

Animal Source Foods to Improve Micronutrient Nutrition and Human Function in Developing Countries

The Impact of Semi-Scavenging Poultry Production on the Consumption of Animal Source Foods by Women and Girls in Bangladesh^{1,2}

Hanne Nielsen, Nanna Roos and Shakuntala H. Thilsted³

Department of Human Nutrition, The Royal Veterinary and Agricultural University, Frederiksberg, Denmark

ABSTRACT Semi-scavenging poultry production is a potential avenue for increasing poultry production and income, and improving the livelihoods of members of poor rural households. Since 1998, the Participatory Livestock Development Project (PLDP) has used this strategy to increase poultry production and household income in the northwest and north-central regions of Bangladesh. The aim of this study was to investigate the impact of the PLDP on the food and nutrient intakes of females in the PLDP-adopting households. A cross-sectional comparative study was conducted using data for 35 women of reproductive age and 35 girls (5–12 y old) from both the PLDP-adopting and nonadopting households. Data was collected in 1999 on food consumption as well as poultry production, household socioeconomic status and food preferences, using quantitative and qualitative questionnaires. High-yielding parent poultry stock and egg production were significantly higher in the PLDP households ($P < 0.001$). Intakes of chicken and eggs were similar in both groups and negligible compared to other foods, especially rice, vegetables and fish. Fish intake was higher in the PLDP-adopting women ($P < 0.08$) and girls ($P < 0.06$) compared to their nonadopting counterparts. Women had a higher preference for small fish compared to other animal foods. The results of this study suggested that if a project such as the PLDP, which increases animal food production and income in rural Bangladesh, also aims to increase intakes of animal source foods in females, then the accessibility of small fish must be ensured. *J. Nutr.* 133: 4027S–4030S, 2003.

KEY WORDS: • poultry • fish • eggs • food intake • Bangladesh

In many developing countries, there is a focus on agricultural production as a means of increasing the incomes of the poor. Strategies and interventions that target women and improve their status are of special interest, as it has been shown that assets controlled by women are used to improve the livelihood of household members, and in particular that of children (1,2). Also, part of the increased household incomes controlled by women may be used to purchase nonstaple foods, thus increasing food diversity and micronutrient intakes. In Bangladesh, this is of particular importance because food and nutrient intakes are low and micronutrient deficiencies are prevalent, especially in the at-risk groups, women and children (3–5).

Small-scale poultry production has several advantages as an enterprise for generating income controlled by women. Poultry

is affordable livestock for resource-poor households, the enterprise provides regular outputs using small inputs and the production can be undertaken by women in the household.

In Bangladesh, programs that support semi-scavenging poultry production have been carried out for >10 y. The Participatory Livestock Development Project (PLDP)⁴ is one of these programs (6). It supports the development of small-scale poultry enterprises, comprising the whole production chain from hatching to poultry rearing. Women from rural poor households are invited to participate in one of the enterprises, and loans and technical assistance are given through women's groups. The PLDP is financed by the Danish International Development Assistance (DANIDA) and the Asian Development Bank (ADB). In December 1998, selected national nongovernmental organizations (NGO) began the stepwise implementation of the PLDP in subdistricts (*thanas*) in the north-west region of Bangladesh.

The objective of this study was to investigate the impact of the PLDP on food and nutrient intakes of women and girls in the PLDP-adopting households.

¹ Presented at the conference "Animal Source Foods and Nutrition in Developing Countries" held in Washington, D.C. June 24–26, 2002. The conference was organized by the International Nutrition Program, UC Davis and was sponsored by Global Livestock-CRSP, UC Davis through USAID grant number PCE-G-00-98-00036-00. The supplement publication was supported by Food and Agriculture Organization, Land O'Lakes Inc., Heifer International, Pond Dynamics and Aquaculture-CRSP. The proceedings of this conference are published as a supplement to *The Journal of Nutrition*. Guest editors for this supplement publication were Montague Demment and Lindsay Allen.

² Financial support was provided by Danish International Development Assistance (DANIDA), The Ministry of Foreign Affairs, Denmark.

³ To whom correspondence should be addressed. E-mail: sht@kvl.dk.

⁴ Abbreviations used: NGO, nongovernmental organizations; PLDP, Participatory Livestock Development Project.

METHODS

The study was conducted in close cooperation with the PLDP between September and December 1999 in Nawabganj Sadar and Gomastapur thanas, where the PLDP was first started. Six villages, three in which the project was being implemented (PLDP-adopting), and three in which the PLDP had not yet started (PLDP nonadopting), were selected. All villages had similar geographical characteristics, and the PLDP nonadopting villages were situated at least 1.5 km from the PLDP-adopting villages. In the PLDP-adopting villages, between 6% and 25% of the households were end producers of chicken and eggs. This was the most common enterprise as it required the least technical skills and loans. Census and registration lists used by the NGO, facilitated the selection of the study villages and households.

Participants

From the PLDP-adopting villages, 35 PLDP-adopting households were selected. Likewise, 35 non-PLDP-adopting households were selected from the nonadopting villages. From each household, one woman, <3 mo pregnant or at least 6 mo postpartum, and one daughter aged 5–12 y, were selected to participate in the study. One criterion for participating in the PLDP is that households must own <6000 m² of land.

Data collection

Quantitative data on food intakes of the participants were collected using a 24-h recall method. A structured questionnaire was used to collect data on family composition, socioeconomic status, poultry production, resources, living conditions and food preferences. The questionnaire was pretested and revised before the study. With respect to food preferences, the women were asked to prioritize the first four foods that they would buy if they had more money to spend on food. The foods mentioned were scored from 4 to 1, with the first food mentioned having a score of 4.

One investigator, assisted by a specially trained female interpreter, collected all data. Each interview lasted ~1.5 h, and all information given was written down during the interview by the investigator. Heights of the participants were measured with a measuring tape and a ruler. Weights were measured with a calibrated digital bathroom scale to the nearest 100 g, and age was reported by the women.

Dietary assessment

An open ended–24 h dietary recall, combined with weighting of food models representing the recalled portions consumed, was used for collecting semiquantitative data on the food intakes of the participants. The quantity of food eaten was recalled by using cooked rice as a model for rice, thick curries and fried or mashed vegetables. Similarly, water was used to estimate the amounts of drinks, soups and very thin curries. Plates and glasses used by the participants, and the serving spoons and cooking pots used in the households, were used for estimating portion sizes. The recalled portions consumed were weighed using an electronic measuring scale with a precision of 1 g and a capacity of 5,000 g. In addition, a table of weights of raw foods was constructed for common foods bought from the local market. This was used to estimate the amounts of raw foods used in the dishes. The total amount of each cooked dish was estimated using the food models.

Data analysis

Data from 35 women and 35 girls from the PLDP-adopting households were included in the quantitative analysis, whereas data for three women and two girls from the nonadopting households were excluded. Two women and their daughters were excluded because the land holding of the household exceeded the PLDP inclusion criterion, whereas the third woman had eaten irregularly the day before the interview, due to illness.

All data were checked and analyzed by the investigator using SPSS for WINDOWS (version 7.5; SPSS Inc., Chicago, IL). All food items

recorded were categorized in one of eight food groups: cereals, nonstaple plant foods, oil and fats, fish, chicken, eggs and milk. Food items such as water, tea leaves, spices, and vitamin and mineral supplements were not included. The contributions of energy and nutrient intakes from foods were calculated using a food composition table of Bangladeshi foods (7). A factor of 0.36, derived from three cooking trials of local parboiled rice, was used to convert the weight of cooked rice to that of raw rice. Protein intake was adjusted by a factor 0.88 for digestibility in rice (8). Micronutrients were adjusted for loss during cooking, frying and baking (9). Data for poultry production and food intakes were compared between the PLDP adopters and nonadopters. All variables were tested for normal distribution using the Shapiro-Wilk's test. Associations between the PLDP adoption factor and normally distributed variables were analyzed using univariate analysis of variance and the General Linear Model procedure. Associations between the PLDP adoption factor and nonnormal distributed variables were analyzed using the Mann-Whitney U test. Energy and nutrient contributions from food groups, as well as priority scoring of foods, were calculated for the PLDP adopters and nonadopters combined.

RESULTS

The mean age (32 y for women, 9 y for girls) and height (150 cm for women, 123 cm for girls) of the participants in both the PLDP-adopting and nonadopting households were similar. The PLDP-adopting women weighed on average 2.9 kg (7%) more than nonadopting women and the PLDP-adopting girls weighed on average 1.4 kg (7%) more than nonadopting girls. The median monthly household income was \$36 (in U.S. dollars) in the PLDP-adopting group compared to \$31 (in U.S. dollars) in the nonadopting group. The median landholding was 800 m² in the PLDP-adopting households compared to 1200 m² in the nonadopting households. None of these differences was significantly different.

Poultry production and utilization of poultry products

Poultry production, and the utilization of poultry products in the PLDP-adopting and nonadopting households are shown in **Table 1**. The PLDP-adopting households had a larger parent stock, which included high-yielding birds compared to the nonadopting households. The monthly egg production in the PLDP-adopting households was more than twice that in the nonadopting households. The PLDP-adopting households sold more eggs but the number of eggs consumed was not significantly different between the groups. There was no significant difference in chicken production between the two groups. Consumption of chicken was similar in both groups, whereas the PLDP-adopting households sold more chicken.

Food intakes and nutrient contributions from foods

The intake of food groups (g raw food/person/d) by the participants is shown in **Table 2**. The overall diet composition of the PLDP adopters and nonadopters was similar. Cereals, mainly rice, constituted almost 60% by weight of the total raw foods consumed, whereas nonstaple plant foods contributed ~30%. Fish was the most frequently consumed animal source food in both groups, contributing ~75% by weight of total raw animal source foods. The PLDP-adopting participants ate more fish than the nonadopting participants. More than 70% of the energy and 60% of the protein was supplied by rice. The second and third most important sources of protein were nonstaple plant foods and fish. Fish contributed >10% by weight of protein and fat intakes, and 25% of calcium intake.

TABLE 1

Parent stock, poultry production and utilization of produce¹

Production and utilization	PLDP ² -adopters (n = 35)	Nonadopters (n = 33)	Statistical difference (P)
Desi ³ birds (parent stock)	2 (0, 4)	3 (1, 4)	0.77
HYV ⁴ birds (parent stock)	3 (0, 5)	0 (0, 0)	<0.001
Eggs produced (no/mo)	30 (15, 50)	12 (0, 22)	<0.001
Eggs sold (no/mo)	20 (6, 30)	0 (0, 10)	<0.001
Eggs consumed (no/mo)	7 (5, 14)	4 (0, 11)	0.12
Chicken produced (no/y)	14 (9, 24)	19 (0, 30)	0.47
Chicken sold (no/y)	5 (2, 15)	0 (0, 3)	<0.001
Chicken consumed (no/y)	3 (2, 5)	3 (0, 6)	0.39

¹ Values are median (Q₁, Q₃).

² PLDP, Participatory Livestock Development Project.

³ Desi, local variety.

⁴ HYV, high yielding variety.

Food preferences of women

The total preference scores for different foods, and the percentage of women giving the foods 1–4 points, are shown in Table 3. The maximum total score that a food could obtain was 268 (67 women × 4 scores). Fruits scored half of the total obtainable score with three-quarters of the women reporting that fruits were among their first four priorities if they had had more money to spend on food. Small fish and leafy vegetables were the second and third prioritized foods, followed by beef and milk. Less than one-third of the women reported eggs as one of the first four preferred foods on their “shopping list.” Chicken and oil were the lowest priority. Only one woman wished to buy oil if she had more money to spend on food.

DISCUSSION

Production and sale of poultry and eggs

Poultry stock and egg production were significantly higher in the PLDP-adopting households compared to the nonadopting households. Although the PLDP-adopting households pro-

duced more eggs than nonadopting households did, they did not eat significantly more of them than their nonadopting counterparts. On the other hand, the PLDP-adopting households sold 55% of the eggs produced whereas the nonadopting households rarely sold eggs. Hence the PLDP-adopting households had an extra monthly income from eggs (on average 60 taka or ~\$1.20 (in U.S. dollars) per 20 eggs), which could be used to purchase other foods. The higher sale of chicken in the PLDP-adopting households, combined with similar chicken production and consumption in both the PLDP-adopting and nonadopting households, suggests that there may have been a lower mortality of chickens in the PLDP-adopting households.

Food intake

Consumption of chicken, eggs and milk was negligible in both groups. However, the average fish intake among the PLDP-adopting women and girls was higher than that of the nonadopting women and girls. This suggests that some of the income that was gained from poultry production in the PLDP-adopting households may have been used to purchase fish.

Although fish constituted only 4–7% of the total raw foods consumed, it contributed >10% of the protein and fat intakes and 25% of the calcium intakes of the women and girls in this

TABLE 2

Intake of food groups¹

Food group	PLDP ² -adopters g raw foods/ person/d	Nonadopters g raw foods/ person/d	Statistical difference (P)
Women (23–45 y)	(n = 35)	(n = 32)	
Cereals	465 ± 142	483 ± 142	0.62
Nonstaple plant foods	246 ± 185	288 ± 189	0.44
Oil and fats	9 ± 6	10 ± 7	0.58
Animal source foods	72 ± 73	53 ± 57	0.22
Fish	58 ± 54	39 ± 51	0.08
Chicken	0 ± 2	0	–
Eggs	0	2 ± 8	–
Milk	15 ± 41	12 ± 32	0.54
Girls (5–12 y)	(n = 35)	(n = 33)	
Cereals	346 ± 124	310 ± 79	0.16
Nonstaple plant foods	210 ± 146	223 ± 112	0.44
Oil and fats	7 ± 5	8 ± 5	0.42
Animal source foods	51 ± 45	47 ± 55	0.41
Fish	39 ± 33	28 ± 41	0.06
Chicken	0	1 ± 6	–
Eggs	1 ± 5	2 ± 6	0.30
Milk	11 ± 35	16 ± 43	0.84

¹ Values are mean ± SD.

² PLDP, Participatory Livestock Development Project.

TABLE 3

Preference scoring of foods by the women¹

Foods mentioned	Scores	% women giving points 1–4
Fruits	136	75
Small fish	99	52
Leafy vegetables	95	49
Beef	76	51
Milk	64	39
Vegetables	46	27
Big fish	46	21
Eggs	45	28
Pulses	41	24
Sweets and snacks	20	7
Rice and wheat flour	7	3
Chicken	5	6
Oil and fats	1	1

¹ The women (n = 68) were asked to prioritize the first four preferred foods they would buy if they had more money to spend on food. The first food mentioned received 4 points, and the fourth food, 1 point.

study. Fish, especially small fish, is the most important animal food in the Bangladeshi diet, supplying animal protein and micronutrients with high bioavailability (10). The preference shown for small fish is in line with the higher intake of fish among the PLDP-adopting women and girls.

The results of this study suggested that if a project such as the PLDP, which increases animal source food production and income in rural Bangladesh, also aims to increase intakes of animal source foods in women, the accessibility of small fish must be ensured.

ACKNOWLEDGMENTS

We wish to thank the families who participated in the study, the PLDP chief technical adviser, Mr. Stephen Swan, and the PLDP fieldworkers for their collaboration.

LITERATURE CITED

1. Quisumbing, A. R. & Maluccio, J. A. (1999) Intrahousehold Allocation and Gender Relations: New Empirical Evidence from Four Developing Countries. IFPRI Discussion Paper 84. International Food Policy Research Institute, Washington, D.C.
2. Smith, L. C. & Haddad, L. (2000) Explaining Child Malnutrition in Developing Countries. A cross-country analysis. IFPRI Research Report 111. International Food Policy Research Institute, Washington, D.C.
3. Abdullah, M. & Wheeler, E. F. (1985) Seasonal variation, and the intra-household distribution of food in a Bangladeshi village. *Am. J. Clin. Nutr.* 41: 1305–1313.
4. Kramer, E. M., Petersen, K. E., Rogers, B. L. & Hughes, M. D. (1997) Intra-household allocation of energy intake among children under five years and their parents in rural Bangladesh. *Eur. J. Clin. Nutr.* 51: 750–756.
5. Ministry of Health and Family Welfare and the Bangladesh National Nutrition Council (1995) Bangladesh Country Paper on Nutrition. Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.
6. Bangladesh Experience. Network for Smallholder Poultry Development. <http://www.poultry.kvl.dk> (accessed Nov. 1, 2002)
7. Darnton-Hill, I., Hassan, N., Karim, R. & Duthie, M. R. (1988) Tables of Nutrient Composition of Bangladeshi Foods: English Version with Particular Emphasis on Vitamin A Content. Helen Keller International, Dhaka, Bangladesh.
8. Food and Agriculture Organization and the World Health Organization of the United Nations and the United Nations University. (FAO/WHO/UNU) (1985) Energy and protein requirements. World Health Organisation Technical Report Series 724. WHO, Geneva, Switzerland.
9. Møller, A. & Saxholt, E. (1996) *Levnedsmiddeltabeller* (in Danish: Food composition tables) *Levnedsmiddelstyrelsen, Gyldendals Forlagsekspedition, Copenhagen, Denmark.*
10. Roos, N. (2001) Fish Consumption and Aquaculture in Rural Bangladesh. Doctoral thesis. Research Department of Human Nutrition, The Royal Veterinary and Agricultural University, Frederiksberg, Denmark.