Protocol # 98-016 (BINP)

1. TITLE OF RESEARCH

Development of nutrient-dense supplementary foods for malnourished children

2. INVESTIGATORS

Principal Investigator:
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Co-Principal Investigator:
Shaheen Ahmed, College of Home Economics

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3. COLLABORATIVE INSTITUTIONS

ICDDR,B

College of Home Economics

BINP

4. PERIOD OF STUDY

Six months after the award

5. TOTAL BUDGET

US$ 20,000

ABSTRACT

Protein Energy Malnutrition (PEM) is highly prevalent amongst children in Bangladesh. Inadequate dietary intake, particularly at weaning period is a major contributory factor. In most of the areas weaning foods are either energy deficient, dilute or too thick & bulky. Bangladesh Integrated Nutrition Project (BINP) is now giving supplementary food (SF) to the severely malnourished or growth faltered children (6-24 months) with locally made high energy diet containing roasted rice-dal powder with small amount of molasses and soybean oil in the community level of some selected thanas of Bangladesh. Addition of amylase rich flour (ARF) to the supplementary food can reduce the viscosity and make the food more palatable and hence increase the intake. With this in mind, we propose to carry out a study, adding ARF to existing SF of BINP in nine community nutrition centre (CNC) which will be randomly selected and a total of 135 young severely malnourished and growth-faltered children will receive three types of diets, 45 in each group. The main composition of the diet will not be altered however study diet-I will have 2gm of ARF added to it and in study diet-II additional water will be added to make it of same viscosity/consistency as study diet-I.The third group is existing SF in 100 ml as control. The dietary intervention will be continued for three months in Sadar Thana of Faridpur district of Bangladesh.

The addition of ARF in study diet-I will not increase the cost very much. Amount of supplementary food intake (by volume and energy per kg body weight), mothers/caretakers perception regarding acceptability and percent of weight gain will be compared group wise. ARF preparation technology can be adopted at central locations or at community level by womens groups. Since mothers/caretakers will watch the preparation and observe the potential benefits of adding ARF, it is expected that the process will sustain in order to not only alleviate the growth-faltering but further growth in children.

6. INTRODUCTION: BACKGROUND AND PROBLEM STATEMENT

Protein-energy malnutrition (PEM) in young children is a most prevalent form of malnutrition in developing countries (1). The causes of such malnutrition are complex. However, inadequate dietary intake, particularly at weaning period is a major contributory factor. The usual weaning foods in Bangladesh and other developing countries based on cereals with low energy density. Such weaning foods appeared to be thick and sticky (high viscosity). Children are not able to ingest them even when not suffering from acute illness. Therefore, the foods are often diluted with additional water before being given to infants and young children (2). The consequent low energy density of such foods lead to a reduced intake of calories and protein and is an important cause of growth faltering during weaning period from 6-24 months of age (3).

The goal of Bangladesh Integrated Nutrition Project (BINP) is to reduce malnutrition among Bangladeshi children through community-based nutrition intervention, such as supplementary feeding. A common food supplementation consisting of a cereal-pulse mixture with molasses and edible oil (4) is used as supplementary food for malnourished young children at the community feeding centre.

It has been found that after dissolving with water, the prepared food become thick gruel that may not be satisfactory for young children to eat, also when it is diluted with additional water, the nutrient density is decreased.

The problem of high viscosity can be effectively overcome by liquefying an energy-dense thick porridge with amylase-rich flour (ARF) of germinated wheat (5). In our earlier studies, an energy-dense porridge liquefied with ARF was well accepted

with positive effect by malnourished young children recovering from diarrhea and dysentery (6,7,8).

7. OBJECTIVES

To improve the existing supplementary feed with respect to:

1) Means to reduce viscosity
2) Increased energy intake
3) More palatable

8. HYPOTHESIS

Addition of ARF to the existing supplementary food will decrease the viscosity and thus improve energy intake.

9. DESIGN AND METHODOLOGY

Sample size estimation

We expected a 35% increase in daily food intake in the experimental group. This estimate is based on data on food intake from a single meal of similar diet in infants aged 6-12 months (6,9). From that observation the mean intake from ARF-treated porridge was 41 g and that of untreated porridge was 26 g. With a standard deviation of 20 g, the sample size to detect a difference of 5% level of significance and with 80% power was 28 in each group. Due to cluster effect, the sample size in each group will be 28 x 1.5 = 42. Further, considering the 7% dropout, the final sample size would be 45 in each group and total 135.

Setting

In 9 Community Nutrition Centre (CNC) of BINP in Sadar thana of Faridpur district. In each CNC, about 15 young children aged 6-24 months with severely malnourished and growth-faltered children will receive the supplementary feed six days in a week for at least three months. Nine CNC from two unions will be randomly selected, and all children coming to each of these CNC will receive one of the following supplementary feeds:

The composition of different types of food to be supplemented are given below:

Ingredients	Study diet-I	Study diet-II	Control diet
1) Roasted and powdered rice (g)	20	20	20
2) Roasted and powdered dal (g)	10	10	10
3) Molasses (g)	5	5	5
4) Soybean oil (g)	3	3	3
5) ARF (g)	2	-	-
6) Water (ml)	100	300	100

In each type of the feed, total macronutrient content in a given volume is same. The feed with ARF will have some simple carbohydrate because of partial hydrolysis.

Inclusion criteria

- Age 6-24 months

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AND OTHERS

- Severely malnourished and growth-faltered children
- Either sex

Exclusion criteria

- Children with acute infectious diseases or with any other disease or disability that could interfere with dietary intake.

Study protocol

Children fulfilling the enrollment criteria will be assigned one of the three diets. Anthropometric measurement and a baseline history including socioeconomic status (SES) will be obtained. The children will come early in the morning to the CNC. They will not be allowed any home food or breastmilk or water from half an hour before starting the test diets. Each time the test diets will be freshly prepared and offered to each child. Mothers or caretakers accompanying the child will be properly instructed before starting the study and they will be asked to feed their children the study diet with a spoon and cup for half an hour. Previously it was observed that after 30 minutes of preparation of the study diet containing ARF, the osmolality becomes increased and the maximum intake of the diet was within first 15-20 minutes (8). During this half-an-hour period of taking study diet, no other food or breastmilk or water will be allowed. A Health Assistant will observe the process of feeding and take all measurements related to food intake, anthropometry and morbidity history (fever, cough/ARI, diarrhoea) weekly.

The amount eaten will be calculated by subtracting the left-over from the offered amount. A pre-weighed towel and bowl will be used to collect any vomiting, which,

if any, will also be subtracted from the calculated amount of the diet. Measurements of the diet will be taken with a balance (OHAUS, USA) with a 0.1 g sensitivity.

Mothers and caretakers accompanying the children will be also asked about the acceptability of the study diets by their children using a semistructured questionnaire.

ARF preparation

ARF will be prepared from germinated wheat (5). Initially, the production will be carried out at the Nutritional Biochemistry Laboratory of ICDDR,B. Subsequently, the technology will be transferred to any non-government organization (NGO) or a suitable production unit at institutions such as Institute of Food Science and Technology, Institute of Nutrition and Food Science, Home Economics College. Small unit of production may also be possible at the community level.

Each child is expected to consume two packets a day. For each packet, requirement of ARF is only 2 g. The additional cost due to ARF would be Taka 0.25 only and this may further be reduced when there will be bulk production system.

Sustainability of the technology

Initially, the ARF production will be done at the ICDDR,B. The technology can then be adopted either centrally or at the community level small unit. Village women group may be trained (10) to prepare at a semi-cottage industry scale.

Since mothers or caretakers will watch the preparation of supplementary food with ARF and observe the benefits, such as (a) viscosity reduction and thereby more palatable for increased intake of food by their children (b) possible weight gain, it is expected that they will tend to practice it at home and the process will sustain.

Quality control measures

Calibration of weighing machines regularly and a known weight will be checked periodically.

Random check of the SES and volume of porridge intake will be checked by the investigator.

Inter- and intra-observation variation will be monitored.

Periodical visit by the investigators will ensure further quality control.

Data analysis

Outcome variables are:

- Intake of supplementary feed by volume and energy per kg body weight.
- Weight gain over 3 months as secondary outcome.
- Comparison of mean intake (volume and energy per kg body weight) in groups.
- Comparison of weight gain (g/kg over 3 months period) groupwise.
- Comparison of mother's perception regarding acceptability.

Comparisons of means will be tested either by ANOVA or t-test as applicable. Proportion will be compared by Chi-square test. Statistical significance will be considered at 5% probability level.

10. ETHICAL IMPLICATION

Not applicable.

11. SIGNIFICANCE

The existing supplementary food (SF) at the CNC is good. However, this project will develop better tool. The addition of ARF to existing supplementary food for malnourished and growth-faltering children may be a simple and effective method to reduce the viscosity of SF and thereby making the food more palatable for increased intake which will enhance the growth of children under SF programme.

12. COLLABORATIVE ARRANGEMENT

This will be a collaborative study amongst ICDDR,B, Home Economics College (HEC) and BINP. ICDDR,B will prepare ARF for the study and impart the technology to others for continued further production. HEC will provide trained field level staff. Masters students from HEC may be allowed to work as a part of their dissertation. BINP will provide support to carry out the study at their selected site.

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DETAILED BUDGET

A.	Personnel (US$)		
	M.A. Wahed (15%) ...	1,400	
	Shaheen Ahmed (20%) ...	1,000	
	M. Iqbal Hossain (20%) ...	1,100	
	Supervisor (100%) ...	1,000	
	Health Assistant (9) (100%) ...	8,620	
	Field Attendant (3) (100%) ...	1,020	
	Data Analyst (3 months) (10%) ...	500	
	Lab Technician (3 months) (20%) ..	700	
	Subtotal		15,340
B.	Supplies (Taka)		
	Wheat 50 kg ...	1,000	
	Plastic bags ...	1,000	
	Lab Blender ...	2,500	
	Food weighing balance (10) ...	20,000	
	Feeding cups and spoons ...	5,000	
	Stationaries ...	15,000	
	Umbrella + Shoes + Bags, etc. ..	6,000	
	Transportation, etc. ...	70,000	
	Training of staff/women group ..	10,000	
	Tissues, towel and soaps ...	2,000	
	Subtotal	131,500	2,798
	Total (US$)		18,138
	Overhead (10%)		1,814
	GRAND TOTAL (US$)		19,952

MAW:mh/W7:PEM.CON