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Assessing acceptance and effects of child feeding counselling on nutritional status of children aged 6–23 months in a semi-urban community

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Abstract

In Bangladesh, only 34 % of the children aged 18–23 months old are given minimum acceptable diets of complementary foods. Objective of the study was to find the effects of complementary feeding counselling on nutritional status among 6–23 months old children of poor families. This was a community-based randomised control trial. A total of 192 children in two groups were randomly selected. Nutrition education was given for a period of 4 months with post-intervention follow-up for 2 months. After 4 months of intervention, the difference in height for age *Z* score, weight for height *Z* score and weight for age *Z* score were significantly higher in the intervention group than in the control group (1·01 ± 0·31 *v.* 0·19 ± 0·01, $P =< 0·001$; 1·34 ± 0·15 *v* 0·72 ± 0·11, $P =< 0·001$; 1·5 ± 0·24 *v.* 0·62 ± 0·04, $P =< 0·001$). Mid-upper arm circumference *Z* score also improved in the intervention group than in the control group (0·95 ± 0·03 *v.* 0·57 ± 0·12, $P =< 0·001$). Morbidity of the children in the intervention group significantly reduced than in the control group (49 % *v* 80·20 %, $P =< 0·001$). Higher feeding frequency (3–4 times) (71·9 % *v.* 45·8 %) and energy intake increased in the intervention group than in the control group. Promotion of complementary feeding from the family foods can improve the nutritional status of 6–23 months old children of poor families within a short period.

Key words: **Nutrition education: Counseling: Homemade recipe: Demonstration**

Complementary feeding (CF) is well-defined by WHO which should be started after 6 months of age when breast milk remains no longer enough to meet adequate nutritional needs of infants and young children[1]. The transition from exclusive breastfeeding to family foods after 6 months of age is referred to as CF. CF typically covers children aged 6–23 months when nutrient deficiencies and illness may contribute to undernutrition[1].

The introduction of appropriate complementary foods during infancy is essential for desired physical growth and mental development[2]. WHO and United Nations International Children's Emergency Fund (UNICEF) have recommended the timing of the introduction of CF and the importance of frequency of feeding, dietary energy density and adequate nutrient intake for the appropriate growth of children after exclusive breastfeeding[3]. Another study suggested that optimising the use of local foods in the diets of children aged 6–23 months can improve nutrient intake[4]. Locally available foods which are affordable to households can enrich children's diets and ensure increased energy, protein and micronutrients. Complementary foods at the beginning should be soft or mashed and offered in small quantities several times a day[5]. WHO guidelines recommend energy requirements besides adequate breast milk from the complementary foods as 836·8 kJ/d for infants aged 6–8 months, 1255·2 kJ/d for infants aged 9–11 months and 2301·2 kJ/d for children aged 12–23 months[1]. The infants should start receiving CF at 6 months of age in addition to breast milk, initially 2–3 times a day between 6 and 8 months, increasing to 3–4 times daily between 9 and 11 months and more between 12 and 23 months in addition to nutritious snacks offered 1–2 times per day, as desired[1].

In Bangladesh, some mothers introduce foods to infants as early as 1 month of age and by the age of 6–8 months, only 50·3 % of breastfed children receive semi-solid or solid complementary foods according to Bangladesh Demographic and Health Survey 2017–2018. Only 25 % of infants are fed with vitamin A-rich foods and as little as 10 % receive foods from animal sources which may be responsible for high level of stunting such as 31 % in Bangladesh[6].

Cereal-based foods are the major component of CF for most of the children (51 %) at 6–7 months of age. Food items from animal protein sources (flesh foods, e.g. meat, fish, poultry and eggs) are essential for physical and mental development, but

Abbreviations: CF, complementary food; IYCF, infant and young child feeding; MUAC, mid-upper arm circumference.

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are introduced at a somewhat later age. Only about one in ten children are given meat, fish, poultry and eggs when they are at 6–7 months of age, and the proportion of these foods increases with age[6].

Over the years, the country has adopted legislation and curriculum on infant and young child feeding (IYCF), including a National Strategy for IYCF and a Plan of Action on Nutrition (NPAN 1 and 2). Promotion and protection of breastfeeding and CF have been included as one of the key areas in this strategy[7].The nutrient-dense complementary food recipes developed by the Bangladesh Breastfeeding Foundation containing 35 recipes unwrapped by the Honorable Prime Minister of Bangladesh during the World Breastfeeding Week 2014, were recommended to use in the community and disseminated widely, including in the areas where malnutrition is higher[8].

In consideration of the existing malnutrition in infants and young children and poor practices of CF in Bangladesh, this study was undertaken in a poor semi-urban setting to investigate the effects of IYCF counselling on the use of improved homemade food recipes and better feeding to improve the nutritional status of young children.

Materials and methods

Study design and population

In this community-based study in Kamrangir Thana, adjacent to west side of Dhaka city, we randomised infants and young children in two groups (intervention and control) during September to December, 2018. Ward no. 55 was selected to serve as the control area and ward no. 57 was selected as the intervention area, keeping ward no. 56 as a buffer between two selected wards to minimise diffusion of the intervention inputs. The data related to IYCF were collected from mothers and caregivers. Trained nutritionists visited the control group and the intervention group once in week for first two months and once in two weeks for last two months for a period of 4 months. Data were collected and analysed at baseline and at the end line for both the study groups. Fig. 1 shows a flow diagram describing enrollment and follow-up of participants in the study.

Children aged 6–23 months were numbered in each ward, then the desired number of sampled children was randomly selected. Children below 6 months and over 2 years of age were excluded in this study. Sample size was calculated by

$$n = \frac{2\sigma^2\left(Z_{1-\alpha/2} + Z_{1-\beta}\right)^2}{(\mu_1 - \mu_2)^2} \quad (1)$$

where n is the required number of samples in each groups, $z_{1-\alpha/2} = 1.96$ is the critical value of the standard normal distribution at the 95 % significance criterion for $\alpha = 0.05$, $z_{1-\beta} = 0.845$ is the critical value of the standard normal distribution at the chosen power of 80 % for$\beta = 0{\cdot}2$, $\mu_1 - \mu_2$ represents the difference in treatment means between the intervention and control groups, σ is the pooled standard deviation of the two outcome variables, it can be estimated as $S_p = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}$. From our pilot study, we found that $n_2 = 15$, $n_1 = 15$, $\mu_1 = 8.61$, $\mu_2 = 8.01$, $s_1 = 1.75$, $s_2 = 1.16$ and $S_p = 1.485$. Hence, $n = 96.39 \approx 96$ is the required sample size for each group. Therefore, the total sample size was 192 children.

Project staff of Bangladesh Breastfeeding Foundation were given thorough training with practical sessions on the preparation of complementary foods from the advised recipes to advise the mothers and caregivers of the study children according to age in intervention area. Mothers and caregivers were explained the benefits of homemade CF, caring practice for growth and development of the study children. Consents for participation in the study were obtained from the mothers and caretakers during the selection of subjects. The trained study staff stayed for 2 h in the premises of the household to observe the preparation of the complementary foods and feeding of the children by their mothers. The study staff gave counselling to each mother and caregiver in the intervention area on nutrition, breastfeeding, CF and demonstrated the diet preparation and frequency of feeding.

Infant and young child feeding intervention

UNICEF has recommended the implementation of nutrition triangle which includes food security, disease control and caring practices[9] for maintaining optimum health of young children. In this study, the main focus of counselling was to increase caretaker's awareness, knowledge, skills and motivation for the use of home food items to prepare nutrient-dense complementary foods in order to improve the nutritional status of their children. The benefits of nutrient-dense complementary foods prepared with available, diversified ingredients at home were discussed with the mothers and caregivers. In their courtyard, hands-on training on WASH, particularly the importance of personal and food hygiene and sanitation to prevent infection, was explained and demonstrated to the caregivers. During the intervention, mothers and caregivers were advised to feed their children only home-prepared complementary foods and refrain from commercial foods including snacks.

IYCF counselling sessions for mothers and caregivers were conducted at a frequency of once in a week for the first 2 months and once in 2 weeks for the last 2 months in the intervention group. The children in the control area received ongoing public health services and nutrition care through the government health system.

Demonstration on cooking complementary feeding recipes

Trained staff of the study introduced a variety of nutrient-rich recipes of different CF diets namely Khichuri, fish chop (cutlet), meat chop (cutlet), Chirar polao (a special type of rice that is made of flattened rice and ghee), egg suji (semolina), carrot halwa and pustigura using flipcharts and pictorial booklets prepared for this study. The selected recipes were already tested in the improved recipe trial all over Bangladesh where local availability and acceptability were examined. It was adopted from traditionally used local diet and improved in nutrient density in the recipe trial at household level, and it was then published in the complementary recipe book of the FAO and international

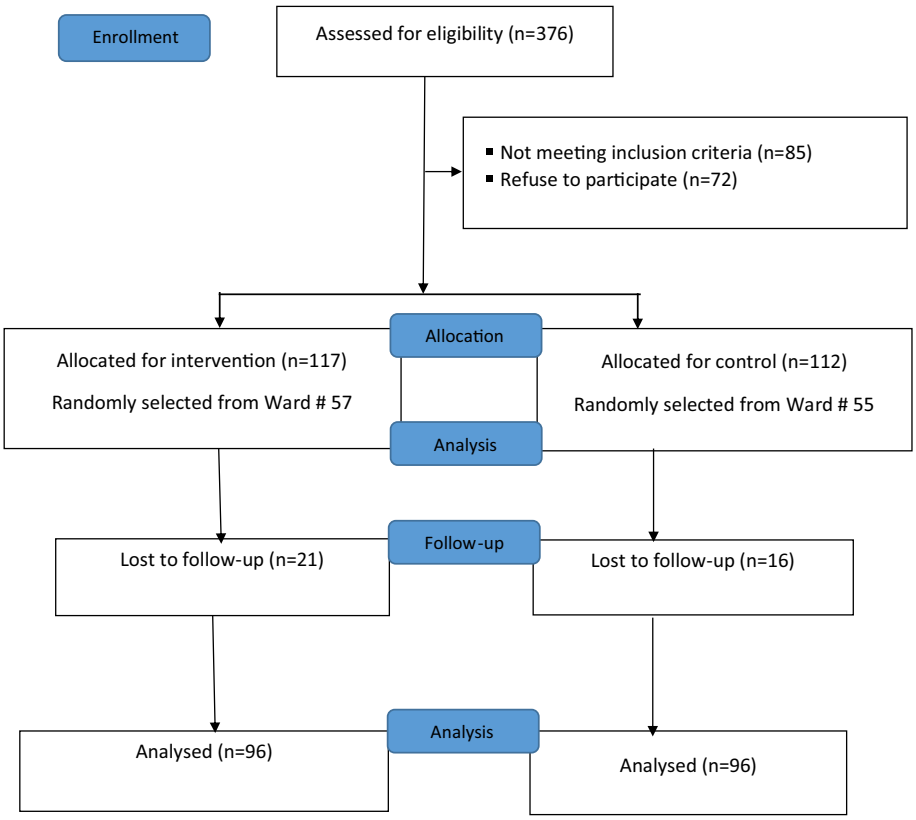

Fig. 1. Flow diagram of inclusion of participants within the study for the intervention and control groups and included in the analyses. Data from home visits at baseline and at end line performed during September to December 2018 were included in the analyses.

journal[9]. Two groups of foods were selected for two age groups of study children in this study from the improved recipe book published by BBF.

Diet A: (For 6–12 months old children)

1. Main meal: Egg khichuri, egg suji (semolina), vegetable khichuri

2. Snacks: Pumpkin soup, tomato soup, Sujir halwa

Diet B: (For 13–23 months old children)

1. Main meal: Chicken khichuri, chirar (flattened rice) polao, liver khichuri

2. Snacks: Small fish chop, chicken chop, carrot laddu

Composition of the recipes

1. **Egg Khichuri** was made with 75 g rice, 30 g pulse, one pc egg, 20 g pumpkin, 20 g dark green leafy vegetables and 5 tea spoon of oil. This provided a total of 493.7 KJ energy and 3·80 g protein/100 g and was highly acceptable.
2. **Egg suji** was made with 30 g rice powder or suji, one egg, 15 g sugar, 15 g pumpkin, 10 g carrot, 5 g oil and water. This amount of Egg-suji provided 652.7 KJ of energy and 5·97 g protein/100 g.
3. **Chirar polao** was made with 60 g flat rice, one egg, 25 g carrot and 25 g vegetables, 5 g spices, 10 g oil and water. This gave 732.2 KJ energy and 5·46 g protein.
4. **Chicken Chop** was made with 25 g powder rice, 30 g chicken, 15 g pumpkin, 120 g potato, 5 g spices, 10 g oil and water. This gave 707 KJ energy, 5·83 g protein and small fish chop gave 765.7 KJ energy and 5·66 g protein.
5. **Carrot laddu** made with 15 rice powder, 70 g carrot, 200 ml milk, 15 g papaya, 20 g sugar, 5 g oil. This gave 903.7 KJ energy, 6·19 g protein/100 g.
6. **Tomato soup** made with 150 g tomato, 5 g rice powder, 15 g pumpkin, 25 g carrot, 15 g oil, 5 g sugar, 15 g oil and water. This gave 456 KJ energy and 4·91 g protein, 5·78 g fat and pumpkin soup gave 405.8 KJ energy and 3·07 g protein/100 g.
7. **Vegetable khichuri** was made with 40 g rice, 20 g pulses, 5 g nut, 15 g carrot, 15 g spinach, 10 g oil and water. This gave 523 KJ energy and 3·78 g protein/100 g.
8. **Sujir Halwa** was made with 20 g rice powder, 20 g sugar, 200 g milk, 10 g coconut and 15 g carrot. This provided 753.1 KJ energy and 5·93 g protein/100 g.
9. **Chicken khichuri** ingredients were 40 g rice, 10 g lentil, 20 g chicken, 10 g carrot, 20 g onion, 5 g string beans, 10 g oil, 5 g necessary spices and added 370 g water. This recipe gave 531.3 KJ energy and 4·39 g protein/100 g.
10. **Liver Khichuri** was made with 20 g liver, 30 g rice, 20 g potato, 10 g pulses, 15 g pumpkin, 10 g oil and water. This gave 552.2 KJ energy, 5·36 g fat, 16 g CHO and 4.20 g protein/100 g.

As part of hands-on training, a research assistant helped the mother to cook the diets as appropriate for the age of her child.

Mothers and caregivers were advised to serve the main meals for three times and snacks for two times in-between the main meals daily. When the food was ready, mothers tested and served the food to her child. Research assistant measured the intake of food using a food scale as well as recorded the frequency of feeding per day.

Data collection

Data were collected at baseline and end line on anthropometry of children and CF practices were collected from both the intervention and control groups. For 24 h dietary recall, mothers were asked to recall the amount of food intake, frequency of intake, cooking method and food ingredients used in last 24 h. Previously measured feeding pots, bowls, cups and glasses were used to get the estimate of amount of food fed by the mother. The mothers and caregivers were also asked to recollect the memory of illness of their children during last 2 weeks. This was recorded as recent morbidity history of the study subjects. The recall was done both in baseline and end line.

Body weights of the children were measured using an electronic weighing scale (Tanita, HD-661) with a sensitivity of 100 g. For children, supine length was measured using locally made length board in which a measuring tape was fixed between a foot plate and headboard with the sensitivity of 1 mm. The mid-upper arm circumference (MUAC) of the children was measured with a MUAC tape (TALC) with the sensitivity of 2 mm.

Quality control measures

Investigators of the study re-examined the weight, height and MUAC of selected subjects measured by research assistants and feeding practices of the children once in a week for the first 2 months and once in 2 weeks for the last 2 months. Principal investigator monitored the intervention weekly and two weekly for first 2 months and second 2 months, respectively.

Statistical analysis

WHO Anthro software was used to calculate weight-for-age, height-for-age and weight-for-height *Z*-scores. The outcome variables were changes in anthropometric measurements, IYCF practices, energy and nutrient intake over time between two groups. SPSS software (version 20) was also used for analysing the variables. The bivariate analyses compared the background characteristics of children between two groups. Difference-in-difference was used to estimate net changes in children's growth over time periods between the two groups. Logistic regression model was fitted to show statistical significance of the changes over time.

Results

Socio-demographic status

In this study, among 6–23 months of children (*n* 96), 45 (46·9 %) were boys and 51 (53·1 %) were girls in the intervention group. Mean age of the children in the intervention group was 13·25 ± 4·89 months. In the control group, there were 41 (42·7 %) boys and 55 (57·3 %) girls. Majority of the mothers were housewife, 20·8 % completed primary education and 28·1 % did not complete secondary education. Professional engagement of 35·4 % of fathers was as industrial workers and 28·21 % as service holders. More than half of them earned 10 000–15 000 BDT (USD 125–188) per month. Table 1 shows the baseline anthropometric and demographic characteristics of study subjects in the intervention and control groups. The groups were poor, less educated, and mostly petty workers, and the groups were comparable in socio-economic characteristics at the baseline.

Frequency and type of complementary feeding

At the baseline, 46 % of children in the intervention group were fed 1–2 times daily and 51 % were fed 3–4 times and 2 % were fed more than five times. On the other hand, in the control group, 49 % of subjects were fed 1–2 times daily, 42 % were fed 3–4 times and 8 % were fed more than five times in a day. Feeding frequencies were comparable in the baseline. It was observed that at the end line, children in the intervention group had improved feeding practice than those of the control group, such as 2 % *v* 52 % were fed 1–2 times, 71 % *v* 45 % were fed 3–4 times and 26 % *v* 2 % were fed five times in a day (Fig. 2).

Cost of extra food for children

Fig. 3 shows that in the baseline, in the intervention group, 47 % of caretakers used to spend less than BDT 100 (USD 1·20) per month but 13 % of parents had to spend more than BDT 5000 for CF while the median of the cost for CF for a month was BDT 600. The median for the subjects of the control group was BDT 750/month. At the end of the intervention period, the median cost for CF decreased to BDT 500 in the intervention group while the same remained higher at BDT 750/month in the control group.

Nutritional status (difference-in-difference)

Increases in height, weight and age-adjusted height and weight *Z*-scores are shown in a logistic regression model of difference-in-difference adjusted for child's sex, maternal education and household income (Table 2). Difference-in-difference estimation was used to track longitudinal differences in weight, height and nutritional status from baseline to end line between the control and intervention groups. The use of difference-in-difference eliminates the influence of individual characteristics correlated with the uptake of interventions. Difference-in-difference was tested for statistical significance and a 95 % confidence interval around the OR using logistic regression model with an interaction of area and time, adjusting for sex of child, maternal education, and household income (in log scale).

Table 2 shows that mean body difference in the baseline and end line for the two groups. The intervention group was significantly higher than the control group (1·62 ± 0·26 *v* 0·62 ± 0·01 kg, $P =< 0·001$). Length of children also increased more in the intervention group than in the control group (2·71 ± 0·59 *v* 0·48 ± 0·16 cm, $P = 0·004$). MUAC increased in the intervention group more

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Table 1. Socio-demographic characteristics of children in intervention and control groups at baseline

Characteristics	Categories	Intervention *n* 96		Control *n* 96		*P*-value
		n	%	*n*	%	
Gender	Boy	45	46·9	41	42·7	0·56
	Girl	51	53·1	55	57·3	
Age group	6–12 months	41	42·7	44	45·8	0·66
	13–23 months	55	57·3	52	54·2	
Family member	1–5 person	74	77·1	86	89·6	0·02
	6–10 person	22	22·9	10	10·4	
Mother's education	No education	18	18·8	27	28·1	0·12
	Primary incomplete (I–IV)	15	15·6	20	20·8	
	Primary complete (V)	20	20·8	22	22·9	
	Secondary incomplete (VI–IX)	27	28·1	20	20·8	
	Secondary complete and above	16	16·7	7	7·3	
Mother's occupation	Housewife	87	90·6	89	92·7	0·60
	Service holder	9	9·4	7	7·3	
Father's education	No education	23	24	20	20·8	0·10
	Primary incomplete	14	14·6	15	15·6	
	Primary complete	18	18·8	33	34·4	
	Secondary incomplete	23	24	18	18·8	
	Secondary complete and above	18	18·4	10	10·4	
Father's occupation	Rickshaw puller	20	20·8	30	31·3	0·34
	Industrial worker	34	35·4	30	31·3	
	Businessman	15	15·6	16	16·7	
	Service holder	27	28·1	20	20·8	
Household monthly income	<BDT 10 000	19	19·8	11	11·5	0·24
	BDT 10 000–15 000	49	51	49	51	
	BDT 15 001–20 000	16	16·7	16	16·7	
	>BDT 20 000	12	12·5	20	20·8	

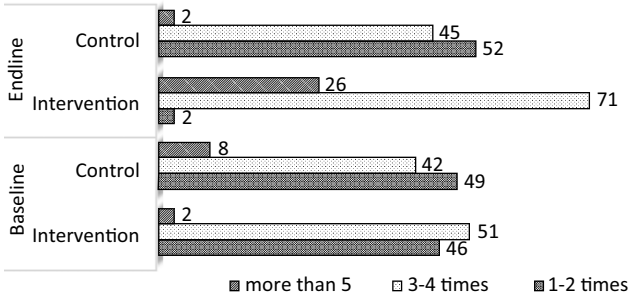

Fig. 2. Difference in feeding frequencies between intervention and control groups at the baseline and end line.

than the control group (1·09 ± 0·16 *v* 0·63 ± 0·05 cm, *P* =< 0·001). The height for age *Z* score, weight for height *Z* score, weight for age *Z* score significantly increased in the intervention group compared to the control group (1·01 ± 0·31 *v.* 0·19 ± 0·01, *P* =< 0·001; 1·34 ± 0·15 *v* 0·72 ± 0·11, *P* =< 0·001; 1·5 ± 0·24 *v.* 0·62 ± 0·04, *P* =< 0·001 respectively). Mid-upper arm circumference *Z* score also improved more in the intervention group than that of the control group (0·95 ± 0·03 *v.* 0·57 ± 0·12, *P* =< 0·001).

Table 3 shows that in the intervention group after controlling for confounding variables in the multiple regression, weight gain of the subjects was significantly and positively related to the frequency of CF (*P* =< 0·001), positively with continued breastfeeding (*P* = 0·03), intake of total energy (*P* =< 0·001) and negatively with morbidity of last month (*P* = 0·14). However, the monthly family income had no significant relationship with weight gain.

Energy and nutrient intake

At the baseline, the study children used to consume a low level of energy and nutrients. After the intervention, the median of macro and micronutrient intake in the intervention group were significantly higher compared to those of the control group. Table 4 shows that the median intake of energy (kcal) (1351 *v* 984, *P* =< 0·001); carbohydrate (g) (245 *v* 57·1, *P* =< 0·001), protein (g) (54·2 *v* 34·5, *P* =< 0·001); Fat (g) (17·5 *v* 7·5, *P* =< 0·001); Fe (mg) (7·5 *v* 3·9, *P* =< 0·001); Zn (mg) (8·9 *v* 3·4, *P* =< 0·001); Ca (mg) (222·6 *v* 141·2, *P* =< 0·001); Vitamin A (mg) (41 *v* 6·3, *P* = 0·005); Vitamin C (16·5 *v* 9·3, *P* =< 0·001) and Vitamin D (mg) (0·22 *v* 0·12, *P* =< 0·001) were higher in the intervention group than the control group.

Morbidity status

Morbidity data were collected by the recall for 2 weeks from the caretakers. After the intervention, total illness was reduced in the intervention group than in the control group (49 % *v* 80·2 %, *P* =< 0·001). At the end line, different kinds of illness had reduced in the intervention group than in the control group such as diarrhoea (19 % *v* 26 %, *P* =< 0·001); fever (17 % *v* 26 %, *P* =< 0·001); cold (17 % *v* 33 %, *P* =< 0·001) and more children in the intervention group were free from illness (51 % *v* 19 %, *P* =< 0·001) (Table 5).

Discussion

Kamrangirchar is a densely populated poor area at the west of Dhaka city. There are extreme scarcity of water and gas supply along with a lack of hygiene and sanitation facilities for the dwellers. Our study shows that the mothers and caregivers have proven a self-help means to improve the nutritional status of their children by improving CF practices.

This study was conducted to investigate the impact of short-term nutrition education with recipes of CF on improving nutritional status of 6–23 months old children in low socio-economic status who lived in semi-urban area. We found that children from households receiving nutrition interventions were more likely to meet minimum acceptable diet. They were given homemade complementary foods from four or more groups[5].The improvement in CF patterns was associated with an improvement in the nutritional status of children.

CF in our study did not improve as much as we expected as there were several constraints but the results are comparable with other previous studies[10,11,]. Some previous studies showed that early initiation of CF before 6 months resulted from the lack of knowledge of mothers[12]. A study in the coastal south India reported almost one in every ten children had initiated CF too late[13]. Another report showed that 12 % of children were delayed for initiating CF[14]. A study from China showed that the most common reason for early initiation of CF was the

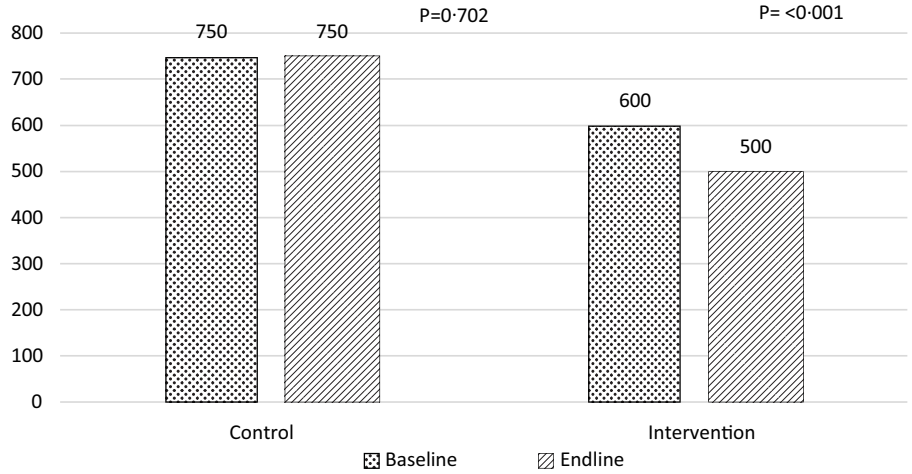

Fig. 3. Costs (in BDT) of commercial food items purchased for children in the intervention and control groups.

Table 2. Difference-in-difference in height, weight, MUAC and nutritional status (*Z*-score) of children between intervention and control groups

	Intervention group (*n* 96)						Control group (*n* 96)								
	Baseline		End line		Difference		Baseline		End line		Difference		DID		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Variables	1		2		A (col 2-1)		3		4		B (col 4-3)		A-B		*P*-value*
Height (cm)	71·86	4·87	74·57	5·46	2·71	0·59	71·8	4·47	72·28	4·31	0·48	0·16	2·23	0·43	0·004
Weight (kg)	8·21	1·35	9·83	1·61	1·62	0·26	8·16	1·17	8·78	1·18	0·62	0·01	0·99	0·25	<0·001
MUAC (cm)	13·62	1·24	14·71	1·40	1·09	0·16	13·48	1·13	14·11	1·08	0·63	0·05	0·9	0·21	<0·001
HAZ	−1·5	1·19	-0·49	1·50	1·01	0·31	−1·29	1·51	−1·1	1·51	0·19	0·01	0·29	0·30	<0·001
WHZ	−0·69	1·40	0·65	1·25	1·34	0·15	−0·71	1·39	0·01	1·28	0·72	0·11	0·72	0·04	<0·001
WAZ	−1·27	1·27	0·23	1·03	1·5	0·24	−1·21	1·12	−0·59	1·08	0·62	0·04	0·93	0·2	<0·001
MUACZ	−0·78	1·12	0·17	1·15	0·95	0·03	-0·87	1·06	-0·3	0·94	0·57	0·12	0·95	0·09	<0·001

MUAC, mid-upper arm circumference; HAZ, height for age *Z* score; WHZ, weight for height *Z* score; WAZ, weight for age *Z* score; MUACZ, mid-upper arm circumference *Z* score.
* Based on logistic model results.

Table 3. Multiple regression for weight gain of children

Independent variable	*β*-coefficient	SE	*P*-value
Frequency of CF	0·59	0·13	<0·001
Morbidity in last 2 weeks	−0·91	0·36	0·01
Continue breastfeeding	1·56	0·72	0·03
Intake total kcal	0·001	0·000	<0·001
Monthly family income (BDT)	0·287	0·19	0·14

CF = complementary food.
Dependent variable = weight gain of children.

mothers' perception that breast milk was inadequate for their babies[15]. In our study, the baseline data showed that one-third of the mothers did not start CF at the right time due to a lack of knowledge.

Initially, the caregivers of the children were very reluctant to agree with the change of feeding practices and ingredients of homemade recipes, but after explaining the benefits of each ingredient on child health and nutrition, they began to accept more studies. Nutrition education on CF alone significantly improved height for age *Z* score (SMD: 0·23; 95 % CI (0·09, 0·36)), weight for age *Z* score (SMD 0·16, 95 % CI (0·05, 0·27)) and significantly reduced the rates of stunting[16]. Demonstration on preparation of CF at home by the trained health workers helped the mothers to cook and feed their children by themselves with homemade foods. To improve nutritionally sound feeding practices, it was important to give them correct knowledge and demonstration on the cooking methods with locally available nutritious foods. This was also reflected in some previous study[8].

Our study identified the impact of nutrition education on the expenditure on CF by families. Adopting the recipes for CF and using available foods at home, the cost of external foods was reduced. Several studies demonstrated significant relationships between nutrient intake based on dietary intake and nutrient intake derived from food expenditures[17]. Higher expenditures for animal foos and non cereal foods were associated with reduction of stunting in Indonesia[18].

In addition to continued breastfeeding, mothers were suggested to feed their children five times in a day with three major meals and two snacks[19]. Frequency of feeding was a very important component in child feeding practice as it could ensure increased dietary intake in spite of the small size of stomach. Earlier studies suggested that if caregivers gave frequent feeding to their children, they were more likely to improve in nutritional status[8]. Consistent with the results of earlier studies, the present study clearly demonstrated that feeding homemade recipes from

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Table 4. Difference in energy and nutrients intake between intervention and control groups at the end line

Energy and nutrients	Intervention *n* 96		Control *n* 96		*P*-value
	Median	25th perc.–75th perc.	Median	25th perc.–75th perc.	
Energy	1351	1468·15–1573·05	984	1242·50–723·75	<0·001
CHO (g)	245	256·61–310·99	57·1	93·75–129·73	<0·001
Protein (g)	54·2	45·61–59·06	34·5	66·50–49·92	<0·001
Fat (g)	17·5	58·83–12·59	7·5	66·75–4·60	<0·001
Fe (mg)	7·5	6·91–5·64	3·9	1·75–4·31	<0·001
Zn	8·9	6·36–8·29	3·4	9·28–5·44	<0·001
Ca (mg)	222·6	271·13–134·64	141·2	239·50–2·40	<0·001
Vitamin A (mg)	41	1469·60–69·51	6·3	495–99	0·005
Vitamin C	16·5	5·00–11·12	9·3	26·75–4·05	<0·001
Vitamin D	0·22	2·50–0·02	0·12	0·25–99	<0·001

Independent samples= Mann–Whitney *U* test.

Table 5. Prevalence of self-reported two-weekly morbidity in the intervention and control groups at the baseline and end line (Number and percentages)

Morbidity type	Baseline					End line				
	Intervention (*n* 96)		Control (*n* 96)		*P*-value	Intervention (*n* 96)		Control (*n* 96)		*P*-value
	n	%	*n*	%		*n*	%	*n*	%	
Diarrhea	19	19·8	14	14·6	0·33	19	19·8	25	26	<0·001
Fever	53	55·2	35	36·5	0·09	17	17·7	25	26	<0·001
Cold	51	53·1	46	47·9	0·47	17	17·7	32	33·3	<0·001
No disease	15	15·6	21	21·9	0·26	49	51	19	19·8	<0·001
Any illness	52	53·6	45	46·2	0·57	47	49	77	80·2	<0·001

diversified foods with increased intake could improve the health of the children[8,10]. In our study, the weight gain of the subjects was positively associated with the frequency of homemade complementary foods with nutrient density. Ingredients such as eggs provided high-quality protein and the limiting amino acid methionine helped to build muscle and other tissues[8,10].

The intervention had a significant impact on the reduction of morbidity in those malnourished children. At the baseline, most of the children were seen to have a high frequency of illnesses such as fever, diarrhoea, and pneumonia, which could act as a barrier to their growth. The disease burden in the children of the intervention group was reduced as the mothers adopted hygiene practices and reduced external foods, as well as the children might have developed better immunity along with their better nutritional status. Real impact in the improvement of the nutritional status of children of poor families using their own skills and knowledge increased the empowerment of mothers. Impact of good health on the children was also seen as a reduction in morbidity as well as a reduction in the cost of feeding.

Change in behaviour is considered to be difficult, but our study showed improved feeding practices by the caregivers through the intervention and supported by our previous studies[8,20].

Some limitations of our study need to be mentioned here, such as we faced communication problem initially, mothers and caregivers were not co-operative and the decision makers of their families showed reluctance to receive counselling from outsiders on child feeding. Secondly, daily working hours were limited due to less availability of time from the busy mothers and caregivers. Lastly, when we informed them that we would not be providing any food, most of the mothers and caregivers appeared to lose interest in speaking with our research staff. However, with the progress of study, the situation reversed to cooperation when they were counselled for the benefits of homemade CF and demonstrated the cooking of complementary foods.

Conclusion

We have demonstrated that a short-term nutrition education intervention for young children resulted in increased body weight, height and MUAC, feeding practices, hygiene practices and reduction in morbidity and reduced cost for buying commercial complementary foods compared to the control group in a very poor community.

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S. K. R., the principal investigator, was involved in designing the study, trained up the staff, supervised the study and provided substantial advice on data analysis and interpretation of results. K. J. coinvestigator contributed to ensure quality control, editing and interpreting the results and supervision during the study.

N. A. reviewed the manuscript, guided analysis of data and provided interpretation. S. T. participated in planning the study, monitoring, data analysis and editing the manuscript. R. R. participated in supervision. field site control, analysing and reviewing the manuscript. All authors read and approved the final manuscript.

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