

Evaluation of the impact of a food-based approach to solving vitamin A deficiency in Bangladesh

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Abstract

The impact of the third year (March 1992–March 1993) of a Worldview International Foundation project to increase the production and consumption of high-carotene foods in Gaibandah district, Bangladesh, was evaluated. The mothers of more than 2,500 children age one to six years, representative of Gaibandah, were interviewed at one-year intervals and compared with a similar sample in a geographically adjacent non-project area of equal size. A 24-hour recall was done regarding green leafy vegetables, yellow fruits and vegetables, oil-rich foods, and non-carotene-rich vegetables.

This project was multidimensional and was based on community participation. It used women volunteers, health assistants, and schools to spread knowledge, skills, and encouragement for growing carotene-rich foods and feeding them to young children. Modern and traditional mass media reinforced the messages. Seeds for mainly local varieties of high-carotene foods were distributed free or in certain cases sold by a network of trained women volunteers.

Knowledge of the problem and its causes increased in response to the communications. Home production of the targeted high-carotene foods increased remarkably in both the project and the non-project areas. Consumption patterns changed markedly but predictably toward more expensive foods during the study year due to an unprecedented drop in the price of rice.

Children's consumption of all but the non-carotene-rich vegetables increased significantly in Gaibandah. In the non-project area, consumption of yellow fruits and vegetables increased as much as in Gaibandah, oil-rich foods less than in Gaibandah, and non-carotene-rich vegetables much more than in Gaibandah. However, consumption of green leafy vegetables decreased significantly in the non-project area and increased significantly in Gaibandah. In March 1993,

26% and 52% of children, respectively, had eaten green leafy vegetables the day before the interview.

Introduction

The impact of the third year of implementation of the Worldview International Foundation (WIF) Nutritional Blindness Prevention Programme (NBPP) in Gaibandah district, Bangladesh, was evaluated. The 1991 population of Gaibandah was estimated to be 1,856,000, divided into seven subdistricts (*thanas*). The NBPP began by testing various communication approaches to solve vitamin A deficiency in a pilot project in one thana in 1984–1986. This was evaluated by Helen Keller International (HKI) [1]. The recommendations for this evaluation were followed by NBPP and greatly influenced the design of the programme and how it was run during the next five years. Several additions were made in 1991 and 1992, as detailed below. To date, the programme has been implemented throughout four districts in northern Bangladesh with a total population of about 5 million.

In Gaibandah district, NBPP was funded by the Swedish International Development Authority (SIDA), which also funded this evaluation. Although the authors have had a close relationship with NBPP for several years, no NBPP personnel were involved in any stage of this evaluation and analysis. The NBPP staff did not know which areas were to be sampled in either the pretest or the post-test surveys, or where the control areas were.

Description of the NBPP

The NBPP attempted to achieve a cost-effective and sustainable solution to the problem of vitamin A deficiency in Bangladesh. It combined incentives for growing selected vitamin A-rich foods with education and encouragement to increase consumption of

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them and other high-carotene foods among young children. Early during the evaluation year, the third year of the programme in Gaibandah, a message was added encouraging the use of increased amounts of fat in young children's diets.

The NBPP worked through modern and traditional mass media and through a network of women volunteers (WVs) recruited from the villages, two in each union, a total of 165 in the district. The WVs, who had a minimum of 10 years of education, were given a three-day training course at the beginning and monthly one-day orientations thereafter. They worked nearly full time and received an honorarium of 600 taka (US\$1 = 38 taka) per month. WVs were expected to visit 25 households daily, five days a week, according to a planned schedule. Late in 1991 a sixth day was added, and their honorarium was increased accordingly. The WVs were supervised by thana officers who had university degrees.

The following description of the programme includes data obtained from NBPP's own records for 1992 as well as from reviews done for SIDA by one of the authors (TG) in 1992 and 1993.

Methods to increase production of vitamin A-rich foods

During the evaluation period in Gaibandah, five activities were pursued to achieve the goal of increasing production of foods that are high in carotene or fat and are therefore likely to improve vitamin A status.

Twenty schools in each of the eight subdistricts were chosen based on their interest in and prospects for gardening (land and water availability). The headmaster and one teacher were trained in relevant skills and provided with funds to purchase the inputs necessary for a school garden focusing on carotene-rich vegetables and fruits. The subsidy was 1,000 taka for the first year, 500 for the second year, and none for the third year; however, it was decided to stop the subsidy midway through the project. The schools had not been prepared for the stopping of the subsidy, and 60% of the school gardens disappeared within a few months. Seed was provided free to about 15 highly motivated students per school who wanted to begin gardening at home, for a total of about 2,400 student gardens throughout the district.

Free vegetable seed and other assistance were provided to families of all children in the project areas found to be night-blind. (According to 1992 project statistics, 1,768 new individuals with night-blindness were identified. Of these, 828 were cured during the year, but the disorder reappeared in 208 of them.) Three types of seeds were distributed to all households in the district: bottle gourd, sweet pumpkin, and climbing beans. All of these crops grew on vines

that crept up onto rooftops and into trees, thus providing carotene even for landless families.

In late 1991 the WVs became involved not just in nutrition education but also in production. They formed "green banks," consisting of demonstration gardens at their own homes and items for sale, such as seedlings, saplings, manure, and sometimes insecticide. This was intended to encourage other women in the communities to view the WVs as a source of easily available input and expertise for doing their own gardening, and thus to add sustainability to the project after it was phased out.

During 1992 the WVs began forming women's groups, usually consisting of four landholding and five landless women. These groups were given one-day training seminars in subjects ranging from horticulture to management skills. A total of 615 women's groups were formed that year, 3.7 per WV. A group garden was then started, with the harvest to be shared equally, although the landless women provided nearly all the labour. Although this was problematic to negotiate and sustain in many cases, it did provide many landless families with an increased supply of carotene-rich foods and some income. An evaluation of this approach in another district, Lalmonirhat, showed that it was successful in targeting the landless: 46% of women's group members were landless, compared with 36% of non-member households in the same area [2].

Nutrition education programme

Nutrition education in Gaibandah had six components geared toward increasing demand for these foods, especially for feeding to young children. A mass media campaign was developed to increase consumption of vitamin A-rich foods. Two different short spot advertisements were broadcast every day from the Rangpur radio station (which reaches Gaibandah). Earlier, NBPP had broadcast short spots on national television a few days a month on average. By 1992 this had become too expensive to continue, but HKI had started doing it by that time. In Bangladesh, radio reaches much of the poorer segment of the population, and television was believed to reach leaders, decision makers, and so on. The NBPP also paid for short vitamin A advertising spots to be shown continuously in local cinemas. Earlier, NBPP funded the production of a professional-quality 33-minute film in traditional melodrama-comedy style that included messages relevant to the programme. Using portable generators, this was shown outdoors at night 1,125 times in the villages in Gaibandah in 1992, attracting large audiences.

The NBPP messages were designed in the mid-1980s by a local group of experienced non-government organizations, scientists, and international agency re-

representatives to reflect the lessons learned during the previous decade or more of efforts to solve vitamin A deficiency problems in the country. These messages were modified over the years in response to four earlier project evaluations; however, they were still somewhat general. The NBPP did not use social marketing methods to tailor messages to the needs of different target groups or to identified resistance points. For example, they did not address popular beliefs such as the belief that consumption of leafy vegetables during breast-feeding causes diarrhoea. However, this was a minor component of the WIF communication effort.

Messages were conveyed through the 160 cooperating schools. In addition, the WVs (according to their own records) made 781,600 home visits. On average, each household would have been reached 2.1 times in 1992 if these visits had been evenly distributed. The WVs also gave talks to groups using a flip chart and handed out 52,560 posters during the year after giving the talks.

The WVs promoted increased production and consumption of the following special foods: 19 high-carotene vegetables consisting of 12 types of dark green leafy vegetables plus carrots, tomato, pumpkin, sweet potato, beans, arum/chara root, and cabbage; 3 types of fruit (papaya, jack fruit, and mango); 2 types of locally common fish; and 2 oil-containing foods (peanuts and mustard seeds). The NBPP had earlier chosen this message in response to a local research project that, apparently using incorrect methods, arrived at the conclusion that these fish were very high in vitamin A, especially the heads. It was later reported that the pigment responsible for this finding did not have vitamin A activity. In any case, our observations suggest that few people in Bangladesh eat either the heads or the innards of fish, meticulously removing the latter from even small fish. The NBPP never dealt with production of fish or any other animal foods.

WVs also promoted the use of colostrum and continuation of breast-feeding for two years, with dietary supplements only from five months of age. The WVs made a total of 185,000 follow-up home visits to children with night-blindness to encourage their continued receipt of these special foods.

A team of four traditional folk singers was recruited and trained for each of the eight subdistricts. They put on outdoor shows in the villages that attracted large audiences. They conveyed messages about vitamin A by singing and chanting in the local dialects, illustrating their act with flip charts. Their own estimates of audience size suggest that about 750,000 people, 40% of the population of the district, witnessed their 3,631 performances during 1992, that is, 208 per performance.

A series of one-day awareness-raising seminars

was given three times a year to a total of 200 village leaders. Finally, about twice a month the WVs did home visiting together with local government health assistants (HAs), providing information on dietary sources of vitamin A, the need to boil drinking water for children, and the use of oral rehydration for diarrhoea. Enough of these visits were made in 1992 to have covered about half of the households in the district. The 383 health assistants in the district were also paid 100 taka per month if they attended monthly meetings where they received relevant messages.

Even though the range of activities was wide, the entire three-year programme in Gaibandah cost only Swedish kronor (SKr) 4.5 million, approximately SKr 0.8 (under US\$0.13, based on an estimated 1992 population of 1.9 million for Gaibandah and an exchange rate of SKr 6.2 = US\$1) per capita per year.

The evaluation

Evaluations have been conducted by the Institute of Nutrition and Food Science, Dhaka University, of the other three districts in which NBPP has been implemented (although the components have differed somewhat in each). In Lalmonirhat there was no baseline study. In Rangpur and Dinajpur questions about food consumption were asked in a different way than they were for the baseline, and thus changes could not be evaluated. There were no control areas, so it was difficult to know if the other changes found were specific to the areas in which NBPP was working. These latter evaluations found that after three years of programme implementation, about twice as many households grew key vegetables and fruits high in carotene. Night-blindness levels, as reported by mothers to interviewers, were reduced by about half from baseline, when about 5% to 6% of households had a member with the disorder. The prevalence of night-blindness as reported by mothers was found to be a useful and reliable indicator of vitamin A status in Bangladesh [3]. It is the only practical indicator to use in a grass-roots project on the scale at which the NBPP is implemented.

In connection with a consultant visit by one of the authors (TG) to Bangladesh in January 1992, SIDA decided to fund a study that could determine more precisely the impact of NBPP in Gaibandah district. He was responsible for overall study design, interpretive data analysis, and writing this report; the other (SNM), through Mitra and Associates, conducted the field survey interviewing, coded and entered the data in a computer, compiled the data, and was responsible for the statistical analyses.

The two surveys were conducted in March 1992

and March 1993. In both years, all interviews took place during the Islamic month of Ramadan, when most of the population (93%) fasts during daylight hours. In addition to Gaibandah, a non-project comparison area was chosen consisting of seven geographically adjacent subdistricts in the districts of Joypurhat and Bogra. It was assumed that their geographical closeness would ensure that they were similar to Gaibandah, although it was recognized that NBPP activities were likely to influence such nearby areas.

The NBPP started its operations in Gaibandah in early 1990 and actual field operations began in April 1990. The programme continued until mid-1993. Thus this evaluation covered changes that occurred in the third and final year of the programme's field activity. The changes occurring during this one year were compared with those taking place in the non-project area. No baseline study had been done at the beginning and no further evaluation was done at the end. Therefore, this evaluation does not report on the full impact of the NBPP in Gaibandah. Nor can it be generalized to the other three NBPP districts where the set of activities that took place was slightly different and, in the case of Dinajpur and Lalmonirhat, the period of implementation was longer, up to six years.

Survey methods

Interviews were conducted only with households having at least one child age one to six years. Questions were asked of the mother or other guardian most involved in caring for young children. Four attempts were made on other days to obtain interviews with families not at home or unavailable at the first visit. Respondents were assured of confidentiality. Interviewers were instructed to advise parents of children with night-blindness to take them to a health worker.

The sample was chosen to be large enough that a difference of one percentage point in rates of night-blindness among children between one and six years of age over time or between the project and the non-project area would be statistically significant at the 95% level. This required a sample of 2,500 children in each area for each survey. The final resulting sample sizes for children and for respondents (mothers of the children in 97% of the interviews) are given in table 1. The interviews were conducted in private and took on average 53 minutes to conduct.

The two surveys were conducted on separate samples and were not repeat visits to the same households or even to other households in the same clusters. This ensured that any change in attitude or

openness toward acquiring relevant new knowledge that might have been occasioned by the first survey had no influence on the results of the second one. (The random selection of clusters for the repeat surveys resulted in 1 of the 70 being chosen again. However, selection of households within that cluster resulted in few, if any, repeat visits.) A description of the sampling method used can be obtained from the authors.

Statistical analyses were performed on only a few key relationships and are reported in all cases in which they were performed. Student's two-tailed *t* tests were performed using standard errors.

Results and discussion

Characteristics of the sample populations

Results are presented here for both surveys and for project and non-project groups, for a total of four cells. The exact sample sizes were 2,559 and 2,522 for the project area in 1992 and 1993, respectively, and 2,529 and 2,518 for the non-project area. The mean age of about 42 months in all four cells was about the same as the median age. However, the tendency was toward heaping of reported ages in all four cells at five years of age. Ages are difficult to determine in Bangladesh, because they are not recorded and growth monitoring is uncommon. Therefore local calendars were used. Almost 52% of the children in all cells were boys.

The samples of respondents (their guardians) were 1,615 and 1,530 in 1992 and 1993, respectively, for the project area, and 1,733 and 1,599 for the non-project area. Over 99% of the children in all four cells lived at home with one or both parents. There were about 1.5 target children per respondent in all four cells.

The proportion of respondents who were non-Muslim (mainly Hindu) varied from about 6% to about 8% among the cells. The average age of the respondents was also similar, 28 years in the project area and 27 years in the non-project area. Despite their geographical proximity, clear socio-economic differences existed between the two areas. The educational level was lower in the project area, where 76% had never attended school, compared with 66% in the non-project area. The project area also was poorer than the non-project area. Average land holdings were somewhat smaller in the project area, with 44% of the respondents landless, compared with 37% in the non-project area. About 40% of the houses in the project area and 60% of the houses in the non-project area had metal rather than straw

TABLE 1. Proportion of households growing different types of foods

Types of foods	NBPP action	Project area		Non-project area	
		1992	1993	1992	1993
Green vegetables					
bottle gourd leaves	1	94.4	95.2	78.1	87.5
beans (green; on vine)	1	84.0	89.5	79.5	83.3
sweet pumpkin leaves	1	83.7	88.9	69.3	81.8
pui shak (a local vine)	2	60.8	73.6	53.4	64.1
radish leaves	2	45.5	53.8	41.1	46.5
red amaranth	2	37.9	53.6	33.7	40.6
local spinach	2	23.4	37.9	21.5	29.0
cabbage	2	4.8	9.1	8.2	6.5
kang kong	2	4.4	4.8	3.6	5.2
colocasia leaves	3	32.2	46.6	27.0	30.2
colocasia shoots	3	21.1	33.7	14.8	21.3
jute leaves	3	41.5	46.1	35.7	36.5
sajna ("drumstick" tree leaves)	3	12.9	23.9	14.2	22.5
chinese cabbage	3	1.7	5.3	3.4	2.9
mint	3	2.0	3.0	0.6	0.3
amaranth	4	52.3	64.1	43.3	51.4
lafa shak (local shrub)	4	22.8	30.4	1.1	4.2
watercress	4	2.5	8.6	2.9	3.6
others	—	8.2	9.1	6.6	9.7
Yellow vegetables and fruits					
sweet pumpkin	1	84.4	90.3	71.0	81.6
tomato	2	18.0	53.3	19.5	58.6
papaya	2	30.9	44.5	18.7	27.6
carrot	2	3.5	9.7	0.9	1.6
mango	3	71.8	78.1	61.2	68.3
jack fruit	3	57.6	64.3	53.6	58.5
sweet potato	3	22.3	34.5	24.0	27.5
palmyra palm fruit	4	6.4	10.0	26.2	26.6
Other vegetables and fruits					
banana	5	81.6	86.9	60.2	69.6
potato	5	49.0	49.9	64.8	66.1
eggplant	5	46.2	50.5	34.3	43.6
pineapple	5	14.6	20.3	14.9	17.2
dates	5	9.3	15.3	25.1	22.0
cauliflower	5	5.5	9.7	9.2	7.1
wood apple	5	4.6	7.2	14.8	16.8
others	—	9.3	10.5	13.8	9.6
Oil-bearing foods					
mustard seed	3	31.0	36.0	43.0	44.9
peanuts	3	3.2	7.8	3.3	3.3
sesame	4	10.0	18.7	14.5	16.4
soya beans	4	0.1	0.6	0.1	0.2
others	—	4.0	2.7	2.0	1.5
Number of respondents	—	1,615	1,530	1,733	1,599

1 = distributed by NBPP to all households in Gaibandah district.

2 = distributed by NBPP only to people with night-blindness and student gardeners.

3 = not distributed, but promoted by NBPP.

4 = special food, but not promoted by NBPP.

5 = not a special food (i.e., not high in carotene or fat) and not promoted by NBPP.

roofs. About 4% of the project houses and 10% of the non-project houses had electricity.

Production of special foods

It is not possible to determine how much overall impact the project had on production of foods. Furthermore, it is clear that the NBPP influenced production in geographically adjacent areas, not just the project area. There were no baseline data, and as discussed below, of the various project activities undertaken by NBPP, production of special foods is perhaps the one most likely to have made substantial progress during the first two years of the project, 1990 and 1991.

Table 1 presents data on the percentage of households growing various foods, in relation to NBPP activities in promoting them, divided into five categories. Interpretation of the results is facilitated by keeping in mind that the table records the results of the third year of a three-year process of change, gradually increasing acceptance of the promoted foods during the course of the project. As could be expected, the universal distribution of seed (category 1) appeared to have the greatest effect on the proportion of households growing them. This probably was true also for the adjacent non-project subdistricts. Universal seed distribution appeared to have reached a saturation level by 1992. Thus the incremental increase during the third year was relatively smaller in the project than in the non-project area.

The foods in category 2 were distributed free to target groups and promoted to everyone. Production of these appeared to increase during 1992 in about equal increments in the two areas, with the non-project area being slightly behind in the process. Exotic or new varieties such as carrots and cabbage were exceptions. They appeared to be just catching on after two to three years of promotion, leading to greater incremental increases in the project than in the non-project area.

A rapid qualitative survey of vegetable and vegetable seed salesmen in five cities where NBPP activities could have been expected to have had a cumulative effect over several years found that NBPP-promoted foods were those that had increased most in sales in recent years. Carrots, which had been relatively unknown in the area a few years before, had become one of the most popular vegetables [4].

Production of foods in category 3, which NBPP only promoted, without providing any free seed, could be expected to increase more slowly. Examination of the data suggests that this was indeed the case. Only in this category were the incremental increases in production generally much greater in the project area than in the non-project area. Again, these differences were especially pronounced for new or

exotic varieties such as Chinese cabbage and sweet potato. There was also an increase in the number of people who grew traditional or wild foods for which seed need not be purchased, such as drumstick tree leaves and colocasia. Here the mass media may have enhanced the status of these easily available but underappreciated or "poor man's" varieties.

Foods for which NBPP provided free seed appeared to increase more in the non-project areas than those for which NBPP provided only promotional messages. This suggests that the free seed was widely sold to neighbouring areas, especially the seed that everyone received, which would rapidly have lost its market value in Gaibandah district. Information probably diffuses more slowly than something that can be sold. Among foods not promoted by NBPP (category 4), there was great variability in both the areas, with mainly increases in production, often of large magnitude, but also some decreases.

A statistically significant increase was seen in the proportion of households growing green vegetables and yellow fruits in the two areas, but for oil-rich foods only the increase in the project area was statistically significant. This is consistent with the fact that promotion of consumption of these foods started late, and seeds for them were not distributed. There was also a smaller but statistically significant increase in the proportion of households growing non-special foods in both areas (category 5).

Respondents were asked where the family was growing special foods and the size of the areas cultivated. As expected, respondents in the project area had fewer and smaller separate gardens, since more of them were landless. On the other hand, more of them were growing more special foods in strips beside their homes and on rooftops, presumably in response to NBPP encouragement and assistance. An increase in rooftop gardening was probably a year behind in the non-project area, as cheap seeds for vines were presumably coming there from Gaibandah.

Separate gardens are larger and are more likely than the other types to be intended to generate income. They actually seemed to be declining in prevalence and size more in the project area than in the non-project area. Three factors may have contributed to this rather anomalous finding.

First, it might have been partly due to disappointment among the larger vegetable farmers caused by the low prices their produce had obtained the year before. Apparently, NBPP efforts to increase demand had not kept pace with increases in production. Unlike the seed itself, fresh produce is expensive and difficult to transport; the market was not used to handling large quantities of surplus produce; and it cannot be stored. The Bogra portion of the non-project area has a long-established tradition of vegetable production and marketing and may have

been better able to find markets for its increased production, especially since the pace of increase was slower.

Second, an unusual storm, including heavy rain and hail, occurred in early 1993 and destroyed over 70% of the NBPP gardens in Gaibandah. This may have had a greater effect on the more exposed separate gardens than on those against walls or on rooftops. Some of the affected gardens may not have been restarted by the time of the March 1993 survey.

Finally, a substitution effect may have been caused by distributing free seed for vegetables suitable for growing on rooftops. Gardens could then be used for other foods instead.

The proportion of sample households not growing any special foods declined in the project area from 6.8% to 2.7% and in the non-project area from 9.6% to 4.3%. In both areas, about 97% of these households gave as the reason that they had little or no land to cultivate. Other reasons mentioned by 5% to 10% were no money and poor yield.

Consumption of special foods

Respondents were asked to recall the types of foods the household and children age one to six years had consumed during the past 24 hours (tables 2 and 3). No information was requested regarding amounts consumed. Table 4 compares consumption of special foods by households and young children in the two areas. In table 5 the differences in consumption of special foods by children are compared between 1992 and 1993 and tested for statistical significance. The following four factors must be taken into account in interpreting these data:

- » The population in the non-project area had a higher socio-economic status than that in the project area. Therefore they were able to consume more expensive foods and less of the cheaper, less desirable foods such as wheat and green leafy vegetables.
- » The evaluation was conducted in the third year of the NBPP's field activity. Some of NBPP's com-

TABLE 2. Foods consumed by households (24-hour recall)

Types of foods	Project area		Non-project area	
	1992	1993	1992	1993
Rice	95	99	98	99
Wheat	67	4	46	11
Potatoes	74	86	86	93
Sweet potatoes	11	7	16	12
Meat ^a	8	16	18	23
Fish ^a	43	49	60	60
Eggs ^a	15	13	14	15
Dal (lentils)	20	24	25	25
Green vegetables	46	59	42	31
Other vegetables	72	77	65	74
Oil in curry ^a	90	97	92	99
Other oil/fat ^a	14	31	14	36
Yellow fruits ^a	14	25	11	22
Other fruits ^a	2	2	4	2
Peanuts	0.1	0.9	0.4	0.3
Mustard seed	4	14	4	10
Sesame	0.4	0.6	1	0.8
Coconut	0.9	0.5	0.9	0.4
Soya bean	2	0.6	2.0	0.8
Rice snacks ^a	42	74	55	75
Spices	97	100	97	99
Lemonade, etc. ^a	5	5	12	9
Fresh milk ^a	14	26	28	41
Powdered milk ^a	3	4	5	5
Sugar, molasses ^a	24	29	39	38
Others	0.2	6.4	0.5	15
At least one special food	93	95	87	89
Sample size	1,615	1,530	1,733	1,599

a. Foods probably consumed more than usual during Ramadan.

TABLE 3. Foods consumed by children age one to six years (24-hour recall)

Types of foods	Project area		Non-project area	
	1992	1993	1992	1993
Rice	87	97	90	97
Khichuri (rice porridge)	5	2	11	4
Wheat/bread	57	3	35	9
Potatoes	62	77	74	84
Sweet potatoes	13	6	12	10
Meat ^a	8	12	14	19
Fish ^a	34	39	47	49
Eggs ^a	10	9	10	9
Dal (lentils)	16	19	19	20
Green vegetables	40	52	34	26
Other vegetables	59	65	49	62
Yellow fruits ^a	9	21	7	19
Other fruits ^a	2	1	3	2
Oil with curry ^a	77	91	78	91
Other oil/fat ^a	10	23	10	27
Peanuts	0.8	0.6	0.5	0.5
Mustard seed	3	11	3	8
Sesame	0.4	0.4	0.6	0.6
Coconut	0.4	0.2	0.2	0.3
Soya bean	2	0.2	2	0.1
Rice snacks ^a	36	62	48	64
Spices	91	94	90	93
Sugar, molasses ^a	25	24	32	28
Lemonade, etc. ^a	14	2	14	4
Fresh milk ^a	10	21	18	33
Powdered milk ^a	1	2	3	3
Breast milk	35	36	35	37
Sample size	2,559	2,522	2,529	2,518

a. Foods probably consumed more than usual during Ramadan.

TABLE 4. Consumption of special foods by households and young children

Special foods	Project area				Non-project area			
	Households		Children		Households		Children	
	1992	1993	1992	1993	1992	1993	1992	1993
Green vegetables	45.6	58.8	39.7	52.2	42.8	31.3	33.8	25.9
Other vegetables	72.5	76.5	59.0	64.6	65.3	73.9	48.6	61.9
Yellow fruits	14.0	25.3	9.1	21.1	10.7	21.8	6.6	18.6
Oil-rich foods	6.4	15.0	5.7	11.7	6.1	11.1	4.5	9.1
Sample size	1,615	1,530	2,559	2,522	1,733	1,599	2,529	2,518

These figures represent the percentage of households and children, respectively, who ate at least one item within each respective category (as shown in tables 2 and 3).

munication efforts in the mass media probably had an effect on the non-project area as well as on the project area.

- » Bangladesh had an especially large rice harvest a few months before the 1993 survey. In the early months of 1993, rice was selling for 5 taka per kilo-

gram. In the months before the 1992 survey, it had been selling for 9 taka per kilogram. This meant that in early 1993 rice was actually cheaper than wheat (usually eaten in rural Bangladesh only by those who cannot afford rice), an unprecedented occurrence.

TABLE 5. Percentage of differences in consumption of special foods among children from 1992 to 1993

Special foods	Project area			Non-project area		
	Differences 1993-1992	95% confidence intervals		Differences 1993-1992	95% confidence intervals	
		Lower	Upper		Lower	Upper
Green leafy vegetables	12.5 ^a (3.3)	6.0	19.0	-7.9 ^a (3.0)	-2.0	-13.8
Other vegetables	5.6 (3.3)	NA	NA	13.3 ^a (4.2)	5.2	21.4
Yellow fruits	12.0 ^a (2.2)	7.6	16.4	12.0 ^a (1.5)	9.1	14.9
Oil-rich foods	6.0 ^a (2.1)	1.9	10.1	4.6 ^a (1.8)	1.0	8.1
At least one special food	4.8 ^a (1.4)	2.1	7.6	4.7 ^a (2.1)	0.6	8.8

a. Differences are statistically significant at the 5% level, using the two-tailed *t* test.

Figures in parentheses are the estimated standard error of the difference.

NA = not applicable. Since the difference is not statistically significant, the confidence limit is not given.

» Poorer people tend to spend a larger proportion of their income on food. When the major source of calories declines this much in price, much of the money that is freed is spent on more desirable and more expensive foods. Through a substitution effect, consumption of cheaper, less desirable foods will concurrently decline.

About one-fourth of the households in Gaibandah are totally landless and another one-fourth are effectively so, since they own far too little land to be self-sufficient in food production. For these families, lower rice prices have an income-increasing effect. For the few households that produce substantial surplus rice, the lower prices may have had an income-reducing effect. This would tend to negate or dilute the impact of lower rice prices on consumption patterns in the sample as a whole. However, the wealthier households are few in number, they were already spending a lower proportion of their income on food, and reduced income after one harvest probably reduced the variety of foods they consumed less than the quantities of expensive foods. The larger the farm, the greater the negative impact of lower prices, but the greater the cushion of wealth that could absorb the temporary shock and thus reduce any temporary impact on consumption patterns.

Due to the requirements of the donor agency, the timing of this evaluation was inflexible. This meant that it had to be conducted during the Islamic fasting month of Ramadan. Nearly everyone avoids consuming foods and fluids during the daylight hours during this month (exceptions are small children, sick people, and some pregnant women). This probably does not result in overall decreases in consumption, however. After sunset and before sunrise, people

eat two or three meals, including certain distinctive foods, often resulting in higher than normal food expenditures for this month.

In general, the data in table 3 do behave in expected ways once the factors as explained are taken into account. In 1992 most of the expensive, desirable foods, including meat, fish, snacks, drinks (lemon and other concentrates), milk, and sugar, were consumed by a greater proportion of households in the non-project area than in the project area. The opposite, as expected, was true for wheat and vegetables, which are low-status, cheaper foods.

Although it was clear that NBPP seed had spread to the non-project area, it is more difficult to estimate what impact this and the mass media messages may have had on consumption patterns before and during the evaluation year. Since Bogra has a tradition of commercial production of vegetables, increased production there may not have resulted in an equivalent increased consumption. Increases in production caused by cheap seed from Gaibandah may also have had the effect mainly of reducing the production of similar vegetables. The NBPP messages that reach outside its districts were restricted to radio and television spots. These are likely to have only a small effect when not backed up by the other mass media and interpersonal channels used by NBPP in Gaibandah. Any such effect is also likely to be limited to the wealthier classes.

The remarkable decline in rice prices resulted in only small increases in the proportion of households consuming rice, since nearly all did so in 1992. The major effect was a drop in consumption of wheat. A higher proportion of the non-project sample continued to consume wheat. These may be more modern-

ized or Westernized families who have become accustomed to eating bread and have an income that makes a shift to exclusive consumption of cheaper rice unnecessary. There was a slight drop in consumption of sweet potato as well, since it also is relatively inexpensive and can serve as a replacement for rice.

The money saved by having to spend less on the staple food allowed people to purchase more expensive foods. Greater proportions of people in both areas consumed meat, milk, and snacks, the use of which NBPP did not promote. Other desirable foods that increased in consumption and were also promoted by NBPP included yellow fruits, mustard seed, and oil on foods other than curry. (Oil is also added to rice to make it more tasty when people can afford it.) Some vegetables are fairly expensive and desirable, and this may explain why consumption of "other vegetables" went up slightly in both areas.

Green leafy vegetables, however, are widely agreed to have a reputation as "poor man's food" in Bangladesh [5]. In the non-project area, their consumption went down by 7.9%, a statistically significant decline. In contrast to this expected trend, consumption of these items increased in the project area by 12.5%, also statistically significant. Thus the net change due to the project was its 12.5% increase minus the 7.9% decrease in the non-project area: $12.5\% - (-7.9\%) = 20.4\%$. Whereas households in the two areas consumed green leafy vegetables about equally often in 1992, nearly twice as many did so in Gaibandah in 1993.

Young children are universally thought to resist eating green leafy vegetables, and studies in Manikganj [5] and Comilla [6] supported this belief. Parents in Bangladesh are also said to worry that green leaves cause diarrhoea among very young children. The NBPP encourages production and consumption of some softer and less bitter varieties that children liked.

If consumption levels were this low in the two areas at baseline, substantial increases may already have occurred by 1992, when 23% of one-year-olds in the non-project area and 33% in the project area had consumed leafy vegetables the day before the interview. The figures for the older children were roughly 35% and 40%, respectively. Consumption did generally increase by age in both areas except in the non-project area in 1993, where it was fairly evenly low in all age groups.

In the non-project area, leafy vegetable consumption among children declined from 34% to 26% (SE of the difference, 3.0, $t = 2.6$). In the project area, it increased from 40% to 52% (SE of the difference, 3.3; $t = 3.8$). Both these changes were statistically significant at the 5% level. Similar to the case for the households, consumption of leafy vegetables by

1993 was twice as high among children in the project as in the non-project area.

Consumption of these foods by young children in Gaibandah followed the pattern of consumption in the households in general. Whereas this method of analysis reveals which foods are eaten less by children than by the household as a whole, it cannot reveal which foods may be eaten exclusively or mainly by children. Thus we can only conclude that no special foods are avoided by children in this area. The biggest gap is among "other vegetables." Over 10% of children in all four cells avoided eating them the day before the interview, even though others in the household did so.

Breast-feeding

The NBPP, as many other non-governmental organizations and government workers have been doing in recent years, promoted the value of colostrum for its high vitamin A content. This appears to have been successful, and most mothers probably no longer throw it away. In Lalmonirhat, only 8% did so as of the 1992 evaluation. But mothers still commonly continue to wait one to three days after birth before initiating breast-feeding.

One group estimated that children under two years of age obtain nearly the entire recommended daily allowance of vitamin A if they are breast-fed [5]. Those not breast-fed obtain only 1% to 8% of the recommended daily allowance except during mango season. Analysis of data from the Bangladesh Nutritional Blindness Study of 1982-1983 revealed that breast-feeding was associated with a substantially reduced likelihood of having vitamin A deficiency night-blindness at each year of age from birth to five years [7]. Breast-feeding in the urban slums of Dhaka protects against vitamin A deficiency night-blindness when continued for more than two years [3]. The NBPP did promote breast-feeding for two years, but at least one senior staff member was observed discouraging it after that age.

Exclusive or even predominant breast-feeding according to World Health Organization definitions is probably rare in Bangladesh. However, awareness of this problem is recent, little has been done to promote breast-feeding so far, and relevant data were not obtained in these surveys.

In both project and non-project areas, 69% of sample children were stated to have received colostrum in 1992. In 1993, 78% and 77%, respectively, were reported to have been given colostrum at birth. There were no gender differences. Rates of colostrum use appear to have increased rapidly during the past several years.

No gender differences were observed in the proportion of children currently breast-feeding. Some

increase in breast-feeding rates, especially among one-year-olds, appeared to have occurred in both areas. Suckling frequencies were high and remained so, even among the small proportion who were still breast-fed during their fifth year of life.

Vitamin A capsule distribution

The distribution of vitamin A capsules twice a year to all children age one to six years has been government policy in Bangladesh since 1973. Health assistants deliver the vitamin A capsules to villages. The national coverage rate (percentage of target age children who received vitamin A capsules during the past six months, according to the mother, to whom a vitamin A capsule was shown), according to the 1982 evaluation of this programme, was 45% [8]. The rate had declined to 35% by 1989 [9]. The rate in the project area remained unchanged during the evaluation years, 44.4% in 1992 and 45.1% in 1993. In the non-project area, coverage increased from 44.3% in 1992 to 61.4% in 1993, a statistically significant difference (SE of the difference, 3.83; *t* value for the difference, 4.48, *p* < .05). There were no gender differences in coverage rates.

Recognition of the vitamin A capsule on sight (ability to state that it was a vitamin A capsule) increased from 3.0% to 12.5% in the project area but only from 6.4% to 7.6% in the non-project area. When respondents were then asked if they had heard the term "vitamin A capsule" before, yes answers increased from 22% to 43% in the project area and from 28% to 35% in the non-project area. In the project area, the proportion who knew that vitamin A capsules are distributed to prevent or cure night-blindness increased from 50% to 71%. The increase in the non-project area was smaller, from 40% to 51%.

Night-blindness

The NBPP focuses on night-blindness in its messages to the community, teaching that it can be treated and prevented by the consumption of certain foods that are high in carotene. This is challenging, since night-blindness is often uncommon and not considered to be a serious problem. Thus NBPP had to work in areas where night-blindness was at a high prevalence rate at baseline and focus on long-running, multidimensional communication to convince the population that it was indeed a problem. For example, in open-air film showings in villages at night, night-blindness was said to be a forerunner to permanent blindness.

In Comilla district in southern Bangladesh, night-blindness tended not to be viewed as something dangerous or important [6]. Many women pointed out

that it goes away on its own. Therefore the investigators planned their social marketing programme to promote the consumption of high-carotene vegetables based also on other benefits these foods could offer, stating they were "bursting with vitamins essential to good health and growth." The authors depended more on the mass media than on interpersonal communication and gardening to achieve their goals. Since rural women in particular have little contact with mass media, messages must be designed carefully, and strong wording may be required to achieve much impact.

A message that vitamin A reduces death rates might be problematic, especially in a Muslim society where many believe it is only Allah who determines when each person will die. Stating that vitamin A is generally good for health is probably epidemiologically correct in a country such as Bangladesh where so many are deficient. However, at the individual level, consuming more vegetables may not appear to make most people visibly healthier most of the time, and many people will be healthy much of the time despite not consuming these items in quantity.

As an indicator, night-blindness has several advantages. Awareness that the local term for night-blindness referred to "being able to see in daylight but not at night" was high in both areas, increasing from 76% to 88% in the project area and from 79% to 88% in the non-project area. At least among the poorer classes in Bangladesh, avoidance of night-blindness probably almost always has a close correlation with consumption of breast milk, vegetables, and yellow fruit.

As NBPP began in each district, baseline studies showed that about 5% of households had some member with night-blindness. In Bangladesh many studies show that the rate actually increases with age well into adolescence. The reason attention focuses exclusively on children under five is probably that vitamin A deficiency among older children rarely progresses to permanent loss of sight or death. At this level of prevalence, nearly everyone probably knows a few people who have it. Everyone then has the opportunity to see for themselves the proof of its relationship to diet, increasing NBPP's credibility. When people have seen such proof, the knowledge is more likely to become anchored in local beliefs in a way that will carry on after NBPP has left the area.

When asked how they thought night-blindness could be prevented, respondents answered as indicated in table 6. The NBPP mentions certain vegetables, yellow fruits, and fish in its messages, does not give prominence to vitamin A capsules, and does not mention milk and eggs. Dietary causes, rather than the name of the vitamin involved, are given priority in the messages. These data suggest that the messages were still actively spreading during the third year

TABLE 6. Knowledge of how to prevent night-blindness

Knowledge	Project area		Non-project area	
	1992	1993	1992	1993
Increased consumption of green and other vegetables	58.9	79.6	36.8	52.9
yellow fruits	6.7	43.1	4.9	26.3
other fruits	52.1	11.1	29.4	10.5
fish	29.9	32.3	15.5	14.6
milk, eggs	24.6	21.8	14.4	27.5
vitamin A	1.9	2.4	2.9	1.9
vitamin, unspecified	10.0	2.6	12.1	3.3
medicine/tablet	3.5	0.5	1.9	0.6
Supernatural measures	5.7	2.2	1.6	3.6
Not aware of anything	29.9	16.7	50.3	39.8
Sample size	1,615	1,530	1,733	1,599

of the project. They appear also to have been spreading to the nearby district, if somewhat more slowly. Knowledge itself plays an important role, contributing sustainability to such a project if it is embedded enough to be passed on by schools, the health-care system, and within families themselves, all of which were used by NBPP. In one study, lack of knowledge about nutrition was more important than lack of formal education as a variable associated with vitamin A status [10].

The sources of this knowledge are shown in table 7. These results suggest a remarkable expansion in awareness of NBPP, its workers, and their message in this third year of the project. They also verify NBPP's own records as to how intensive and complete its coverage of the district was. After only three years, the majority were aware of one or more simple ways to prevent night-blindness. The NBPP

was credited as the source of this new knowledge by 79% of respondents.

In addition, workers from other non-governmental organizations in nearby districts may have been picking up or strengthening their messages about vitamin A, as shown in the increased mention of the Bangladesh Rural Advancement Committee (BRAC) as a source of information on the causes of night-blindness in the non-project area. The mass media efforts of NBPP do not seem to have had nearly as much impact as the face-to-face communication channels. Anecdotal evidence supports the finding that the live performances by the traditional singers are the most influential and cost-effective media.

In 1981-1982 it was estimated that 3% of pre-school children in Bangladesh had night-blindness [8]. Another somewhat smaller national survey in 1989 found a prevalence of night-blindness of 1.8%

TABLE 7. Source of knowledge of how to prevent night-blindness

Source of knowledge	Project area		Non-project area	
	1992	1993	1992	1993
Family planning or health workers	14.5	3.8	25.9	26.3
Doctors	10.5	2.7	14.9	8.0
Quack doctors	3.5	1.3	6.3	6.0
Neighbours, villagers	15.1	6.1	23.6	19.8
Relatives	9.9	3.1	11.7	8.6
Old people	1.4	0.5	1.3	0.9
Self-learning	2.1	0.5	3.0	1.9
Radio, television	6.4	2.4	20.7	12.4
BRAC workers, oral rehydration therapy trainers	13.8	4.5	9.9	15.9
NBPP workers, singers, posters	27.9	78.8	0.6	1.7
Others	2.0	0.7	1.8	1.4
Number ^a	1,134	1,275	860	963

a. Number of respondents reporting awareness of at least one measure to prevent night-blindness.

among children six months to six years of age [9]. This apparent decline occurred despite the fact that these same surveys indicated that the coverage of vitamin A capsules among children one to six years of age (target group) had declined from 45% to 35%. Improved health-care delivery, including dramatically higher rates of vaccination, especially for measles, may account for part of this.

Only small changes occurred in the prevalence of night-blindness in both project and non-project areas, neither of which was statistically significant. In 1992, 1.5% of sample children one to six years old were reported to have night-blindness, compared with 1.8% in 1993. In the non-project area, night-blindness prevalence was 0.7% in 1992 and 0.8% in 1993. In both areas, at least one important change had occurred that might have led to the lower rates: diets improved, probably somewhat more so in the project area, and the non-project area had a substantial increase in vitamin A capsule coverage. Presumably, other factors that affect vitamin A status prevented the expected reduction in night-blindness prevalence.

One such factor could be changes in levels of morbidity. The only disease asked about in the surveys was measles, which is known to have a great impact on vitamin A status. Measles vaccination rates were increasing rapidly in Bangladesh at the time of these surveys. Vaccination rates among children increased from 68% in 1992 to 74% in 1993 in the project area and from 75% in 1992 to 84% in 1993 in the non-project area. In the project area, 16% of children suffered from measles in 1991 (the year before the survey) compared with 17% in 1992. The respective figures in the non-project area were 19% and 15%.

None of these differences are statistically significant, nor were there any gender differences in prevalence. Therefore changes in measles rates cannot explain why night-blindness rates did not decline.

Once night-blindness levels have declined to this level, further decline may require a broad range of improvements in the lives of these children and may come slowly. In a population with less than dramatic baseline levels of night-blindness, and where improvement did not occur on a broader range of variables affecting vitamin A status, one year may be too short a time to expect to see changes in night-blindness rates, despite possible increases in carotene, fat, and calorie intakes in both project and non-project areas. Vitamin A capsule coverage rates may have increased in the non-project area among groups who were not in any case at high risk of suffering from night-blindness.

In summary, the major behavioural impact of the NBPP that this study was able to document was an increase in consumption of leafy vegetables among young children in the project area in the face of large changes in dietary patterns occasioned by decreased rice prices. These price changes led to a simultaneous reduction in leafy vegetable consumption in the non-project area. The net change in vegetable consumption resulted in twice as many young children consuming leafy vegetables the day before the interview in the project area than in the non-project area in 1993, despite their having consumed similar levels in 1992. There is no obvious explanation for this other than the successful NBPP efforts to increase home production of these foods in the preceding years and to raise awareness of the importance of feeding these foods to young children.

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