

# Impact of pilot project of Rural Maintenance Programme (RMP) on destitute women: CARE, Bangladesh

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## Abstract

**Background.** The rate of malnutrition among women in Bangladesh is high, but historically there has not been a specific program focusing on the improvement of the nutritional status of Bangladeshi women.

**Objective.** To observe changes in the nutritional status of destitute women of the Rural Maintenance Programme (RMP) by incorporating a health and nutrition intervention package with RMP ongoing activities.

**Methods.** An intervention study involving 1,275 poor destitute women was conducted from July 2004 to June 2005 in 17 districts in Bangladesh under two field offices, Mymensingh and Jessore, covering 8 and 9 districts, respectively. The respondents were divided into intervention, comparison, and control groups. All participants in the intervention and comparison groups were paid as part of the RMP and received weekly 30-minute nutrition interventions for 7 weeks in addition to routine training. The comparison group also received RMP training. The control group consisted of women with similar demographic characteristics to the intervention and comparison groups who did not receive pay or any intervention. The intervention was a unique combination of the three components of the UNICEF triangle model (food security, caring practices, and disease control). Data on socioeconomic and anthropometric characteristics, immunization, and vitamin A capsule intake were also collected with the use of a structured questionnaire.

**Results.** After the intervention, the mean body weight had significantly increased by 1,333 g in the intervention

group and had decreased by 277 g in the control group and 147 g in the comparison group. The body mass index of women in the intervention group had also significantly increased at the end of the study ( $p < .001$ ). There was a significant increase in the intake of iodized salt in the intervention group as well as increased immunization coverage in all groups. Intake of the first vitamin A capsule by children increased (from 60% to 97%) in the intervention group only.

**Conclusions.** The nutrition pilot intervention was highly effective in improving the nutritional status of women in the RMP.

**Key words:** Bangladesh, destitute, health, nutrition education, rural maintenance program

## Introduction

In Bangladesh, the rate of malnutrition is alarmingly high, particularly among children, adolescent girls, and pregnant and lactating women. In addition to child and maternal mortality, malnutrition leads to excess morbidity, increased wage losses, and poverty. The prevalence of women in Bangladesh with a body mass index (BMI) less than 18.5 is 34%; of these 34%, 37% live in rural areas [1]. About 45% of pregnant and 35% of lactating women had anemia in 2001–03 [2].

The proportion of mothers below the BMI cutoff point of 18.5 has continued to drop, from 52% in 1996–97 to 38% in 2004, a decline of 27% in less than 10 years [1]. According to the National Nutrition Program (NNP) baseline survey (2004), the nutritional status of pregnant women and their likelihood of receiving iron supplements are positively correlated with women's education and household asset index [3]. Almost 40% of households of pregnant women in Bangladesh consume table salt with inadequate iodine levels ( $< 15$  ppm), and socioeconomic status and level of education are positively correlated with the use of iodized salt during pregnancy [3]. Widespread mater-

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nal undernutrition in Bangladesh leads to a higher proportion of low-birthweight children, and the vicious cycle of chronic nutritional deprivation entraps each successive generation.

A large number of Bangladeshi women live in rural areas in which their economic status and rates of literacy are very low, and knowledge of good health and nutritional practices is minimal to nonexistent [1, 3]. Historically, there has not been a specific program that focused on the improvement of the nutritional status of women, particularly those working in the labor force in rural areas.

In 1983, CARE Bangladesh designed and piloted the Rural Maintenance Programme (RMP), which was designed to improve the socioeconomic status as well as the nutritional status of participating women and their children. Destitute women were recruited to participate in the RMP and were employed for a 4-year period. During this time, they received wages for maintaining village dirt roads, accumulated savings for investment, and participated in a comprehensive 4-year cycle of life-skills training. By the time the women completed training from RMP, they had received skills training in road maintenance, health awareness, numeracy, human rights, gender equity, health and nutrition, and business management, as well as preparation for income-generating activity. The RMP helped women become self-reliant and prepared them to be better able to face challenges in their everyday life.

Nutrition education can play an important role in minimizing the alarming situation in Bangladesh culture, in which traditional norms include early marriage of girls, and thus early childbearing, and discrimination against girls in food allocation [4, 5]. A Health and Nutrition Capacity Assessment Mission assessed the capacity of the RMP in health and nutrition monitoring, identified existing and planned health and nutrition projects in Bangladesh, and suggested meaningful health and nutrition links.

It was hypothesized that nutrition intervention based on a food and health-care model [6] could improve the nutritional status of the participants, as well as change their practices and knowledge about nutrition and health (e.g., use of iodized salt, immunization coverage, and vitamin A coverage), and serve as the basis for an intervention program to be implemented in the future for the improvement of the nutritional status of RMP women.

## Methods

A longitudinal intervention study was conducted among groups of poor destitute women from July 2004 to June 2005. (The level of poverty was defined as having income < US\$1.00 per day; women who were considered destitute were widows, divorced, or

abandoned, with no income.) The project was carried out in 17 districts in Bangladesh, under two field offices (Mymensingh and Jessore) covering 8 and 9 districts respectively. During site selection, the health and social development indicators of the unions (an administrative unit of *upazila* [subdistrict], consisting of several villages with a population of approximately 25,000) were considered in addition to other factors, and a total of 88 unions (45 under the Jessore field office and 43 under the Mymensingh field office) were randomly selected for the project.

The Rural Maintenance Association (RMA) was formed in each village area in each union by 10 women, who were considered as RMA members. They were selected by the committee of elected Union Council members and worked for the RMP. Eight years of data collected from all over the study area were used to classify areas of high and low economic vulnerability, according to the socioeconomic status of the population and their water and sanitation facilities. Levels of food security and poverty were also considered in the evaluation of socioeconomic status.

Mid-upper-arm circumference, vitamin A coverage, diphtheria-pertussis-tetanus coverage, iodized salt consumption, and stunting were considered.

### Sample size

Sample size was calculated from the formula for comparison of two mean values for weight gain of RMP women in this intervention study, with 95% confidence intervals and 80% power according to the sample-size calculation method of Kirkwood [7]. The calculated sample size was 400 in each group. Ten percent was added to this sample size to allow for dropouts [7].

### Study groups

At baseline, the respondents were divided into intervention, comparison, and control groups. The intervention and comparison groups were composed of RMA (Rural Maintenance Association) members who were recruited for the RMP. The control group was composed of eligible women who wanted to participate in the RMP but were unable to do so due to the limited position and random unbiased selection of the lottery system.

The intervention group received a nutrition intervention package in addition to their routine training for the first year. The comparison group received only the routine training of the RMP. The women in the control group were equally divided between the areas of high and low economic vulnerability and were not employed in the RMP.

The study was approved by CARE, Bangladesh. The objectives of the study were explained to the participants by the local community leaders and union

council chairman, along with staff from CARE. Verbal consent was obtained from the participants who were in the RMP job and none refused. Women in the control group participated readily when they were asked by the union council and CARE staff.

### Nutrition intervention

The nutrition education package was developed and the field trainers were trained by three of the authors (S.K.R., G.A., and F.B.). Ten field trainers from the CARE field office were thoroughly trained on the nutrition triangle proposed by UNICEF (food security, caring practices, and disease control) [6].

The participants were trained on how to seek help, and were facilitated by CARE staff to government and nongovernment health and socioeconomic support programs. The field trainers were trained to perform anthropometric measurements according to World Health Organization (WHO) guidelines [8].

The RMA members were taught how to prepare a special food called *khichuri* (table 1) from locally available foods and were advised to eat it daily at the work place. They were also provided with information about healthy dietary practices, food security, quality and quantity of nutrients, and dietary requirements for improvement and maintenance of health. In addition, they received training about personal hygiene, safe water, immunization, vitamin A, and iodized salt. The RMA members also received training regarding caring practices, going to health care centers in need, cleaning and maintaining a hygienic environment at home, sanitation, appropriate feeding, and immunization for their children. (Immunization is a national vaccination program in Bangladesh against six childhood diseases: diphtheria, pertussis [whooping cough], tetanus, tuberculosis, polio and measles.)

Linkage to other health care facilities was a significant component of this intervention. Local health care facilities near the nutrition pilot areas of 45 unions of Mymensingh and Jessore field office were identified, and the nearest facilities were connected to RMAs. The field trainers made extremely effective contact with government-affiliated facilities, such as an *upazila* (subdistrict) health complex, and a family welfare center. RMAs were also given referrals to higher-level hospitals, and received priority at satellite clinics.

Finally, the RMAs were able to obtain financial support, and increased the frequency of getting loans for home gardens, raising poultry and other small economic efforts, utilizing local micro-credit schemes where available.

### Data collection

The staff (trained field trainers) of CARE, Bangladesh, developed the questionnaire. The structured question-

naire was developed from RMS interviews, field tested, and finalized. Data on weight, height, and mid-upper-arm circumference of the RMA (Rural Maintenance Association) members were obtained by the field trainers at baseline and post-intervention. To ensure the accuracy of the anthropometric measurements, at least two of three measurements had to be the same, or an average of the three was calculated when all measurements were different. Body weight was measured at baseline and postintervention using a Tanita electronic scale with a precision of 100 g placed on a flat surface. Height was measured with a locally constructed wooden height scale with a precision of 1 mm.

BMI was calculated as the weight in kilograms divided by the square of the height in meters. Socioeconomic information—including age, marital status, and educational level—was collected by a structured questionnaire. Information on immunization and vitamin A capsule intake was collected and verified with an immunization record card kept with mothers.

### Data analysis

The impact of the intervention was evaluated on the basis of differences between the intervention, comparison, and control groups, in changes in indicators of socioeconomic status, nutritional status, iodized salt intake, immunization, and vitamin A capsule intake from baseline to the end of the intervention. Data were entered with the use of the Access and Excel database programs. The data were provided to the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B), rechecked, and processed for analysis with SPSS for Windows software. Baseline characteristics were compared among the groups by analysis of variance (ANOVA) for normally distributed continuous variables and chi-square tests for categorical variables. Changes from baseline in body weight and length were compared among the groups by ANOVA. Statistical significance was accepted at a 5% probability level.

### Results

The project outcome variables of this study were changes in nutritional status as indicated by anthropometric measurements, changes in immunization status of the children of the RMA members, change in use of iodized salt, and changes in vitamin A coverage. The background characteristics of the three groups of women were similar (table 2). The groups were almost equally distributed between high and low vulnerable areas. The age distributions of the three groups were similar. Marital status was almost comparable among the groups and no significant change was found in the postintervention period.

The mean age, mid-upper-arm circumference,

TABLE 1. Ingredients, nutrient contents, and cost of *khichuri*

| Ingredient | Quantity                         | Carbohydrate (g) | Protein (g) | Fat (g) | Calories (kcal) | Calcium (mg) | Phosphorus (mg) | Iron (mg) | Vitamin A ( $\mu\text{g}$ ) | $\beta$ -Carotene ( $\mu\text{g}$ ) <sup>a</sup> | Thiamine (mg) | Ascorbic acid (mg) | Cost (taka) <sup>b</sup> |
|------------|----------------------------------|------------------|-------------|---------|-----------------|--------------|-----------------|-----------|-----------------------------|--|---------------|--------------------|--------------------------|
| Rice       | 65 g<br>(2 fistfuls)             | 51.4             | 4.16        | 0.26    | 225             | 5.85         | 5.85            | 0.65      | 0                           | 0  | 0.039         | 0.000              | 1.17                     |
| Lentil     | 25 g<br>(1 fistful)              | 14.8             | 6.28        | 0.18    | 85.8            | 17.3         | 73.3            | 1.9       | 0                           | 67.5   | 0.011         | 0.000              | 1.3                      |
| Egg        | 55 g<br>(1 piece)                | 0                | 7.32        | 7.32    | 95.2            | 33           | 121             | 1.16      | 198                         | 330  | 0.000         | 0.000              | 4.00                     |
| Oil        | 25 g<br>(5 teaspoons)            | 0                | 0           | 25      | 225             | 0            | 0               | 0         | 0                           | 0  | 0.000         | 0.000              | 0.94                     |
| Potato     | 50 g<br>(1 medium)               | 11.3             | 0.8         | 0.05    | 48.5            | 5            | 20              | 0.24      | 0                           | 0.03   | 0.030         | 8.500              | 0.50                     |
| Pumpkin    | 26 g<br>(1 medium)               | 1.2              | 0.36        | 0.03    | 6.5             | 2.6          | 7.8             | 0.11      | 0                           | 13   | 0.000         | 0.520              | 0.41                     |
| Onion      | 17.6 g<br>(1 medium)             | 2.22             | 0.32        | 0.02    | 10.4            | 7.04         | 10.6            | 0.21      | 0                           | 4.4  | 0.014         | 0.352              | 0.45                     |
| Garlic     | 2 g<br>( $\frac{1}{4}$ teaspoon) | 0.6              | 0.13        | 0       | 2.9             | 0.6          | 1.2             | 0.02      | 0                           | 0  | 0.000         | 0.260              | 0.14                     |
| Ginger     | 2 g<br>( $\frac{1}{4}$ teaspoon) | 0.25             | 0.05        | 0.02    | 1.34            | 0.4          | 1.2             | 0.07      | 0                           | 0.8  | 0.001         | 0.120              | 0.14                     |
| Salt       | 3 g<br>( $\frac{1}{2}$ teaspoon) | 0                | 0           | 0       | 0               | 0            | 0               | 0         | 0                           | 0  | 0             | 0                  | 0.04                     |
| Total      | 268 g                            | 82               | 19          | 33      | 700             | 72           | 241             | 4.4       | 198                         | 416  | 0.0955        | 9.75               | 9.09<br>(US\$0.14)       |

a. 6  $\mu\text{g}$   $\beta$ -carotene = 1  $\mu\text{g}$  vitamin A (retinol) [12].  $\beta$ -Carotene + vitamin A = 267.33  $\mu\text{g}$  vitamin A. 416  $\mu\text{g}$  of  $\beta$ -carotene = 69.33  $\mu\text{g}$  of vitamin A. 198  $\mu\text{g}$  vitamin A + 69.33  $\mu\text{g}$  vitamin A = 267.33  $\mu\text{g}$  of vitamin A.

A. Thus all ingredients of *Khichuri* contain 267.33  $\mu\text{g}$  of vitamin A.

b. US\$1.00 = 66 taka (September 2005).

weight, height, and BMI of the women were similar in the control, intervention, and comparison groups at baseline (table 3).

At baseline, the proportion of malnourished women (BMI < 18.5) was similar among the respondent groups. At postintervention, the proportion of malnourished women had increased by about 5% in both the control and the comparison groups and had decreased by 11% in the intervention group. The proportion of better-nourished women (BMI > 18.5) in the control group decreased from 67.5 to 62.9% from baseline to postintervention, and decreased from 67.5% to 62.2% in the comparison group, but increased from 68.8% to 80.0% ( $p = 0.04$ ) in the intervention group (fig. 1).

The net gain or loss of body weight from baseline to postintervention was compared among the respondent groups. The intervention group had a net mean weight gain of 1,333 g, as compared with weight losses of 277

g in the control group and 147 g in the comparison group (Bonferroni correction, intervention vs. comparison group,  $p = .001$ ; intervention vs. control group,  $p = .001$ ). No significant difference was found between the control and comparison groups (fig. 2).

At baseline in each group, 60% to 66% of the women had correct knowledge about the consumption of iodized salt, and 54% to 61% used packaged iodized salt. At postintervention, knowledge and use of packaged iodized salt significantly improved in the intervention group ( $p = .001$ ) as compared with the other two groups (table 4).

About 40% of children under 5 years of age were fully immunized (i.e., vaccinated against six childhood diseases—diphtheria, pertussis [whooping cough], tetanus, tuberculosis, polio, and measles) at baseline. At postintervention, 56.7%, 56.0%, and 49.1% of children in the control, intervention, and comparison groups,

TABLE 2. Comparison of background characteristics of respondents between baseline and postintervention survey (percentage of respondents)

| Indicator                                  | Baseline                   |                                 |                               | Postintervention           |                                 |                               |
|--|----------------------------|---------------------------------|-------------------------------|----------------------------|---------------------------------|-------------------------------|
|  | Control group<br>(N = 415) | Intervention group<br>(N = 439) | Comparison group<br>(N = 421) | Control group<br>(N = 415) | Intervention group<br>(N = 439) | Comparison group<br>(N = 421) |
| Social group                               |                            |                                 |                               |                            |                                 |                               |
| High vulnerability to economic instability | 48.9                       | 51.3                            | 46.3                          | 48.9                       | 51.3                            | 46.3                          |
| Low vulnerability to economic instability  | 51.1                       | 48.7                            | 53.7                          | 51.1                       | 48.7                            | 53.7                          |
| Age (yr)                                   |                            |                                 |                               |                            |                                 |                               |
| 18–24                                      | 12.5                       | 13.0                            | 13.1                          | 9.6                        | 11.2                            | 10.2                          |
| 25–29                                      | 35.9                       | 40.3                            | 40.4                          | 33.5                       | 39.0                            | 42.0                          |
| 30–34                                      | 40.2                       | 37.6                            | 37.1                          | 37.3                       | 36.2                            | 34.0                          |
| 35–39                                      | 9.9                        | 8.4                             | 9.3                           | 18.1                       | 13.0                            | 13.5                          |
| ≥ 40                                       | 1.4                        | 0.7                             | 0.2                           | 1.4                        | 0.7                             | 0.2                           |
| Marital status                             |                            |                                 |                               |                            |                                 |                               |
| Married                                    | 11.8                       | 8.0                             | 7.6                           | 16.9                       | 10.3                            | 11.9                          |
| Divorced                                   | 19.8                       | 17.8                            | 18.3                          | 14.0                       | 14.4                            | 15.9                          |
| Separated                                  | 8.2                        | 7.5                             | 7.1                           | 6.7                        | 8.0                             | 6.7                           |
| Widowed                                    | 37.1                       | 37.8                            | 39.4                          | 34.5                       | 36.9                            | 39.2                          |
| Abandoned                                  | 22.7                       | 28.9                            | 27.1                          | 28.0                       | 30.5                            | 29.2                          |

TABLE 3. Age, weight, height, MUAC, and BMI in the three respondent groups at baseline (mean ± SD)

| Indicator   | Control group<br>(N = 415) | Intervention group<br>(N = 439) | Comparison group<br>(N = 421) | $p^a$ |
|-------------|----------------------------|---------------------------------|-------------------------------|-------|
| Age (yr)    | 28.80 ± 4.34               | 28.55 ± 4.23                    | 28.67 ± 4.06                  | .315  |
| Weight (kg) | 43.62 ± 5.85               | 43.37 ± 5.67                    | 42.87 ± 5.63                  | .261  |
| Height (cm) | 148.99 ± 5.53              | 149.52 ± 6.08                   | 149.00 ± 5.45                 | .229  |
| MUAC (cm)   | 23.86 ± 2.26               | 23.85 ± 2.25                    | 23.77 ± 2.26                  | .747  |
| BMI         | 19.64 ± 2.34               | 19.40 ± 2.27                    | 19.30 ± 2.19                  | .373  |

BMI, body mass index; MUAC, mid-upper-arm circumference

a. One-way analysis of variance.

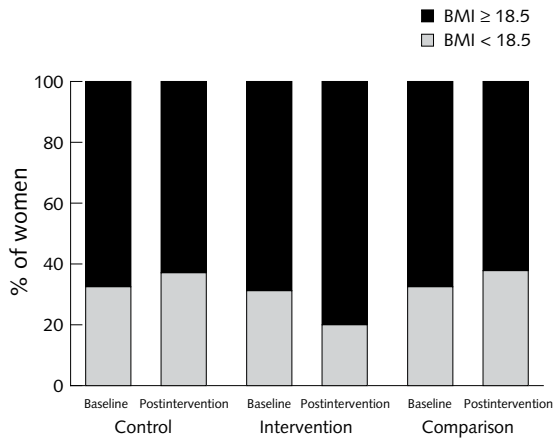


FIG. 1. Distribution of body mass index (BMI) values at baseline and postintervention. \* $p < .005$ , baseline versus postintervention

respectively, were fully immunized. The percentage of children with Bacille Calmette-Guérin vaccination was 54.4%, 54.4%, and 56.3% in the control, intervention, and comparison groups, respectively, at baseline and increased significantly to 84.65%, 78.6%, and 80.9% at postintervention. At baseline, about 40% of children in all groups had received the third dose of oral polio vaccine, and the percentage rose to about 60% at postintervention. The percentage of children who had received the third dose of diphtheria-pertussis-tetanus vaccine was 49.0%, 45.6%, and 44.9% in the control, intervention, and comparison group, respectively, at baseline and 57.7%, 50.8%, and 49.1% at postintervention. At baseline about 20% of children in all groups had received partial immunization; at postintervention the percentage of children with partial immunization had increased to 28.8%, 36.5%, and 34.5% in the control, intervention, and comparison groups, respectively (table 5).

At baseline, 67.4%, 60.4%, and 72.9% of children in the control, intervention, and comparison groups, respectively, had received a first dose of vitamin A

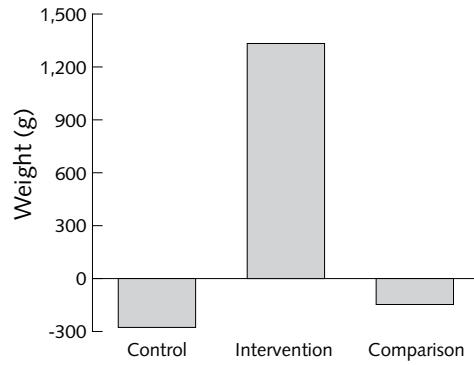


FIG. 2. Changes in mean body weight between baseline and postintervention.  $p = <.001$ , post hoc test (Bonferroni correction), intervention versus control group and intervention versus comparison group

capsules within the previous 12 months. At postintervention, these percentages had increased significantly in the intervention group (97.1%), but not in the control and comparison groups (61.3% and 67.5%, respectively). At baseline, 38.3%, 31.3%, and 41.7% of children in the control, intervention, and comparison groups, respectively, had received a second dose of vitamin A capsules in the previous 12 months. These proportions did not change much at postintervention in the control (36.7%) and comparison (36.4%) groups. However, in the intervention group, 84.4% of the children had received a second dose of vitamin A capsules at postintervention (table 6).

### Discussion

The study aimed to compare the improvement in the health and nutrition situation of the destitute women who were recruited for RMP jobs and received nutrition education with that of women who did not receive education. The health and nutrition pilot project was spearheaded by the RMP CARE staff field trainers and

TABLE 4. Knowledge and practices concerning iodized salt at baseline and postintervention (percentage of respondents)

| Indicator                            | Baseline                |                              |                            |          | Postintervention        |                              |                            |                       |
|--------------------------------------|-------------------------|------------------------------|----------------------------|----------|-------------------------|------------------------------|----------------------------|-----------------------|
|                                      | Control group (N = 415) | Intervention group (N = 439) | Comparison group (N = 421) | <i>p</i> | Control group (N = 415) | Intervention group (N = 439) | Comparison group (N = 421) | <i>p</i> <sup>a</sup> |
| Understands benefits of iodized salt |                         |                              |                            |          |                         |                              |                            |                       |
| Yes                                  | 59.8                    | 65.6                         | 58.9                       | .089     | 77.3                    | 100                          | 84.3                       | .001                  |
| No                                   | 40.2                    | 34.4                         | 41.1                       |          | 22.7                    | 0                            | 15.7                       |                       |
| Type of salt used                    |                         |                              |                            |          |                         |                              |                            |                       |
| Packaged (iodized)                   | 56.6                    | 54.4                         | 60.6                       | .185     | 58.1                    | 96.8                         | 66.7                       | .001                  |
| Unpackaged                           | 43.4                    | 45.6                         | 39.4                       |          | 41.9                    | 3.2                          | 33.3                       |                       |

a. Chi-square test.

technical officers, who were given training for only two days by external faculty members. The baseline and postintervention surveys were conducted less than one year apart, which is a short period for behavior change in health and nutrition. The project outcome variables were nutritional status as indicated by anthropometric measurements, change in immunization status of the children of RMA (Rural Maintenance Association) members, change in use of iodized salt, and change in vitamin A coverage. Immunization coverage uniformly improved in all study groups at postintervention from baseline, whereas the other three outcomes improved only in the intervention group. The intervention group, which received nutrition education and routine RMP remuneration, had consistent improvement in health and nutrition, as evidenced by increases in anthropometric measurements and BMI. Exposure to education and information can empower a woman to maximize her scanty resources for the health of her family [9, 10]. An earlier study in Bangladesh showed that education intervention can improve the diet, resulting in greater nutrient intake and weight gains of respondents as

compared with controls [11].

Demonstration of preparation of the complementary food (*khichuri*) was a key component in this study and was well received by the mothers. It was established earlier that weight gain is positively associated with the frequency of feeding of *khichuri*, eggs, and potatoes [11]. *Khichuri* is a home-based, nutrient-dense, mixed food containing rice, oil, eggs, and lentils. The limiting amino acid of rice is lysine, which is provided by lentils, and the limiting amino acid in lentils is methionine, which is high in rice and egg in *khichuri*, increases quality of the protein in diet. The vegetables in *khichuri* increase the beta-carotene content. Egg yolk adds vitamin A and minerals. The ingredients of *khichuri* are available year-round throughout Bangladesh. Foods of animal origin are rich sources of iron, but are not easily affordable by most people of Bangladesh, except for eggs.

All anthropometric indicators of the three respondent groups were similar at baseline. At postintervention, body weight, mid-upper-arm circumference, and BMI had increased significantly in the intervention

TABLE 5. Immunization coverage of 0- to 60-month old children of respondents at baseline and postintervention (percentage of children)

| Immunization                      | Baseline                   |                                    |                                  | Postintervention           |                                    |                                  |
|-----------------------------------|----------------------------|------------------------------------|----------------------------------|----------------------------|------------------------------------|----------------------------------|
|                                   | Control group<br>(N = 149) | Intervention<br>group<br>(N = 285) | Comparison<br>group<br>(N = 176) | Control group<br>(N = 104) | Intervention<br>group<br>(N = 126) | Comparison<br>group<br>(N = 110) |
| None                              | 44.3                       | 43.9                               | 43.2                             | 14.4                       | 17.5                               | 16.4                             |
| BCG                               | 54.4                       | 54.4                               | 56.3                             | 84.6                       | 78.6                               | 80.9                             |
| OPV-0                             | 53.0                       | 48.8                               | 44.9                             | 70.2                       | 59.5                               | 68.2                             |
| OPV-1                             | 51.7                       | 50.5                               | 51.7                             | 74.0                       | 67.5                               | 72.7                             |
| OPV-2                             | 49.7                       | 46.7                               | 46.0                             | 62.5                       | 59.5                               | 63.9                             |
| OPV-3                             | 43.0                       | 40.7                               | 39.8                             | 64.4                       | 58.7                               | 59.1                             |
| DPT-1                             | 53.7                       | 50.9                               | 51.7                             | 69.2                       | 66.7                               | 69.1                             |
| DPT-2                             | 50.3                       | 48.1                               | 49.4                             | 57.7                       | 50.0                               | 50.0                             |
| DPT-3                             | 49.0                       | 45.6                               | 44.9                             | 57.7                       | 50.8                               | 49.1                             |
| Measles                           | 40.9                       | 37.9                               | 38.1                             | 55.8                       | 46.0                               | 48.2                             |
| Partial immunization <sup>a</sup> | 16.1                       | 19.3                               | 19.9                             | 28.8                       | 36.5                               | 34.5                             |
| Full immunization <sup>b</sup>    | 39.6                       | 36.8                               | 36.9                             | 56.7                       | 56.0                               | 49.1                             |

BCG, Bacille Calmette-Guérin; DPT, diphtheria-pertussis-tetanus; OPV, oral polio vaccine

a. Did not receive one or more of the six vaccines (diphtheria, pertussis [whooping cough], tetanus, tuberculosis, polio and measles) of immunization program.

b. Received all six vaccines.

TABLE 6. Distribution of vitamin A capsules to children of the respondents at baseline and at postintervention (percentage of children)

| Vitamin A dose | Baseline                   |                                 |                               |                       | Postintervention           |                                 |                               |                       |
|----------------|----------------------------|---------------------------------|-------------------------------|-----------------------|----------------------------|---------------------------------|-------------------------------|-----------------------|
|                | Control group<br>(N = 128) | Intervention group<br>(N = 163) | Comparison group<br>(N = 139) | <i>p</i> <sup>a</sup> | Control group<br>(N = 120) | Intervention group<br>(N = 135) | Comparison group<br>(N = 121) | <i>p</i> <sup>a</sup> |
| 1st            | 67.4                       | 60.4                            | 72.9                          | .061                  | 61.3                       | 97.1*                           | 67.5                          | .000                  |
| 2nd            | 38.3                       | 31.3                            | 41.7                          | .149                  | 36.7                       | 84.4*                           | 36.4                          | .000                  |

a. Chi-square test.

group. Body weight significantly decreased in the control group, remained unchanged in the comparison group, and increased in the intervention group. Mid-upper-arm circumference remained almost the same as the baseline value in the control and comparison groups but increased in the intervention group. BMI was reduced in the control group, remained unchanged in the comparison group, and increased significantly in the intervention group. Nutritional improvement was expected in the intervention group as a result of their improved dietary practices, especially eating *khichuri* at the workplace. *Khichuri* offers nutritional benefits and has the advantages of being easily prepared from affordable local ingredients.

Over the study period, the percentage of women with an understanding of the benefits of iodized salt increased in all groups and increased to 100% in the intervention group. Intervention had a good impact on knowledge and use of packaged (iodized) salt by the intervention group, as compared with the nonintervention groups.

Nearly 40% of the children were fully immunized in the baseline survey. But it was alarming that the intervention group was comparable with other groups even after the intervention. The proportion of children who were only partially immunized was also alarming, since these children were not protected from all immunizable diseases. Bacille Calmette-Guérin (BCG) coverage improved in all groups at the end of the intervention. This may have been due to the national immunization program EPI.

At postintervention, the proportion of children who

had received at least the first dose of vitamin A capsules in the previous 12 months significantly increased in the intervention group, but not in the control and comparison groups. This result showed that the intervention had significantly increased awareness and utilization of the national vitamin A supplementation program in the country by the respondent mothers of the intervention group.

The success of this pilot health and nutrition project is evident, although there were some limitations; the data on food behavior and caring practices, or linkages were not collected at baseline or postintervention survey. This might have provided some causal relationship of nutritional improvement with those factors in the intervention group. It is important to mention that the nutrition intervention had a positive impact on the destitute women of the RMP; they received regular wages, which enabled them to buy food and medicine and maintain better hygiene. It is recommended that nutrition education modelled on this type of linkage program to local health-care and other services be incorporated with programs such as the RMP involving destitute and malnourished women.

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