach could be multilevel modelling[16]. Since our main focus was to assess the effect of BRAC interventions as compared with the population of similar social background but without intervention (i.e. TG), we did simple logistic regression and controlled for all possible confounders. Finally, an interaction term was evaluated between BRAC membership and independent variables.

Results

Background characteristics (first-round survey, 1995)

Of the 576 children, 34.5% came from NTG, 17% were from BM and 48.5% were from TG households (Table 1). The proportion of boys and girls in the study sample was almost equal across all these three groups. The average age of the sample was approximately 4 years and no age difference was found between the groups.

More than three-quarters of the children were stunted, about 80% of the children were underweight and more than one-quarter of the children were wasted. The prevalence of stunting was significantly lower among BM children than among TG children, and no difference was observed between BM and NTG children.

The median age of the mothers was 33 years (25th–75th percentile, 29–39 years) and 31.4% were literate. More than 95% of the mothers were engaged in household work. The median age of the household head was 40 years (35–50 years) for men and 36 years (30–43 years) for women. Twice as many NTG male household heads were literate compared with their BM and TG counterparts. Among female household heads, 30.4% were literate and no significant difference was observed in literacy between BM and TG households.

About half of the BM households resided outside the embankment and within the MCH-FP catchment area. The distribution of NTG and BM households was similar. A majority of the TG households resided inside the embankment and within the comparison area (>60%). In Matlab, most villages are situated very close to one another, whereby a few BM households were found in areas other than BRAC (1% and 5%).

Approximately 14% of the children were from female-headed households and no significant difference was observed in terms of the proportion of female-headed households among the groups. The average household size was around six persons, with BMs having a significantly larger household size followed by NTGs and TGs.

Per capita monthly income of the study households was less than Tk 500 (less than US$ 10.00) and they owned less

Table 1 Characteristics of the study children during the first round of the seasonal survey, 1995

				P-value	
Indicator	NTG ($n = 199$)	BM ($n = 98$)	TG ($n = 279$)	NTG vs. BM	BM vs. TG
Gender (%)					
Boy	50.8	44.9	47.7	NS	NS
Girl	49.2	55.1	52.3	NS	NS
Age of child (years), mean (±SD)	4.19 (±1.17)	4.25 (±1.18)	4.20 (±1.18)	NS	NS
Sick in last 14 days (%)	8.4	13.8	17.2	NS	NS
Nutritional status (%)					
Stunted*	67.3	69.4	84.6	NS	0.001
Wasted†	24.1	25.5	30.1	NS	NS
Underweight‡	71.9	80.6	85.3	NS	NS
Gender of household head (%)					
Men	87.4	84.7	86.0		
Women	12.6	15.3	14.0	NS	NS
Literate household head (%)					
Men	63.2	34.1	30.6	0.001	NS
Women	48.0	25.0	21.2	0.001	NS
Household size, mean (±SD)	5.98 (±2.10)	6.48 (±1.82)	5.81 (±2.10)	NS	0.01
Number of living children, mean (±SD)	4.21 (±2.02)	3.21 (±1.59)	3.66 (±1.76)	0.001	0.05
Age of household head (years), median (P_{25}–P_{75})					
Men	46 (38–58)	39 (34–47)	37 (33–45)	0.01	0.05
Women	34 (29–43)	33 (34–57)	34 (27–39)	NS	NS
Mother's age (years), median (P_{25}–P_{75})	37 (31–47)	32 (28–50)	31 (27–36)	0.01	0.05
Mother's literacy (%)	44.9	33.3	22.3	0.05	0.05
Child's health status good (as perceived by mother) (%)	90.1	85.0	90.1	NS	NS
Mother's occupation (%)					
Housework	94.5	92.2	97.0		
Outside work	5.5	7.8	3.0	NS	NS
Per capita monthly income (Taka), median (P_{25}–P_{75})	582 (460–750)	446 (336–562)	450 (354–548)	0.001	NS
Land ownership (acre), median (P_{25}–P_{75})	0.37 (0.20–0.81)	0.14 (0.03–0.28)	0.11 (0.03–0.21)	0.001	0.01
Per capita daily energy intake (kcal), median (P_{25}–P_{75})	1892 (1550–2165)	1746 (1490–2083)	1588 (1340–1920)	NS	0.01
Per capita daily energy intake from animal protein (kcal), median (P_{25}–P_{75})	96 (55–161)	70 (36–108)	38 (15–81)	0.001	0.001
Drinking water from tube well (%)	98.7	97.6	97.9	NS	NS
BRAC village (%)	59.8	93.9	25.8	0.001	0.001
MCH-FP area (%)	46.7	50.0	38.0	0.05	0.05
Study cell (%)					
BRAC + MCH-FP	23.6	49.0	9.7		
Only BRAC	36.2	44.9	16.1		
Only MCH-FP	22.1	1.0	28.3		
Comparison	17.1	5.1	45.9	0.001	0.001
Embankment (%)					
Inside	50.8	49.0	62.4		
Outside	49.2	51.0	37.6	NS	0.05

NTG – non-target group; BM – BRAC member; TG – target group; SD – standard deviation; P_{25} – 25th percentile; P_{75} – 75th percentile; BRAC – formerly Bangladesh Rural Advancement Committee; MCH-FP – Maternal Child Health and Family Planning; NCHS – National Center for Health Statistics.
* Stunted – height-for-age < -2SD from median of the NCHS reference population.
† Wasted – weight-for-height < -2SD from median of the NCHS reference population.
‡ Underweight – weight-for-age < -2SD from median of the NCHS reference population.

than 0.35 acres of land including homestead. Use of a tube well for drinking water was universal among all the study households (>98%). Per capita total energy intake was less than 1800 kcal day^{-1}.

No income difference was observed between TG and BM households. However, total energy intake and energy from animal sources were higher among BM households than among TG households.

Gender and social equity in stunting at group level

Overall, both boys and girls of TG households had the highest proportion of stunting compared with BM and NTG, and no significant differences were observed between BM and NTG children in any observation period (Table 2). The prevalence of stunting in the first round was 67.3% in NTG, 69.4% in BM and 84.6% in TG children. In the first round, a significantly higher proportion of the girls

Table 2 Proportion of stunting at group level (BRAC membership) during the three rounds of the survey, by gender

	First round		Second round		Third round	
Group	Boys	Girls	Boys	Girls	Boys	Girls
NTG	60.4	74.5	59.4	72.4	57.4	71.4
BM	63.6	74.1	68.2	74.1	68.2	70.4
TG	78.2	90.4	82.0	89.0	77.4	89.0
Total	69.4	82.2	71.6	80.9	68.7	79.9

BRAC – formerly Bangladesh Rural Advancement Committee; NTG – non-target group; BM – BRAC member; TG – target group.

were stunted compared with the boys in all groups. At the end of the observation period, the prevalence of stunting was decreased among both boys and girls, except for BM boys for whom the prevalence increased. At the end of the observation period, the nutritional status of BM girls became almost equal to that of the BM boys, while gender inequity remained large over time among both TG and NTG children.

Gender and social equity in stunting at individual level

Individual-level changes in stunting showed a similar pattern to the group-level changes (Fig. 2). The proportion of BM children who remained 'not stunted' at the end of the observation period was approximately equal to the proportion in the NTG group (NTG 37.6% and BM 31.8%). A very low proportion of TG children were 'not stunted' in both the first and third rounds (18%). A significantly higher proportion (5.6%) of BM girls recovered from stunting compared with all other groups ($P < 0.05$). In contrast, no recovery was observed among BM boys. In addition, a higher proportion of BM boys became stunted at the end of the observation period compared with boys in the other groups (BM 4.6%, TG 3.8%, NTG 2.0%).

Results from the regression analysis

The nutritional status of the children whose mothers were BRAC members was comparable to that of the socio-economically better-off population, i.e. NTG (Table 3). In comparison, around twice as many TG children were stunted. Besides being children of TG mothers, a number of indicators turned up as significant risk factors for being stunted. These included being a girl, child's health status bad (as perceived by the mother), having a young mother, a mother having more than three children, illiterate household head, energy intake below 1800 kcal day^{-1} and residing inside the embankment (almost 10 times higher prevalence of stunting compared with outside the embankment). At the community level, neither combined

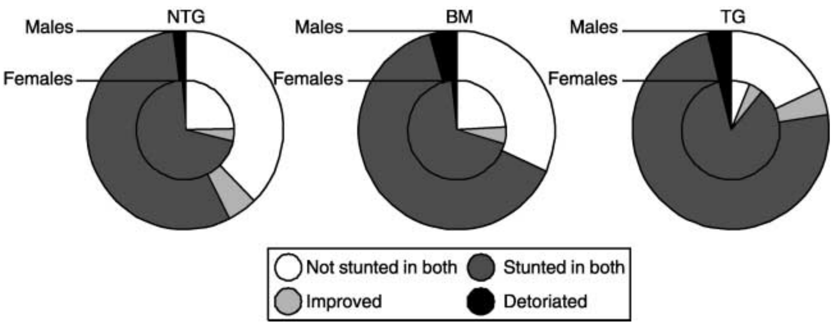

Fig. 2 Individual-level changes in stunting between the first and the third rounds of the survey by gender and BRAC membership status. NTG – non-target group; BM – BRAC member; TG – target group; BRAC – formerly Bangladesh Rural Advancement Committee

Table 3 Multiple logistic regression analysis of the risk of stunting in the three rounds of the survey

	First round		Second round		Third round	
Background characteristic	OR	95% CI	OR	95% CI	OR	95% CI
Group						
NTG	1.00		1.00		1.00	
BM	1.16	0.51–2.66	1.99	0.86–4.65	1.09	0.49–2.42
TG	2.06	1.05–4.05	3.52	1.75–7.07	2.54	1.30–4.98
Girl child	2.64	1.27–2.39	1.87	1.23–2.41	2.02	1.05–2.54
Child's health status bad (as perceived by mother)	3.68	1.14–11.85	3.04	0.89–10.42	4.25	1.22–14.70
Younger mother (<35 years)	2.60	1.35–5.00	1.88	0.98–3.62	1.60	0.86–2.96
Illiterate household head	2.31	1.24–4.29	2.00	1.08–3.74	2.41	1.32–4.39
Having more than 3 children	3.55	1.92–6.57	2.57	1.41–4.71	2.32	1.30–4.13
Per capita daily energy intake <1800 kcal	2.00	1.17–3.43	2.14	1.25–3.69	1.70	1.01–2.86
Inside embankment	9.83	1.92–50.41	10.87	2.05–57.72	8.38	1.72–40.81

OR – odds ratio; CI – confidence interval; NTG – non-target group; BM – BRAC member; TG – target group; BRAC – formerly Bangladesh Rural Advancement Committee.

interventions nor single intervention of BRAC and ICDDR,B showed any significant effect, in contrast to the bivariate analysis (non-significant figures are not presented in Table 3). Results from the interaction term analysis showed that the effect of all the risk factors on stunting differed depending on BRAC membership status (two examples are given in Fig. 3).

Discussion and policy implications

The study results suggest that the BRAC initiative, aimed to increase health equity, may have contributed to equity gain in growth for girls and also to increased social equity in health between the children of poor BM and non-poor NTG households. However, gender inequity remained quite large among NTG and TG children.

The strengths of our study include the validity of the data. As mentioned previously, several measures were taken to ensure the quality of the data including re-survey of 5% of the households and cross-checking with the main survey data, which was found to be very satisfactory. This was also confirmed from the part of our analysis where data, especially anthropometric measurements, were deemed to be consistent over time. However, since the focus of this study was on growth increment over time, we chose to study height measurement only because gain in weight and mid upper-arm circumference are more sensitive to seasonal variations and infectious diseases than gain in height.

A relatively large proportion of the children were excluded from the analysis due to missing anthropometric measurement in the second and/or third survey round, but this should not influence our results for several reasons. First, these missing children were equally distributed among all of the study groups; second, most of the background characteristics were similar between the children with and without missing data; and third, the problem of missing data was not due to non-response or the selection process, it was mainly due to technical problems during survey activities. When both a household and an anthropometric survey team were present at the same time, a household occupied by one team may have been skipped by the other team to achieve coverage of a maximum number of households in one day and also to avoid the burden of too many questionnaires in one day for a household. Unfortunately, not all skipped households were revisited at a later date. Beside this coordination problem between the teams, the anthropometric survey was done only on a sub-sample, which led to incomplete information from each surveyed household. As these problems were not considered during the planning process or during data collection, the interviewers were not trained to make sure that each household gave complete information in every aspect

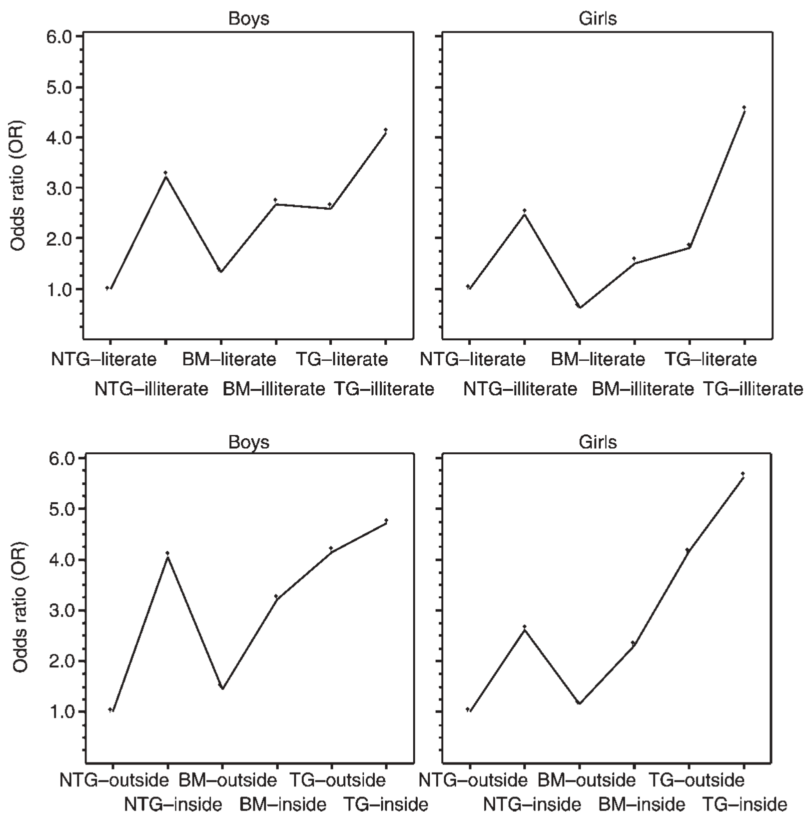

Fig. 3 Odds ratios for stunting: interaction between BRAC membership and literacy of the mother (top) and interaction between BRAC membership and embankment (bottom), by gender. NTG – non-target group; BM – BRAC member; TG – target group; BRAC – formerly Bangladesh Rural Advancement Committee

(such as economy, health, women's status, anthropometric data, etc.). We could therefore not use the very important information on women's status in the analysis since it was collected from only very few women in our study households. Thus, when designing epidemiological studies, it is important to take into consideration other on-going or planned studies in the same area.

As stated earlier, the status of rural women in Bangladesh is very low and they are discriminated against in almost every aspect of their lives. Privileges, power and resources are distributed enormously unequally between women and men, which in turn negatively affects not only the women's health and well-being but also their children's, as women are the principal caregivers. Improving women's status by empowering poor women is one of the primary objectives of the BRAC initiative. Another very important aspect of this initiative is to promote gender-sensitive behaviour among mothers such as educating them to treat girls as equal to boys. In this paper, we have quantified the relative impact of BRAC's integrated development project on the nutritional status of the children, especially regarding equity gain in regard to gender and social class. We are not aware of any previous study that has examined gender and socio-economic equity gain in terms of growth among BM children. However, in their study of child survival in the same study area, Bhuiya *et al.*[17] showed a similar result, where girls experienced a greater reduction in mortality than boys. Moreover, BM children had the same survival advantages as the children of non-poor non-members.

Growth faltering or stunting is a proxy of deprivation, and stunting below 5 years of age is much more related to social, economic and environmental factors than to genetics[18,19]. Stunting during this period is mostly associated with inadequate feeding practices, infections and low food intake, which together cause growth faltering. Many of these factors are related to women's low status in the society, reflected in their poor education and knowledge, economic dependency on a male partner, low ownership and control over assets, lack of decision-making power and mobility. Whether improved health status of BM children was caused by improved status of the mothers was not revealed in this study, because of the lack of indicators on women's status for this part of the study population. However, there is evidence of a positive impact of BRAC initiatives on several indicators of women's status[8–10]. This study has shown that BM households had both larger quantity and higher quality of diet even though they had similar monthly income to TG households (Table 1). This might indicate that mothers of BM households are more knowledgeable about choosing proper food for the household with minimum resources. Positive gender-sensitive behaviour regarding food allocation has also been evident among BM households, where foods were more equally distributed between boys and girls[20]. This positive impact on women's status including improved knowledge and gender-sensitive behaviour may have led to improved nutritional status of BM children, specifically girls.

Beside an overall gain in social equity among BM children, it is interesting to see the gender dynamics of stunting over time at individual level and at group level. The prevalence of stunting declined in a similar pattern among both boys and girls in the NTG and TG groups. However, both at group and individual level, BM girls showed a significant improvement in growth compared with NTG and TG boys and girls. In contrast, BM boys had an increased prevalence of stunting. The important question arises, was the health gain of BM girls at the cost of the boys, and if so, is this fair? In one way it was at the cost of the boys: because these BMs belong to the poorest part of the population with limited resources and if these resources (for instance food) are distributed equally/fairly between boys and girls, the boys will get less than before, which in turn might affect their health. As long as the health of BM boys does not deteriorate so much that their health status falls below that of the girls but rather stays equal to the girls', we would argue this is fair from a gender equity perspective.

Regarding community level, BRAC interventions did not show any significant effect on child growth in our study. This finding contradicts the previous study by Chowdhury and Khandker[21] which showed that children in BRAC villages had better growth (weight and height increment) than children in Gramin Bank and BRDB (Bangladesh Rural Development Board) villages. They concluded that this improvement in growth might be because BRAC has both health and non-health interventions while the other two programmes provide only non-health interventions. The lack of a significant effect at community level in our study might be explained by the presence of another important environmental factor such as embankment, which makes the study villages heterogeneous. In the bivariate analysis, we found a significant influence within BRAC villages but it was no longer significant after controlling for embankment. The BRAC villages in our study were distributed both inside and outside the embankment while no such embankment was present in Chowdhury and Khandker's study areas, thus making them homogeneous. We found that the prevalence of stunting was almost 10 times higher inside the embankment compared with areas outside. This wide difference in prevalence suggests that the embankment is a strong influential factor.

However, the embankment effect in our study is contrary to the results of Myaux *et al.*'s[22] study, which showed that death from severe malnutrition was higher outside than inside. This finding may be explained by the fact that Myaux's study was done less than 2 years after the embankment was constructed. It might be that, in the long term, adverse effects of the embankment, such as reduced soil fertility due to decreased seasonal deposition of nutrients and destruction of small fisheries, lead to reduced crop and fish production, which in turn affects health and nutritional status of the population residing inside the embankment. More in-depth analysis of the embankment's effect upon population health and well-being is needed in the future. Furthermore, the presence of an embankment should be considered as a confounder when assessing the impact of public health interventions at the community level in the Matlab area.

In conclusion, this study indicates that BRAC initiatives contributed to a reduction in both gender and socio-economic inequity in health among the studied population. Thus, BRAC programmes should be extended to other disadvantaged areas, such as the comparison area, with special emphasis on villages residing inside the embankment.

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