Government of the Peoples Republic of Bangladesh
Flood Action Plan

FAP 17

Fisheries Studies and Pilot Project

FINAL REPORT

(Draft)

JUNE 1994

special study

Supporting Volume No. 27

REVIEW AND BIBLIOGRAPHY OF NUTRITION IN BANGLADESH

ODA
Overseas Development Administration, U.K.

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Funded by ODA in conjunction with the Government of Bangladesh

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EXECUTIVE SUMMARY

1 In the context of the Bangladesh Flood Action Plan, concern has been expressed over several potential impacts of flood control, drainage and irrigation (FCD/I) projects on the nutritional status of rural households.

a) FCD/I projects will result in the reduction of floodplain fisheries, thus reducing an open-access resource which provides an important source of nutrients for rural households in general, and poor households in particular.

b) FCD/I projects also result in the intensification of the shift to rice monoculture and the decline in the production and consumption of other traditional food crops such as pulses and oilseeds. Although this may lead to increased energy and protein intakes in some households, it will also mean greater reliance on rice as the main component of the diet. This in turn would decrease dietary diversity and lead to a greater likelihood of dietary deficiencies occurring.

c) Fishing may also constitute an important income source for poor landless households. Removal of this income source might further aggravate the already precarious food security situation for these households, particularly during periods of the year when there are few alternative sources of income available.

2 Taken together, these potential negative impacts of FCD/I projects could lead to a deterioration in the already inadequate nutritional status of many households in rural Bangladesh. These impacts would not be evenly distributed among all inhabitants of floodplain areas, but there is a general perception that they would tend to affect the poorest people most.

1 A REVIEW OF NUTRITIONAL ISSUES AND LITERATURE WITH REFERENCE TO FISH CONSUMPTION AND THE FLOOD ACTION PLAN

1.1 Background

FAP studies to date have frequently highlighted the importance of floodplain fisheries and the need to pay greater attention to possible losses to open water fisheries when assessing the feasibility of flood control measures. The FAP 16 Environmental Study has looked at the nutritional importance of fisheries bio-diversity, which would almost certainly be reduced as a result of major increases in flood control in Bangladesh. For four floodplain locations in Bangladesh, the importance of subsistence fisheries as a seasonal source of food and income was highlighted. Most of the FAP regional studies have included fisheries components which have made some attempt at assessing possible benefits and disbenefits to fisheries as a result of different flood control options.

The general consensus emerging from these studies and FAP 17's own work seems to be that the economic importance of inland fisheries in Bangladesh has probably been underestimated. FCD/I schemes generally have negative impacts on fish production, although they are by no means the only factor involved in the reported current steady fall in productivity from open water fisheries in the country. These findings heighten concerns that had already been expressed regarding the nutritional implications of a reduction in fish consumption as a potential consequence of the FAP and, in particular, the loss of a source of "high-quality animal protein" to poor rural households.

These concerns form the background for this review and bibliography. The purpose of these are to identify nutritional issues relevant to the assessment of floodplain fisheries production and provide a bibliography which FAP planners can use to investigate these issues further.

1.2 Studies of Nutritional Status in Rural Bangladesh

There are a large number of nutritional studies which have been carried out in Bangladesh in recent years. The main findings of these are reviewed very briefly here in order to put any discussion of possible nutritional impacts of FAP into context. A comprehensive bibliography of these studies is included in Section 2.

Three national nutrition surveys have been carried out in Bangladesh by the Institute of Nutrition and Food Science (INFS) at Dhaka University (USDHEW, 1966; INFS, 1977 and INFS, 1983). These included dietary, clinical and anthropometric assessments of nutritional status.

The measurements of dietary intake show a progressive decline in total food intake and average per capita intake of nearly all nutrients, except iron[1], over the last 30 years (Table 1.1). In the latest national survey carried out in 1981-2 (INFS, 1983), average per capita intakes of total energy, vitamin A, vitamin C, riboflavin, niacin and calcium failed to meet requirements. Intakes of these nutrients met 86%, 38%, 51%, 50%, 87% and 58% of recommended intakes respectively.

Table 1.1 Changes in average per capita nutrient intake in Bangladesh according to the INFS national surveys

NUTRIENTS	1962-4	1975-6	1981-2	REQUIREMENT
Total energy (kcal)	2301	2094	1943	2273
Protein (g)	57.9	58.5	48.4	45.3
Fat (g)	15.8	12.2	9.8	-
Carbohydrate (g)	482	439	412	-
Calcium (mg)	273	305	260	450
Iron (mg)	10.3	22.2	23.4	7.6
Vitamin A (IU)	1870	730	763	2013
Thiamin (mg)	1.50	1.65	1.38	0.90
Riboflavin (mg)	0.50	0.87	0.68	1.35
Niacin (mg)	23.20	22.21	13.15	14.84
Vitamin C (mg)	*48.00	9.51	13.26	26.0

*Note: This figure does not include any correction for cooking losses which are approximately 70%.
Source : INFS (1983)

Overall consumption of all food groups has declined due to a diminishing total food intake, but consumption of pulses has dropped more than any other food group. Average daily intake

[1] Although per capita iron intake has increased, it must be remembered that most of this iron will be non-haeme or inorganic iron and thus will not be well-absorbed. The prevalence of anaemia in Bangladesh is high.

of pulses was only 8 g or 1% of total intake (by weight) in 1981-2 compared to 24 g in 1975-76 and 28 g in 1962-64 (Table 1.2).

Table 1.2 Changes in average intake of different food groups

FOOD GROUP	1962-64	1975-76	1981-82	% CHANGE 1962/64-1981/82
Cereals (g)	545.8	523.0	487.9	- 10.6
Animal foods (g)	56.5	44.0	44.0	- 22.1
Vegetables (g)	283.7	240.3	232.6	- 15.3
TOTAL (g)	886.0	807.3	764.5	- 13.7

Source : INFS (1983)

Rice is now the main component of the diet (59% of total food intake) and the main source of nearly all nutrients. It supplies 87% of total energy intake, 78% of protein intake, 82% of iron intake, 84% of thiamin intake, 70% of riboflavin intake, and 82% of niacin intake. These figures are higher than those found in the 1975-76 survey indicating an increasing dependence upon rice as a nutrient source. Consumption of wheat has increased slightly from an average per capita intake of 16.3 g in 1962-64 to 31.0 g in 1981-82, but it still only represents an average 7% of cereal intake and 4% of total intake.

These findings are corroborated by the Household Expenditure Surveys conducted by the Bangladesh Bureau of Statistics (BBS), although there are some differences in figures for consumption of certain food groups. This is probably due to differences in sampling procedures and methodology, the Household Expenditure Surveys being based on assessments of household expenditure rather than actual dietary intake.

These aggregated figures, however, obscure wide variations according to socio-economic status, region and season. When disaggregated by socio-economic status, it becomes clear that the intakes of the majority of poor rural households are not meeting requirements. In the 1981-82 INFS surveys, land tax was used as a proxy measure for socio-economic status and it was found that total energy intake correlated directly with landowning; total energy intake per caput per day was 1802 kcal for category A (landless), 1873 kcal for category B (marginal landowners), 1955 kcal for category C (rural middle class) and 2191 kcal for category D (wealthiest landowners). A similar pattern was found for protein intakes.

Clinical, biochemical and anthropometric assessments of nutritional status confirm the poor nutritional status of the majority of the rural population of Bangladesh. These studies have found a high prevalence of anaemia, night blindness and xerophthalmia due to vitamin A deficiency, iodine deficiency disorders and acute malnutrition in young children as evidenced by poor growth performance.

1.3 Fish Consumption

There is very little information available on fish consumption in Bangladesh apart from the national surveys conducted by INFS on dietary intake and the Household Expenditure Surveys conducted by BBS.

The INFS studies show a long term decline in fish consumption since the 1960s; average daily intake in both 1981-82 and 1975-76 was about 23 g compared with 27.7 g in 1962-64. These aggregated figures might suggest that fish does not occupy a central place in the diet, but they should be interpreted with caution since, as already noted above, they obscure large regional, seasonal and socio-economic differences. The original national nutrition survey of East Pakistan (USDHEW, 1966), which included a much larger number of sample areas, showed huge regional differences in fish consumption, with rural intakes ranging from 86.4 g per day in Sylhet to only 6.9 g per day in Bogra. A re-analysis of the 1981-82 survey (Hassan and Ahmed, 1990), which disaggregated the data by region, also showed a similar degree of variation in intakes of fish, although gross intakes were reduced.

The latest INFS survey also found both quantitative and qualitative variation according to socio-economic status; intake ranged from 18 g per day by the landless to 29 g per day in the highest income group. With regard to the type of fish eaten, it is stated that whereas the higher income groups are relying upon a market supply of fish, the lower income groups were primarily consuming small fish which they had caught themselves.

In relation to seasonality, fish availability and consumption shows a different pattern to other foods, especially cereals. In a study of seasonal patterns of food intake, Hassan *et al.* (1985) found that, whereas intakes of most food were lowest in October-November during the traditional pre-harvest hungry season, fish availability peaked at this time and intakes were correspondingly at their highest. The availability of fish as an open-access resource may have implications for landless labourers for whom this is a time of low labour demand.

In terms of contribution to nutrient intake, according to INFS figures, fish is only making a marginal contribution to the intakes of most nutrients (6% of total protein intake, for instance), although it contributes 22% of total calcium intake. The nutrient content of many of the small fish, however, which are largely consumed whole by poor rural households, has not yet been determined and therefore its contribution to intakes of nutrients, such as vitamin A, is unknown.

1.4 Identification of Potential Nutritional Impacts of FAP

There are a number of potential impacts of flood control on the nutritional status of rural households :

1) through directly reducing the availability of fish to certain sections of the rural population, to whom it may be an important source of food, particularly at certain times of the year;

2) by encouraging rice monoculture which will reduce the degree of diversity in the diet and thereby increase the likelihood of shortfalls of certain essential nutrients in the diet;

3) by reducing the income of households dependent upon capture fisheries for all or part of their livelihood and so reducing their exchange entitlements to acquire food.

These effects will all be superimposed upon a diet that already fails to meet the recommended daily requirements of nearly all nutrients.

1.5 Impacts of Fish Consumption

On the basis of such sparse information it is impossible to make any quantitative assessments about the place of fish in the rural diet and its contribution to nutrient intake. There are, however, indications that for certain groups of people, such as the landless, fish may be an important resource and source of nutrients at times of low labour demand. FAP 16 found from their investigation into fish consumption by different groups of people in rural Bangladesh that "small and medium farmers consumed more fish than landless and marginal farmers". The nutritional value of fish compared to other food, in the context of the

consumption disparities was not investigated. This information is important to enable the effects of reduced fish consumption as a result of FAP to be discerned.

Any increase in fish production from aquaculture is unlikely to compensate for the loss of the open-access resource of capture fisheries, since the larger commercial fish species grown by aquaculture are too expensive to be purchased by the rural poor. This is emphasised by the fact that 90% of the fish consumed were captured and 61% of the subsistence catch came from the most adversely effected habitats: floodplains; *beels* and canals.

1.6 Dietary Diversity

As described above, there is evidence from the INFS surveys of growing dependence upon rice as the main component of the diet and principal source of many nutrients, such as protein, iron and several B vitamins. Studies of the impact of agricultural modernization (i.e. increased rice production, primarily of *boro* rice) on the food and nutrient intake of rural households have shown that although total energy and protein intakes were significantly higher in areas where agriculture had been modernized, intakes of several other essential nutrients, notably vitamins A and C, riboflavin and calcium, were much lower (Abdullah, 1988; Hassan et al., 1985). This was due to a reduced intake of vegetables, fruits and pulses in the agriculturally modernized areas. Intakes of these foods also showed greater seasonal fluctuations in these areas.

From a nutritional perspective, this heavy dependence upon rice is extremely undesirable; no single food can provide all the nutrients required by humans and reliance on a single food, such as rice, greatly increases the likelihood of nutritional deficiencies occurring. Rice is a good source of energy and an adequate source of protein, but has a low or zero content of many essential nutrients such as vitamins A and C, zinc and calcium.

If the effect of the FAP is to intensify the shift to rice monoculture and reduce the production and consumption of the traditional dry season crops of oilseeds, pulses and vegetables, as has occurred in areas where FCD/I schemes have been implemented, then it can be predicted that, while intakes of protein and energy may rise, intakes of nutrients may fall. As mentioned above, vitamin A deficiency is already prevalent in Bangladesh. It is a major cause of blindness in young children and is also associated with increased mortality and morbidity rates from infectious diseases. A reduced vitamin C intake may have implications for iron status. Despite a high intake of iron, anaemia is prevalent in Bangladesh and it can

be surmised that this is partly due to the poor absorption of iron from a cereal-based diet. Vitamin C is important in this respect since it enhances the absorption of inorganic iron from the gut. Calcium is an essential nutrient and requirements are particularly high during early childhood and pregnancy and lactation.

Any intervention that might lead to a reduction in dietary diversity and in the intakes of these nutrients is a cause for great concern from the perspective of health and nutrition.

1.7 Household Food Security

Although there may be an increase in household food security for some households with regard to rice, a reduction in capture fisheries can be expected to result in a reduced household food security for those households dependent upon fisheries as an economic activity. This group includes both professional and subsistence fishermen, as there is evidence that subsistence fishing is an important part of the survival strategies of the landless poor and an activity of last resort in times of low demand for agricultural labour (Abdullah and Ahmed, 1992). If no alternative means of income generation are provided, both these groups will have reduced access to adequate food supplies.

2 BIBLIOGRAPHY

2.1 Introduction

A vast number of reports and studies relating to nutrition[2] issues in Bangladesh have been written in the period 1985-1992. These are collated in this section of the report.

Because of the large number of references, this bibliography has been divided into two broad sections, sub-sections 2.2 to 2.12 and 2.13 to 2.18. The first section contains references on observational and analytical studies and reports on the prevalence of malnutrition in Bangladesh and factors affecting its incidence. It has been sub-divided into sub-sections according to the method of nutritional assessment used (measurement of dietary intake; clinical or biochemical assessment; anthropometry) and also according to topic (weaning and breast feeding practices; maternal nutrition; nutritional status, morbidity and mortality; fisheries). The second section contains references on interventions aimed at improving nutritional status. It has been sub-divided into sub-sections according to the type of intervention (nutritional rehabilitation; supplementation and fortification; nutrition education; nutritional surveillance). Sub-sections 2.2 and 2.13 contain more general references. Because of overlap, some references appear in more than one sub-section.

In addition to published material, unpublished reports have been included. By the nature of such a bibliography it is regrettably inevitable that there will be some omissions.

2.2 Research and Reports on General Nutrition Issues in Bangladesh

1. Ahmed, A.U. 1990.
Food policy in Bangladesh: an analysis of economic efficiency and distributive justice.
Colorado; thesis, Colorado State University, (available from University Microfilms, Inc.).

In Bangladesh, the growth performance of rice production is an important determinant of the

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[2] Please note the subject of this bibliography is human nutrition and that references on animal nutrition and food technology have been excluded.

nutrition and real income of the majority of the people and, although it has increased moderately over past years, it has not kept pace with population growth. The general objective of the study is to formulate a strategy to achieve self-sustainable growth in rice production that fosters greater economic efficiency and promotes distributive justice in the society. Specifically, the study attempts to analyse the effects of irrigation-induced technological change (ITC) on rice production, price, economic efficiency, distribution of benefits between consumers and producers, alleviation of poverty, inequality in income distribution, and rural employment. The study compares the predicted effects of the ITC in fiscal year 1994/95 (FY95) with the actual situation in FY87. The results indicate that with the ITC, the annual growth rate of rice production would surpass the expected population growth, resulting in an increase in per caput consumption of rice. The ITC would also promote distributive justice in the society by creating employment and income for the poor, thereby alleviating poverty. The production of rice would be self-sustained because it would be supported by effective demand. Contrary to the conjecture of equity-efficiency conflict, this study demonstrates that the ITC accompanied by a policy that further increases income of the poorest would lead to a higher level of economic efficiency. Based on the findings, the study recommends an equity-oriented irrigation-induced technological change as the rice production strategy for Bangladesh. The study identifies the priority areas where efforts and investments are to be made for a balanced and sustainable rice policy for Bangladesh.

2. Ahmed, K. and Hassan, N. 1985.
Nutrition research needs in agriculture.
In Touch. **9**: 21-24.

3. Ahmed, S., Khasnam, S.T. and Abdal, N.M. 1989.
A study on researches conducted in the field of nutrition in Bangladesh from 1981 to 1986.
Hygeia. **3**: 115-160.

4. Alam, A.K.A.M.
Bangladesh country paper.

Manila; Asian Development Bank, Urban Policy Issues, Regional seminar on major national urban policy issues, February 3-7 1987.

5. Alauddin, M. and Tisdell, C.A. 1991.
Welfare consequences of Green Revolution technology.
Development and Change. **22**: 497-517.

Recent literature not only recognizes the dominant role of agriculture in the economic development of less developed countries (LDCs) but sees technological packages, such as those used during the Green Revolution, as a key dynamic force for transforming their traditional structure. This study adopts the Poirier linked exponential method, used to estimate crop output growth, to examine changes in the Bangladeshi crop sector in 1947/48, using aggregate time-series data. Growth rates for the output of major crops like wheat and rice as well as commodity groups like fruit and spices are calculated for various sub-periods, emphasizing the period following the Green Revolution. A comparative 'crowding-out' of non-cereal crop production and other food sources is noted in this period. Cereal production has been absorbed by a rising population to allow a roughly constant per capita availability while crops like pulses, fruit and spices have fallen markedly. Furthermore, the per capita protein content (both vegetable and animal) of the typical Bangladeshi diet has declined, leading to a less balanced and less nutritious food intake. Monocultural multiple cropping of the cereals that have 'crowded out' other crops is seen as ecologically unsustainable, as well as limited in terms of productivity. In any case the rising population necessitates the import of supplementary food grain so there may as well be a shift towards the cultivation of those crops that constitute a healthier diet.

6. Azaduzzaman, M. 1988.
Feeding our future towns: an overview of urbanisation and associated food policy issues. *In*: Food strategies in Bangladesh [Government of Bangladesh, Planning Commission].
Dhaka; University Press Limited.

7. Banerji, C. 1991.
Life and food in Bengal.
London; Weidenfeld & N.

8. Bangladesh Bureau of Statistics. 1986.
Socio-economic indicators of Bangladesh. 2nd edition.
Dhaka; Bangladesh Bureau of Statistics.

9. Bennish, M.L. and Ronsmans, C. 1992.
Health and nutritional consequences of the 1991 Bangladesh cyclone.
Nutr. Rev. **50**: 102-105.

10. Bhuyan, M.A.H., Chowdhury, M.M.H., Akteruzzaman M. and Ali, S.M.K. 1989.
The 1988 flood in Bangladesh and the nutritional consideration.
Hygeia. **3**: 73-76.

11. Chen, L. C. 1986
Explorations of food consumption and nutritional status: Bangladesh.
In: Mann, C.K. and Huddleston, B. (eds.) Food policy: frameworks for analysis and action .
Bloomington, IN, USA; Indiana University Press: 67-79.

The variables which affect nutritional state such as socioeconomic status, diet, food distribution and infectious diseases are discussed. The preliminary findings of a study in Bangladesh on the relation between these factors and their impact on the nutritional state of children are reported. The results show that income is a less important determinant of nutritional state than previously suggested, and that childrens' energy intake and infectious disease morbidity are not associated with nutritional state. The possible methodological weaknesses in this study are reviewed and it is suggested that other types of health care and public educational intervention should be considered rather than just supplying more food.

12. Chowdhury, N. 1987.
Seasonality of foodgrain price and procurement programme in Bangladesh since liberation: an exploratory study.
Bangladesh Dev Stud. **15**: 105-128.

13. Chowdhury, O.H. 1989.
A critical review of studies on nutrition in rural Bangladesh.
Dhaka; Bangladesh Institute of Development Studies.

14. Cutler, P. 1985.
Detecting food emergencies: lessons from the 1979 Bangladesh crisis.
Food Pol. **10**: 207-224.

15. Food and Agriculture Organization. 1987.
ESN - Nutrition country profiles - Bangladesh.
Food and Agriculture Organization. Rome, Italy.

16. Ghafur, A.; Norbye, O.D.K. 1990.
Food policy of Bangladesh and some constraints.
In Norbye, O.D.K. (ed.) Bangladesh faces the future.
Dhaka; University Press Limited: 66-109.

Access to food and nutrition is the most important of all human rights and must be addressed by policy-makers in countries like Bangladesh. Various aspects of food policy in Bangladesh are discussed here, including the budgetary implications of food aid. A brief review of food policy within a macroeconomic framework is followed by an account of recent economic performance in the country, in terms of the agricultural sector, savings and investment, and poverty and income distribution. Policy relating to food in general, and food grains in particular, is analysed with details of the Public Food Distribution System (PFDS) and its subsidiary channels. Nearly all aspects of food supply are governed by aid conditions whose intentions and effects are a much debated subject. It is recommended that more attention be paid to the demand side of malnutrition and hunger as opposed to the present exclusive emphasis on supply side factors such as production, imports, domestic procurement and distribution.

17. Gopalan, C. 1987.
Nutrition problems and programmes in South-East Asia.
SEARO Regional Health Papers, Regional Office for South-East Asia, World Health Organization. **15**.

This report attempts to highlight some of the main nutritional problems and programmes in the countries of the WHO South-East Asia Region; the 11 countries covered are Bangladesh, Bhutan, Burma, India, Indonesia, Maldives, Nepal, Sri Lanka and Thailand. The report is based on discussions with nutritionists and health administrators from the 9 countries and on relevant publications and reports. Only such aspects as provide some general messages of significance to the Region as a whole have been highlighted and the report attempts to consider the nutritional problems in the total context of health and socioeconomic development. The main nutritional problems are endemic goitre and related iodine-deficiency diseases, vitamin A deficiency, iron-deficiency anaemia and protein-energy malnutrition.

The final section of the report presents lessons from the experiences of different countries in combating malnutrition.

18. Government of the People's Republic of Bangladesh. 1992.
    Bangladesh country paper.
    Rome; International conference on Nutrition.

19. Greene, B.A. 1986.
    Estimating economic subsistence and nutrition poverty levels from primary data, Bangladesh, 1981-85.
    Bangladesh Journal of Agricultural Economics. **9**: 39-54.

Two indicators were used in the study: the economic subsistence level (ESL) where annual income equalled expenditure; and a nutritional poverty line (NPL) where average annual total income equalled the estimated cost of an acceptable nutritional diet per average household for each size grouping. Across three samples reviewed in detail, 22% of the total sample of 135 Bangladeshi farmers were below the ESL and 16% below the NPL. A further 15% were around the ESL and 5% around the NPL. These figures appeared to be much lower estimates than those found by other researchers. The main difference was that the data for this study were collected from weekly monitoring over the whole season/year and should therefore have been more accurate than the cross sectional data used in other studies.

20. Islam, A.B.M.S. 1986.
    Bibliography on population, health, and development in Bangladesh.
    Bangladesh Institute of Development Studies. Dhaka.

This bibliography has been compiled from published and unpublished literature on population and related topics, including books, journals, dissertations, reports and conference proceedings, and from relevant literature cited in secondary sources. It contains 2188 entries organized under 23 subject headings including woman's status, fertility, rural communities, water use, health, irrigation, nutrition, education, employment and population policy.

21. Kafiluddin, A.K.M. 1990.
    Directory of completed researches related to health research scientists and researchers of Bangladesh.
    Bangladesh Medical Research Council. Dhaka.

22. Kanai, M., Uno, T., Kobayashi, J., Morozumi, K., Fujita, K. and Mizuno, M. 1991. Some papers on food and agricultural problems of Japan and other Asian countries. Japan; National Research Institute of Agricultural Economics. Research Paper **10**.

This publication is a collection of papers written for the 21st International Conference of Agricultural Economists, held August 22-29, 1991, in Tokyo. The first two papers, by T. Uno and H. Kobayashi, deal with the economic structure and statistical analysis of rice production in Japan, respectively. There is concern about the decline in the number of rice producers in the country, giving rise to the need for reorganizing farming methods. Actual agricultural labour evaluation and farmers' income have been declining in the economic structure, where manufacturing sector wages exceed the earnings of cultivators, by far. This problem has been exacerbated by rising land rents in rural Japan. Another paper, by K. Morozumi, looks at the problem of rural debt faced by full-time farming households in the country, outlining its main causes. The remaining papers analyse various aspects of the rural economy and food supply in the context of Asia, in general, and Nepal and Bangladesh, in particular. Agrarian structure as a determinant of technology choice is discussed in the case of Bangladesh by K. Fujita, while the rural energy problem in the Nepalese Himalayas is addressed by M. Mizuno. A regional perspective is taken of food consumption patterns in Asia by Kanai, measuring calorie intake for 27 countries and up to 19 food categories, between 1961 and 1977.

23. Kaul, A.K. 1984.
Interaction between agriculture, nutrition and food science in Bangladesh.
In Achaya, K.T. (ed.) Interfaces between agriculture, nutrition, and food science. Tokyo, Japan; United Nations University: 324-342.

24. Khan, Q. M. 1985.
A model of endowment-constrained demand for food in an agricultural economy with empirical applications to Bangladesh.
World Development. **13**: 1055-1065.

The paper explores the relationship between distribution of assets and systematic undernutrition in rural populations. A formal theoretical model is developed to explore the impact of short-term price changes in the nutrition of various economic classes. An empirical simulation model is developed for rural Bangladesh using data from the agricultural census, the land occupancy survey and two household demand surveys. This model links

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endowments like land, labour and livestock to demand for food using prices and incomes and intermediate variables. The results suggest that the landless would consume about half their minimum requirement even if production were 50% above requirements and prices remained stable. When prices rise the picture gets much worse. This analysis precludes assistance from better-off neighbours or the state but it demonstrates conclusively how much of starvation is due to income and asset distribution rather than shortfalls in food availability per caput. Increased production of food, while providing some necessary conditions for eliminating starvation, is not sufficient by itself. Prices and incomes have to be taken into account.

25. Lipton, M., Gittinger, J.P., Leslie, J. and Hoisington, C. 1987.
Variable access to food.
In Gittinger, J.P., Leslie, J. and Hoisington, C. (eds.) Food policy. Integrating supply, distribution, and consumption
Baltimore, Maryland, USA; Johns Hopkins University Press: 385-392.

Two additional problems may compound the impact of poverty on nutrition. One is that undernutrition in poor families may be caused partly by inappropriate food distribution within the household. The second is that the 'peaky' distribution of nutritional needs over time (seasonally and in the life cycle) may increase the nutrition risk of some members of the household. It is rare to find food discrimination against adult women in intrafamily food allocation, slightly more common to find it against children, and most common to find it against girls aged zero to four, though even this appears to be typical only in Bangladesh and northern India. Where food discrimination does exist, it may often represent a desperately poor family's last resort, maximizing its prospects of pulling through by feeding members most likely to earn incomes, either currently or when they are older. Intervention in intrafamily food distribution is probably seldom practicable. Fluctuations in nutritional risk occur for various reasons. People at risk from undernutrition tend to be at greatest risk in the hungry season. Direct nutritional risks, such as infection and inadequate food, then interact and are intensified by the greater tendency of the poorest to be exposed to covariant, relatively severe, fluctuation in employment and wage rates. People not normally at risk from a given degree of undernutrition may also move into risk during unexpectedly bad seasons or years.

26. Murshid, K.A.S. 1987.
Micro-level adjustments to foodgrain shortages in Bangladesh.
Bangladesh Dev. Stud. **15**: 25-63.

27. Nutrition Society of Bangladesh. 1986.
Proceedings of the fourth Bangladesh nutrition conference, 9-11 March.
Dhaka; Nutrition Society of Bangladesh.

28. Nutrition Society of Bangladesh. 1991.
Proceedings of the fifth Bangladesh nutrition conference, 10-12 August.
Dhaka; Nutrition Society of Bangladesh.

29. Osmani, S.R. 1987.
Controversies in nutrition and their implications for the economics of food.
Helsinki, Finland; World Institute for Development Economics Research. Working Papers. **16**.

30. Osmani, S.R. 1990.
Food deprivation and undernutrition in rural Bangladesh.
Helsinki, Finland; World Institute for Development Economics Research. Working Papers. **82**.

The issue of long-term changes in food deprivation and undernutrition in rural Bangladesh is reviewed, with an attempt to understand the processes underlying these changes and to glean a few lessons for public policy. It is argued that the evidence of all-round improvement in poverty cannot but be illusory, arising perhaps from the choice of non-comparable surveys and/or inappropriate methodologies. Some of the poor have in fact improved their position but others have become poorer. The processes behind the differential fortunes of the poor are considered. Both the limited success in alleviating 'moderate' poverty and the failure to improve the lot of the poor as a whole are argued to be related to the nature and pace of technological progress in agriculture. Technological progress has the potential to raise the entitlement of all categories of rural poor. But its pace has not been sharp enough to help any but a handful of middle and not-so-small farmers to escape beyond the poverty line. This suggests that a sustained attack on the food deprivation of the poor depends critically on the ability to accelerate the tempo of technological diffusion. Food deprivation plays an important role in long-term changes in nutritional state. Also, independently of changes in food

entitlement, undernutrition can be reduced through successful control of diseases and environmental hygiene. Discussion of the incidence of undernutrition in children of four different income groups and of mothers' education leads to the conclusion that neither income nor education can in isolation have great effect, but when working together they do represent a considerable force in the battle against undernutrition.

31. Osmani, S.R. 1991.
The food problems of Bangladesh.
In Dreze, J. and Sen, .A. (eds.) The political economy of hunger
Oxford; Oxford University Press.

32. Quddus, M.A. and Ara, S. 1991.
Nutrition in rural communities with seasonal variations.
Comilla, Bangladesh; Academy for Rural Development.

33. Rahman, M. A. 1990.
Potato and sweet potato in Bangladesh.
Bogor, Indonesia; Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific. Working Paper - CGPRT. 7.

Rice cultivation in Bangladesh is greatly influenced by flood, drought and other environmental stresses. Production is always uncertain and diversification is necessary to avoid reliance on rice alone. Potato and sweet potato crops are flood resistant and have the greatest potential to reduce dependence on rice. Potato production should therefore be exploited to the fullest extent. This study presents information on the nutritional value of potato and sweet potato; determines the present status of potato and sweet potato in Bangladesh in terms of area, yield and production; considers the scope for production; studies the demand and supply position including projections of demand and supply up to the year 1999/2000; identifies constraints to production; and makes suggestions for a programme for root and tuber production. Potato and sweet potato could contribute to the achievement of food self sufficiency in Bangladesh, although market development is required to this effect. Low yields and marketing and storage constraints are aspects that need immediate attention for both crops.

34. Rahman, A. and Haque, T. 1988.

Poverty and inequality in Bangladesh in the eighties: an analysis of some recent evidence.

Dhaka; Bangladesh Institute of Development Studies. Research Report **91**.

According to Household Expenditure Survey (HES) data, there was a significant decline in poverty in Bangladesh during the period 1982-84, with the rural poverty ratio declining from 79% to 50% and the urban poverty ratio from 51% to 40%. This paper asks whether the reported changes could be attributed to a faulty data base, a change in the methodology of HES data collection, or a change in definitions. The HES data is critically examined in order to identify shortcomings and biases in estimating income and consumption figures of the poor in different years. Changes in data collection methodology are noted. Various macro-economic poverty correlates (such as employment, nutrition, and the income position of female headed households) are examined to determine whether the changes in these variables corroborate the HES evidence of declining poverty. It is concluded that the HES data exaggerate poverty reduction to a significant extent for the period studied. This is mainly due to the fact that HES under-reported income in 1982, as opposed to over-reporting income in other years.

35. Rizvi, N. 1987.

The socio-cultural chain and family food availability in Bangladesh.

Social and Human Sciences in Asia and the Pacific, RUSHAP Series on Occasional Monographs and Papers, UNESCO Principal Office for Asia and the Pacific. **20**: 168-178.

Despite an increase in the production of rice and wheat in Bangladesh, the country still had a food deficit in 1985, the year in which it had been planned (under the second 5 Year Plan) to attain self sufficiency in grain production. According to the 1981/82 National Nutrition Survey, 74% of the population were deficient in energy intake and the percentage has increased over the last 20 years. The paper examines the question of whether, if self sufficiency in food grain production can be attained, it will ensure adequate food intake for all the population and thus eliminate chronic hunger. Detailed studies of two rural areas of Bangladesh investigate household food supply and its relationship to socioeconomic and cultural factors, and examine problems related to inadequate food intake, its relationship to employment and income status, and the values and beliefs related to food, health and disease. The food consumption patterns in the two areas studied show that the economic status of the

household generally determines the quality and variety of the diet. The household food situation has been deteriorating over the past years. Even when production of cereals reaches the required level, lack of purchasing power will continue to limit food intake in poor households and women will continue to endure the greater food deprivation.

36. Schulz, L.O. and Csete, J. 1990.
Nutrition concerns in Bangladesh: the focus for improvement.
Prog. Food. Nutr. Sci. **14**: 259-276.

The results of efforts to identify the prevailing nutritional deficiency disorders in Bangladesh and major topics of local scientific investigation influencing those nutrient disorders are reviewed. Primary areas of emphasis include studies addressing nutritional status (especially vitamin A); factors influencing diarrhoeal incidence, morbidity and mortality; child nutrition; the influence of seasonal variations; and the implementation of successful intervention programmes. Programmatic implications of the findings are presented.

37. Shams-Ur-Rahman and Clarke, H.E. 1991.
Nutrition model for developing nations with special reference to Bangladesh.
Bangladesh Dev. Stud. **19**: 83-97.

38. Talukder, R.K. 1989.
Food supply, distribution, consumption and nutritional status in Bangladesh.
Bangladesh J. Agr. Econ. **12**: 1-26.

The paper examines the supply, distribution and consumption of food in Bangladesh, and the country's overall nutritional state. The level and composition of available food supply, the role of the public food distribution system (PFDS) in modifying food availability and consumption, and the adequacy of consumption in relation to nutritional requirements are examined. The public food distribution system appears increasingly biased in favour of urban dwellers or the small group of rural dwellers whose earnings are comparable to urban levels. Although per capita food and calorie intakes are declining on the average, the analysis suggests that the current level of per capita consumption is consistent with defined normal calorie intake. There is, however, widespread undernourishment among a large segment of the population, suggesting the importance of nutrition policies being commodity and target group specific and informed with a proper understanding of the food preference patterns of the different classes of people.

39. Walker, P. 1989.
Famine early warning systems: victims and destitution.
London, UK; Earthscan Publications Ltd.

Famine is a socioeconomic process which occurs because of a failure to practise sustainable development. In considering whether it is possible to see famines coming and to prevent irreversible disaster, this book looks at: the nature, stages and causes of a famine; the outsider's and victims' view of the predicament; the traditional responses of victims to their situation and their attempts to avert mass starvation, taking examples from Africa and South Asia; the non-victims' reaction (host and donor governments, international and non-governmental organizations); the purpose of early warning systems and the nature of information required; the tools available for running such a system (remote sensing, nutritional surveillance, market and social behaviour models); how states warn of and respond to famine (taking India, Bangladesh, Botswana, and Ethiopia as examples); non-governmental and international early warning systems; recommendations for such systems; and the future for those vulnerable to famine. It is concluded that the pressures brought about by population growth and global warming create a depressing future for the vulnerable of the world but there is hope that on the development front there is an increasing recognition of the importance of evolving sustainable programmes which work with rather than against the environment. Future prosperity will depend on peoples' salvation from international debt, repressive government policies and an indifference to human rights.

40. Wheeler, E. and Khanum, S. 1986.
Nutrition and malnutrition in Bangladesh.
London, UK; Save the Children Fund (UK).

41. World Bank. 1985.
Bangladesh food and nutrition sector review.
Washington D.C., USA; World Bank, Population, Health & Nutrition Development.

42. World Bank. 1989.
Bangladesh: promoting higher growth and human development.
Washington D.C., USA; World Bank. World Bank Country Study.

43. World Health Organization. 1985.
Nutrition and food safety - Bangladesh.
International Digest of Health Legislation. **36**: 425-427.

2.3 National Surveys and ad hoc Studies of Dietary Intake and Food Use and Factors Found to Influence Them

1. Abdullah, M. 1988.
Modernization of agriculture and seasonality in food intake.
Nutrition Reports International. **37**: 1147-1159.

Seasonal patterns of food intake were studied in 2 traditional subsistence farming villages and in one agriculturally modernized village in Bangladesh and the effect of modernization on the seasonality of food intake was examined. In the traditional subsistence farming villages there are two distinct pre-harvest lean periods when energy intakes decreased significantly compared with the two post-harvest seasons. Modernization of agriculture resulting in increased rice production resulted in very high rice intake. Although seasonality in energy intake virtually disappeared, modernization resulted in increased dependence on cereals for a diet which is already overwhelmingly cereal-dominated. It is suggested that a mix of cereals and other food crops would be a nutritionally more desirable strategy towards modernization of agriculture. In traditional subsistence farming villages, target group approaches and programmes to increase employment opportunities during lean periods, would be appropriate strategies for coping with seasonal food shortages.

2. Abdullah, M. 1988.
Ecology of malnutrition in distressed areas of Bangladesh.
Bangladesh J Nutr. **1**: 90-97.

3. Abdullah, M. and Ahmed, L. 1990.
Inadequate dietary intake of vitamin A in rural Bangladesh children; seasonal, location and ethnic variations.
Bangladesh J Nutr. **4**.

4. Abdullah, M. and Sahn, D.E. 1989.

The effect of seasonality on intrahousehold food distribution and nutrition in Bangladesh.

In Sahn, D.E. (ed.) Seasonal variability in Third World agriculture: the consequences for food security .

Baltimore, Maryland, USA; Johns Hopkins University Press: 57-65.

Seasonal variations in the intrahousehold distribution of food are examined following a brief discussion of seasonality in food availability and an overview of the general pattern of intrahousehold food distribution in Bangladesh. Results indicate that children, especially females, are discriminated against in the intrahousehold distribution of food energy. However, during the preharvest, i.e., hungry season, the share of household resources allocated to young girls is greater than during the postharvest season. It is argued that households display a strategy of protecting the most vulnerable during seasons of greatest stress in contrast to the general pattern of discrimination evident during the more prosperous seasons.

5. Abdullah, M. and Wheeler, E.F. 1985.

Seasonal variation and the intra-household distribution of food in a Bangladeshi village.

Am. J. Clin. Nutr. **41**: 1305-1313.

6. Ahsan, R.M. and Hussain, S.H. 1990

A review of socio-economic and nutritional issues of Bihari camp dwellers in Bangladesh: a micro study.

Geojournal (Dhaka University, Department of Geography, Dhaka, Bangladesh). **20**: 285-291.

The living conditions of the Bihari camp dwellers of Bangladesh are an embarrassment to the country's social environment. An investigation was made into the socioeconomic conditions of the Biharis living in the Khalishpur camp, Khulna. A comparison was made between the Biharis and equivalent Bengali slum dwellers in Khalishpur. The data were collected from primary sources. A 10% systematic sampling was undertaken to collect a total of 150 Bihari households and, through a 20% systematic sampling, 150 Bengali households were surveyed by questionnaires. Data analysed both qualitatively and quantitatively indicate that the Biharis are leading an extremely substandard life, when food consumption, medical expenditure,

schooling, income and employment pattern were considered. The conditions prevalent in the camp have led to a high rate of infectious diseases which are likely to aggravate environmental hazards. The country may then face serious social problems which should be prevented through gearing up the process of repatriation and through encouraging community participation in improving the economic and social environment.

7. Bairagi, R. 1986.
Seasonal food shortages and female children in rural Bangladesh.
Am. J. Clin. Nutr. **43**: 330-332.

8. Bairagi, R. 1987.
Food crises and female children in rural Bangladesh.
Soc. Sci. **72**: 48-51.

9. Banerji, C. 1991.
Life and food in Bengal.
London; Weidenfeld & N.

10. Bangladesh Bureau of Statistics. 1988.
Bangladesh household expenditure survey, 1985-86.
Dhaka; Bangladesh Bureau of Statistics.

11. Bangladesh Bureau of Statistics. 1989.
Report of the survey on institutional feeding in Bangladesh.
Dhaka; Bangladesh Bureau of Statistics.

12. Becker, S., Black, R.E., Brown, K.H. and Nahar, S. 1986.
Relations between socio-economic status and morbidity, food intake and growth in young children in two villages in Bangladesh.
Ecol. Food Nutr. **18**: 251-264.

13. Bidinger, P.C., Nag, B. and Babu, P. 1986.
Nutrition and health consequences of seasonal fluctuations in household food availability.
Food Nutr. Bull. **8**: 36-60.

14. Brown, K.H., Black, R.E., Robertson, A.D. and Becker, S. 1985.
Effects of season and illness on the dietary intake of weanlings during longitudinal studies in rural Bangladesh.
Am. J. Clin. Nutr. **41**: 343-355.

Longitudinal, quantitative studies of the dietary intake of 70 weanlings between five and 30 months of age from two Bangladeshi villages have been analyzed to determine the effects of season and illness on dietary intake. During 1014 days of observation, all foods consumed by the children were weighed by a field worker present in the home; 24-hour breast milk intake was estimated from 12-hour test weighings. Inter-individual differences explained 29% to 50% of the variance in consumption of selected nutrients and foods during 632 studies conducted when children were free from diarrhoea and fever. Multiple linear regressions controlling for inter-individual differences indicated that 60-day seasonal periods explained a significant proportion of the variation in intake. Average energy consumption (kcal/kg/day) was approximately one-third greater during the post-harvest periods than during the pre-harvest monsoon period. Breast milk intake varied similarly even after controlling for age-related decreases. Consumption of rice and wheat, the major non-breast milk sources of energy and protein, had distinct seasonal patterns, thus limiting the overall seasonal variability in cereal intake. Older children, particularly boys, benefited more from the post-harvest relative abundance of food. The intake of most nutrients was significantly depressed by approximately 10% during febrile illnesses. Minor decreases in intake with other illnesses were not statistically significant.

15. Chaudhury, R.H. 1986.
Determinants of nutrient adequacy in a rural area of Bangladesh.
Food Nutr. Bull. **8**: 24-31.

This study examines the relative impact of some factors, particularly those socioeconomic factors known to influence nutrition, as a means of identifying the most important determinants of malnutrition in rural Bangladesh. The factors included in the model were per caput income, education, family size, female participation, and male participation in economic activities. Of the seven variables included in the model to explain nutrient adequacy, all but one had a significant effect on energy adequacy, while only four were significantly related to protein adequacy. Of the six variables significantly affecting energy adequacy, the effects of three (husband's education, mother's employment status, and per caput expenditure on food) were positive, while those of the remainder (family size, number

of minutes given to cooking) were negative. Among the variables, number of minutes given to productive activities by male members of the household (per day per person), number of minutes given to cooking by female members of the household (per day per person), and expenditure on food (per day per person), significantly affecting protein adequacy, all but one (expenditure on food) had a negative effect. The variables considered in the model explained 56% and 43% of the variations in dietary adequacy of calories and protein respectively, which is statistically significant.

16. Chaudhury, R.H. 1987.
Dietary adequacy and sex bias: pre-school children in rural Bangladesh.
Social Action. **37**: 107-125.

The study examines some aspects of nutrient intake, adequacy and distribution for pre-school children (0 to 4 years), using data from a rural area of Bangladesh. The findings show that the calorie intake of a sizeable proportion of pre-school children falls short of estimated energy requirements. The data also show a strong bias in favour of boys with regard to expenditure by mothers on health and child care time. The findings indicate the need to augment household income to ensure adequate nutrient intake of pre-school children and to reduce the sex bias in favour of male children. The latter, however, depends to a large extent on changing the value system and/or economic structure of society.

17. Chaudhury, R.H. 1988.
Adequacy of child dietary intake relative to that of other family members.
Food Nutr. Bull. **10**: 26-34.

Data were collected from 108 households in the village of Muyiarchar, Bangladesh, to examine how children fare in meeting their nutritional needs compared with other members of the family. The findings show that the calorie intake of a sizeable proportion of pre-school children falls short of estimated energy requirements, whether the need is assessed according to age, sex, and average weight (method B) or simply age and sex (method A). When the need is assessed by the most logical means, namely method B, at least 40% of pre-school children fail to meet their calorie requirement, and this figure rises to 92% when the need is assessed by method A. The hypothesis that the adult members of the household, particularly males, received preferential treatment over young children in terms of distribution of food in patriarchal societies like Bangladesh is not unanimously supported by data when allowance is made for the difference in nutrient needs of the two groups. The data

also do not support preference for sons in the intra-family distribution of food when adjustment is made for the different nutrient needs of boys and girls. However, a strong preference for sons exists with regard to expenditure on health and mothers' time spent in child care. Some differences by the sex of the child were noted with respect to the consumption of quality foods, with males consuming more of such items than females.

18. Chen, L.C. 1986.
Explorations of food consumption and nutritional status: Bangladesh.
In Mann, C.K. and Huddleston, B. (eds.) Food policy: frameworks for analysis and action .
Bloomington, IN, USA; Indiana University Press: 67-79.

The variables which affect nutritional state such as socioeconomic status, diet, food distribution and infectious diseases are discussed. The preliminary findings of a study in Bangladesh on the relation between these factors and their impact on the nutritional state of children are reported. The results show that income is a less important determinant of nutritional state than previously suggested, and that childrens' energy intake and infectious disease morbidity are not associated with nutritional state. The possible methodological weaknesses in this study are reviewed and it is suggested that other types of health care and public educational intervention should be considered rather than just supplying more food.

19. Choudhury, A.Y., Banu, L.A., Sultana, R. and Laila, R.A. 1990.
Formative research to aid communication development for promotion of vitamin A rich foods and capsules.
Dhaka; Programme for the Introduction and Adaptation Contraception Technology.

20. Cohen M. 1986.
The influence of the street food trade on women and children.
In Jelliffe, D.B. and Jelliffe, E.F.P. (eds.) Advances in international and child health.
Oxford, UK; Clarendon Press: 148-165.

21. Drexler, A.E. *et al.* 1988.
Vitamin A foods; beliefs and practices in Bangladesh.
New Delhi; First World Congress of Clinical Nutrition.

22. Faruque, A.J.M.O. 1985.
Use of soybean in our daily dietaries.
In Touch. **9**: 31-32.

23. Harriss, B. 1990.
The intra family distribution of hunger in South Asia.
In Dreze, J. and Sen, S. (eds.) The political economy of hunger.
Oxford; Oxford University Press: 351-424.

24. Hassan, N. and Ahmad, K. 1986.
Household distribution of energy intake and its relationship to socio-economic and anthropometric variables.
Food Nutr. Bull. **8**: 3-6.

Data were collected from a nutrition survey of rural Bangladesh conducted during 1981/82. An alarming energy situation was revealed: about 48% of the study households had an intake of below 80% of their requirement and 76% lived below the poverty level. Maldistribution within and among the families seemed to aggravate the situation. Socioeconomic factors such as land holding, income and expenditure on food have a positive influence on energy adequacy. Regression analysis revealed a higher contribution from land holding than from income on food expenditure. Since the possibility of increasing the per caput land holding is very limited and expenditure on food depends primarily on income, even a small increase in income would seem to be effective in increasing the energy adequacy. No regular relationship between anthropometry and household energy adequacy was immediately seen, probably because household energy adequacy did not ensure better nutrition for individual consumers. Unequal distribution within the family left many of the members malnourished.

25. Hassan, N. and Ahmad, K. 1998.
Seasonal and regional intakes of vitamin A in rural Bangladesh.
Bangladesh J. Biol. Sci. **14-16**: 21-32.

26. Hassan, N. and Ahmad, K. 1991.
The nutrition profile of the slum dwellers: a comparison with the rural poor.
Ecol. Food Nutr. **26**: 203-214.

In 1985-86 a nutrition survey covering about 1000 people was made in 4 selected urban slums of Dhaka city, Bangladesh. Each slum had 400 or more households. The study revealed an alarming situation for the urban poor and when compared with the situation of the rural poor as had been determined in 1981-82, the latter were found to have better status. Intake of almost all foods and nutrients was lower among the slum dwellers when compared to those of the rural poor. Consumption of cereals, fish, milk and milk products was very low. Among nutrients, the foremost deficiency was that of energy in which 88% of the slum households did not meet their requirement. In slum areas 80% of families had protein intakes below estimated requirements while in poor rural households the proportion was only 59%. Among micro-nutrients the severest deficiencies were in respect of riboflavin and vitamin A. The prevalence of malnutrition was generally higher among the children of slum dwellers than it was among the children of rural poor. Alternative strategies to improve food availability are suggested to minimize the severe consequences of malnutrition.

27. Hassan, N., Huda, N. and Ahmad, K. 1985.
Seasonal patterns of food intake in rural Bangladesh: its impact on nutritional status.
Ecol. Food Nutr. **17**: 175.

The findings suggested at two rural villages, with a population of 600, in Bangladesh, that there was considerable seasonal variation in intakes of foods and of nutrients and in the incidence of malnutrition, with season. Intakes were lowest in late October to early November, and in May and June, the periods preceding the two main rice harvests. Alternative strategies of food production are required.

28. Helen Keller International 1989.
Attitudes and practices related to increasing consumption of vitamin A rich foods and vitamin A supplements in Comilla district - formative research findings.
Dhaka; Helen Keller International.

29. Hossain, Z. and Choudhury, A.F.H. (undated).
Folk dietary practices and ethnophysiology of pregnant women in rural Bangladesh.
Michigan; Office of Women in International Development. Working Paper.

It is widely assumed that the improvement of nutrition is determined by economic factors alone. Yet such a perspective fails to explain why pregnant women in Bangladesh, regardless of their socioeconomic status, consume less food. In view of the inadequacy of economic models, a culture analysis is undertaken of the dietary beliefs and behaviours of pregnant women of rural Bangladesh. The notion of humeral disposition has been found to be practiced in dietary and health values among rural women. The common referent of the humeral properties lies in the cognition of a 'hot' and 'cold' dichotomy in relation to the properties of food and body-state. The transition from puberty to pregnancy signifies changes from a relative 'cold' body condition to a 'hot' state. Pregnant women are viewed as particularly susceptible to variation in hot/cold disposition in body-state. In order to neutralize the undesirable heat and to attain equilibrium, women prefer diets containing elements of coolness. Health is believed to depend upon the careful maintenance of this balance in food habits. The practices originating from this belief system are the delimiting factors of rural women's dietary habits and, therefore, should be reckoned with in any effort of directed nutrition change in Bangladesh.

30. Hussain, M.A. 1985.
Seasonal variation and nutrition in developing countries.
Food Nutr. (Roma). **11**: 23-27.

31. Hussain, M. 1989.
Role of cereals, vegetables and fruits in Bangladesh diet.
Bangladesh J. Nutr. **2**: 33-39.

32. Hussain, S., Quddus, M.A., Choudhury, M.A., Karim, M.R. and Biswas, T.K. 1989.
Survey on consumption, health and nutrition in two villages of Comilla.
Comilla, Bangladesh; Bangladesh Academy for Rural Development.

33. Islam, M.S., Shahid, N.S. and Haque, M.E. 1985.
Beliefs and practices related to food preferences and food avoidances after childbirth in Matlab, Bangladesh.
In Proceedings of the Second National Seminar of the Bangladesh Population Association, Dhaka, 22-24 Aug 1984.
Dhaka; Bangladesh Population Association: 240-246.

34. Mahmud, S. 1987.
Gender aspects of nutrition and mortality among children in rural Bangladesh.
Dhaka; Bangladesh Institute of Development Studies. Research Report No. **63**.

Since hunger and poverty prevail among large sections of the population, nutrition is a primary concern in Bangladesh, with two-thirds of rural households deficient in calorie intake. It is being increasingly recognised that in many poor societies, biases in attitude and behaviour within the family, favouring sons over daughters, could be a major factor in explaining nutritional and mortality differentials among particular age-sex groups of the population. This paper investigates this premise by drawing on evidence from studies of dietary intakes and nutritional levels in rural Bangladesh. It identifies links between nutrition and anthropometric measurements and presents evidence of nutritional and mortality differentials. Hypotheses about factors which affect child nutrition and mortality are postulated. It concludes that the pattern of higher female mortality among children is the result of strong emotional and economic incentives for parents to act preferentially towards sons.

35. Mahmud, W. 1985.
Age-sex aspects of the food and nutrition problem in rural Bangladesh.
Brighton, UK; Institute of Development Studies.

It is recognized that in many poor societies the biases in the distribution of food within the family can constitute a major factor in explaining nutritional deficiencies among particular age-sex groups, such as women and children. This issue is discussed in the light of evidence from rural Bangladesh. Data for the paper were collected from two nationwide surveys carried out by the Institute of Nutrition and Food Science of the University of Dhaka during 1975/76 and 1981/82, and from a survey conducted during 1978/79 by the International Centre for Diarrhoeal Disease Research, Bangladesh. The paper is in three sections, dealing with intra-family food distribution; malnutrition and mortality in rural Bangladesh including

an analysis of the link between seasonality and nutritional status; and factors affecting maternal and child malnutrition. The main findings of the study include a suggestion that family food allocation is biased against children in general and young girls in particular. Pregnant and lactating mothers emerge as a clearly disadvantaged group. Moreover, these biases are found to persist throughout the income scale from the poorest to the richest households. Marked seasonal fluctuations in nutritional status are indicated, particularly among mothers and children. The importance of the economic and social roles of women relative to men, women's access to education and employment, and the prevailing high fertility norms in relation to nutritional status are examined.

36. Mahmud, W. 1985.
Age-sex aspects of the food and nutrition problem in rural Bangladesh.
Dhaka; Bangladesh Institute of Development Studies.

37. Mahmud, W. and Mahmud, S. 1985.
Age-sex aspects of the food and nutritional situation in rural Bangladesh.
International Labour Office, World Employment Programme, Research Working Paper. **10-6/WP74**.

38. Mowlah, G. and Malek, M.A. 1988.
Millet production environment and its importance as a sources of food and nutrition.
Bangladesh J. Nutr. **2**: 41-45.

39. Pitt, M.M. 1985.
Health and nutrient consumption across and within farm households.
Rev. Econ. Statis. **May**: 212-223.

40. Pryer, J. 1990.
Socio-economic and environmental aspects of undernutrition and ill-health in an urban slum in Bangladesh.
London; PhD thesis, University of London.

41. Quddus, M.A. and Ara, S. 1991.
Nutrition in rural communities with seasonal variations.
Comilla, Bangladesh; Bangladesh Academy for Rural Development.

42. Rahman, M.M., Mahalanabis, D., Islam, M.A. and Biswas, E. 1993.
Can infants and young children eat enough green leafy vegetables from a single traditional meal to meet their daily vitamin A requirements?
Eur. J. Clin. Nutr. **47**: 68-72.

To evaluate the feasibility of providing adequate vitamin A precursors to meet the daily need from a meal of traditionally cooked green leafy vegetables and boiled rice and to understand mothers' perceptions and acceptance of leafy vegetables for infants and young children, 118 children aged 6 months to 3 years and their mothers were studied. The mothers were interviewed regarding their acceptance and perceptions about giving leafy vegetables to their young children. Their children were served a measured amount of rice and cooked leafy vegetables and mothers were asked to feed the child within about half an hour. Median intakes of leafy vegetables in children aged 6-11 months, 12-17 months and 18-35 months were 41 g, 71g and 129 g respectively (in terms of raw green leaf). Approximately 40 g green leaf provides the recommended daily allowance for vitamin A precursors. 77% of the under-1-year-old children were breast-fed. The breast-fed children had a lower intake of vegetables than the completely weaned children. 87% of the children were found to like vegetables, 89% of the mothers liked to give vegetables to their children and 74% of the mothers answered that vegetables were good for health. Only two mothers (1.5%) refused to feed their children the leafy vegetables. The results show that leafy vegetables are acceptable to most of the mothers, and that children can eat enough leafy vegetables to meet a day's need of vitamin A precursors. Feasibility of feeding children enough green leafy vegetables at home on a regular basis needs further study.

43. Roy, S.K. and Haider, R. 1988.
Is nutritional status deteriorating in Bangladesh?
Health Pol. Plann. **3**: 325-328.

44. Sarwar, H. 1991.
Nutritional situation in rice and rice-vegetable growing villages in Comilla.
Comilla; Bangladesh Academy for Rural Development.

45. Shahabuddin, Q. 1989.
Pattern of food consumption in Bangladesh: an analysis of household expenditure survey data.
Bangladesh Dev. Stud. **17**: 101-107.

46. Shaheen, N., Ahmed, F., Barua, S. and Bhuyan, M.A.H. 1989-1990.
Studies on the dietary pattern of urban school children in Dhaka.
Bangladesh J. Nutr. **3**.

47. Sultana, S, Nahar, B. and Quazi, S. 1990.
Dietary intake of micronutrients in normal state and during pregnancy.
Bangladesh J. Nutr. **4**.

48. Tahukder, R.K. 1989.
Food supply, distribution, consumption and nutritional status in Bangladesh.
Bangladesh J. Agr. Econ. **12**: 1-26.

49. Talukder, M.Q-K., Kabir, A.R.M.L. and Kawser, C.A. 1988.
Feeding patterns, sociodynamics, clinical spectrum and recovery of severely malnourished children.
Bangladesh J. Child Health. **12**: 1-21.

50. Zeitlin, M.F., Megawangi, R., Kramer, E.M. and Armstrong, H.C. 1992.
Mothers' and children's intakes of vitamin A in rural Bangladesh.
Am. J. Clin. Nutr. **56**: 136-147.

The vitamin A intake of 370 mothers and 183 children 3-27 months of age in rural Bangladesh was ascertained monthly from January to July in 1986. For mothers, dark green leafy vegetables and fruits were the main sources of vitamin A. Vitamin A from vegetables, the single most important source, did not show consistent associations with wealth or with the other socioeconomic indicators. In May and June, fruits provided wealthier (and more educated) mothers with significantly higher vitamin A intakes than poor mothers, whereas in January the poorer mothers had higher intakes. When breast milk was included, average intakes for children came close to 100% of the recommended dietary allowance; the only

other significant source of vitamin A for children was seasonally available mangoes. Fourteen children who had stopped breast-feeding by the end of the study were at very high risk of vitamin A deficiency when fruits were not plentiful.

2.4 Methodological Studies on the Measurement of Dietary Intake in Bangladesh

1. Abdullah, M. and Ahmed, L. 1988.
   Testing IVACG guidelines for measuring vitamin A and carotene rich food intake of pre-school children in Bangladesh.
   Dhaka; Institute of Nutrition and Food Science, University of Dhaka.

2. Abdullah, M. and Ahmed, L. 1993.
   Validating a simplified approach to the dietary assessment of vitamin A intake in preschool children.
   Eur J. Clin. Nutr. **47**: 115-122.

The International Vitamin A Consultative Group (IVACG) developed guidelines for a simplified dietary assessment to identify groups at risk to an inadequate intake of vitamin A. This study was conducted in Bangladesh to validate this simplified approach. The individual food intakes of 121 children, aged 2-5 years, were measured in a two-round weighted household dietary survey for three consecutive days in 112 households in two ecologically different locations. On each next day following the day of weighed dietary survey the simplified questionnaire designed to estimate the preschool child's intake of food sources of vitamin A was administered. The intake of food sources of vitamin A obtained by the two methods was converted both into equivalent units and into consumption index (CI) scores for comparison. There was a very strong agreement between the CI scores obtained by the two methods. Although matched paired tests showed some difference between the mean CIs obtained by the two methods, as far as the identification of children at high risk is concerned (which is the objective of the simplified assessment) there was no marked difference between the two methods. The study revealed that the simplified method can fairly predict the vitamin A intake of preschool children and thus can be regarded as a useful tool for identifying groups at risk to inadequate intake of vitamin A. Large seasonal variations in the habitual intake pattern of vitamin A confirm the necessity of obtaining

information on the usual consumption patterns of seasonally available food sources of vitamin A, in addition to the 24 hour intake estimates.

3. Torres, A., Willett, W., Orav, J., Chen, L. and Huq, E. 1990.
Variabiiity of total energy and protein intake in rural Bangladesh: implications for epidemiological studies of diet in developing countries.
Food Nutr. Bull. **12**: 220-228.

2.5 Food Composition Studies

1. Banu, C.P., Nahar, B., Begum, M. and Ahmad, K. 1985.
Studies on the protein, riboflavin and iron content of some fresh water fish and prawns of Bangladesh.
Bangladesh j. zool. **13**: 25-28.

2. Banu, C.P., Sayeed, S. and Quazi, S. 1991.
Mineral content of fresh water fish and meat.
Bangladesh j. zool. **19**: 59-63.

3. Darnton-Hill, I., Hassan, N., Karim, R. and Duthie, M.R. 1988.
Tables of nutrient composition of Bangladesh foods.
Dhaka; Helen Keller International.

4. Fazl-i-Rubbi, S., Muslemuddin, M., Latifa, G.A. and Bhowmik, C. 1985.
Studies on the seasonal variation of some macro- and micro-nutrient contents of Kachki fish, corica soborna (Hamilton).
Dhaka Univ. Stud. **33**: 1-5.

5. Faruque, A.J.M.O. 1988.
Lipids in some common leafy vegetables of Bangladesh.
Bangladesh J. Scientific Ind. Res. **23**: 132-141.

6. Gomes, B., Jahan, S.S. and Muslemuddin, M. 1989.
Cholesterol contents in various muscles and organs of Hilsha T. Illisha fish.
Dhaka Univ. Stud. [Pt E]. **4**: 47-53.

7. Huq, M.S., Jahan, S.S., Dawlatana, M., Muslemuddin, M. and Rubbi, S.F. 1989.
Studies on fat-soluble vitamins of shark (Carcharhinus melanopterus) and Hilsha (Hilsha T. illisha) oils.
Bangladesh J. Sci. Res. **7**: 91-97.

8. Latifa, G.A., Chowdhury, M.Q., Khan, M.R., Chakdar, S.K. and Chowdhury, A.K.A. 1985.
Fat, protein, vitamin A, iron, calcium and magnesium contents of juvenile and adult Tilapia nilotica.
Bangladesh J. Physiol Pharmocol. **1**: 17-19.

9. Molla, A.M., Rab, M.A., Jalil, A., Nasreen, F. and Mahal, S.F. 1989.
Maximum limits of radioactivity in foodstuffs in Bangladesh.
Nuc. Sci. Appl. **1**: 74-99.

10. Muslemuddin, M., Begum, M., Ahmed, A.T.A. and Mohsin, M. 1991.
A study on the major mineral contents of Cirrhinus mrigala (Ham.).
J. Asiat. Soc. Bangladesh Sci. **17**: 107-110.

11. Quazi, S., Chowdhury, I.H., Mohiduzzaman, M. and Nahar, B. 1989.
Vitamin A and carotene contents of fish and meat.
Bangladesh J. Nutr. **1**: 27-28.

12. Quazi, S., Nahar, B., Hossain, A. and Mohiduzzaman, M. 1989.
Total lipid and cholesterol in fish.
Bangladesh J. Nutr. **2**: 39-40.

13. Quazi, S., Hossain, A., Mohiduzzaman, M., Nahar, B. and Malek, M.A. 1989-90.
A comparative study on the fatty acid composition of sweet-water fishes, meats, fats and oils.
Bangladesh J. Nutr. **3(1&2)**.

14. Rahman, M.M., Wahed, M.A. and Ali, M.A. 1990.
Beta-carotene losses during different methods of cooking green leafy vegetables in Bangladesh.
J. Food Comp. Anal. **3**: 47-53.

15. Rahman, S.M.M., Mosihuzzaman, M. and Westerlund, E. 1991.
Free sugars and dietary fibre in some fruits of Bangladesh.
Food Chem. **42**: 19-28.

16. Regnault-Roger, C. 1989.
Nutritional and ecological value of *Lathyrus* (Papilionaceae) and its perspectives in the control of malnutrition. (Interet nutritionnel et ecologique du Lathyrus (Papilionacees), ses perspectives dans la lutte contre la malnutrition).
In Lemonnier, D. and Ingenbleek, Y. (eds.) Journees Scientifiques Internationales du GERM, Nianing (Senegal) 4-9 october 1987. Paris, France; Karthala et ACCT: 580-585.

Species of *Lathyrus* of nutritional value are discussed. In samples of mature seed of L. sativus from Bangladesh, Ethiopia, Tunisia and France mean crude protein was 30%, starch 28%, fibre 22%, minerals 3 and moisture 10%. Lipids were 1% to 8% depending on variety. Seeds were deficient in sulphurous amino acids. Chemical score was 32, biological value 58, coefficient of protein efficiency 1.58 and coefficient of protein utilization 59. The different samples, considered separately, did not differ significantly in chemical composition although there were differences in the main nutrients in seeds from different countries.

17. Rubbi, S.F., Begum, M., Begum, F. and Faruque, A.J.M.O. 1987.
Loss of vitamin A in storage and cooking.
In Proceedings of the National Planning Meeting for Vitamin A Programme.

18. Rubbi, S.F., Jahan, S.S. and Begum, M. 1987.
Studies on the composition and spoilage pattern of seven varieties of marine fish.
Bangladesh J. Agr. Sci. 14: 59-65.

19. Rubbi, S.F., Rahman, M.M., Khan, A.R., Jahan, S.S. and Begum, M. 1987.
Proximate composition and quality of some commercial species of fresh water fish.
Bangladesh J. Sci. Res. **5**: 1-20.

20. Sharif, A.K., Mustafa, A.I., Mirza, A.H. and Safiullah, S. 1991.
Trace metals in tropical marine fish from the Bay of Bengal.
Sci. Total Environ. **107**: 135-142.

21. Simmer, K., Ahmed, S., Carlsson, L. and Thompson, R.P. 1990.
Breast milk zinc and copper concentrations in Bangladesh.
Br. J. Nutr. **63**: 91-96.

Breast-fed infants in Bangladeshi villages were weighed at 1, 2, 6, 9 and 12 months. The concentrations of zinc (Zn) and copper (Cu) in the breast milk were measured and the daily intake of these elements calculated. Breast milk Zn concentration decreased over the year but was comparable with that found in developed countries. The calculated daily intake decreased from 17.7 to 8.0 μmol (10-30% of recommended dietary allowances (RDA); National Academy of Sciences, 1980). Breast milk Cu concentration also fell over the year and was lower than that reported from developed countries. Calculated daily Cu intake was 1.95-2.63 μmol (RDA 7.81-15.63 μmol). Deficiencies of trace elements may therefore be a problem in poorly nourished communities where breast feeding is continued for several years with only small amounts of additional food. Breast milk may not be adequate as the only source of infant nutrition after the first few months of life in Bangladesh.

22. Sultana, Q., Rahim, K.A., Ahmed, A.T.A. and Rahman, M. 1992.
Effect of helminth infestation and seasonal variation on the nutritional quality of Clarius batrachus (Linn).
Dhaka Univ. Stud. [Pt E]. **7**: 1-5.

2.6 Weaning and Breast Feeding Practices and their Effect on Child Growth and Nutritional Status

1. Ahamed, M.M. 1986.
Breast-feeding in Bangladesh.
J. Biosoc. Sci. **18**: 425-434.

2. Ahamed, M.M. 1988.
Breast-feeding patterns in Bangladesh.
J. Fam. Welf. **34**: 36-44.

3. Ahmed, S. 1988.
Breast feeding, weaning and infant growth in rural Chandpur, Bangladesh.
London; thesis, University of London.

A one year prospective study on feeding, morbidity and growth of a cohort of 145 newborns was undertaken by fortnightly home-visits in 7 villages in Bangladesh. All the children except one were breast-fed at birth. At one month of age 85% were exclusively breast-fed, at six months 30% and at nine months 13%. The mean age of introduction of supplementary food was four and a half months, for both sexes. There was no significant difference in the weight and weight gain of children weaned before or after three months of age. No significant difference could be found when the cut-off point for introduction of supplementary food was six months. The energy content of the weaning foods was low. The frequency and duration of suckling at the breast was also low, and at six months of age infants sucked only five times during the day. At one month, the weight-for-age of 13% of the children was below two Standard deviations of the NCHS median. By 12 months, 85% were below two Standard deviations. The mothers' nutritional status was poor and was associated with inadequate growth of their infants. There was an average of four episodes each of diarrhoea and respiratory infections per child per year. The percentage of time ill with diarrhoea was associated with poor weight gain of children. Socioeconomic status of the families did not correlate with better growth but maternal literacy was associated. The study raises an important question: what should the balance of health education be between supplementation and lactation? This study suggests more emphasis be placed on the education of the mothers to increase their supply of breast milk and perhaps less on supplementary foods unless their energy concentrations can be increased. Long-term interventions for better nutrition of the growing girl and increased female literacy are essential investments in infant health.

4. Alam, M.S. 1992.
Determinants of breast-feeding and post-partum amenorrhoea in an urban setting in Bangladesh: a case study.
Chittagong; MSc thesis, Chittagong University.

5. Anonymous. 1984.
Practice and attitude towards breast-feeding in Bangladesh: a survey report.
In Touch. **8**:7.

6. Briend, A. 1989
Breast feeding and child survival in a rural area of Bangladesh.
Allaitement au sein et survie de l'enfant en milieu rural au Bangladesh.
In Lemonnier, D. and Ingenbleek, Y. (eds.) Journees Scientifiques Internationales du GERM, Nianing (Senegal) 4-9 October 1987. Paris, France; Karthala et ACCT: 523-529.

Breast feeding incidence and arm circumference were estimated monthly during six months of 1985 to 1986 in about 4600 infants, 12 to 36 months old in the Matlab region of Bangladesh. In infants 18 to 36 months old mortality in infants not breast fed was about twice that in breast-fed infants. Mortality attributable to weaning in this group was 34.4%. Mean arm circumference was similar in breast-fed and weaned infants. The number of infants with arm circumference less than 110 mm was 4.9% and 7.7% in the two groups, respectively, indicating that breast-fed infants were slightly better nourished than weaned infants. The relationship between weaning and mortality risk is evident only in infants with an arm circumference less than 110 mm.

7. Briend, A. and Bari, A. 1989.
Breast Feeding improves survival, but not nutritional status, of 12-35 months old children in rural Bangladesh.
Eur. J. Clin. Nutr. **43**: 603-608.

The association between breast feeding, nutritional status and survival was investigated in a cohort of 1087 children aged 12-35 months from rural Bangladesh followed monthly during two years. Mean weight-for-age (%NCHS) of breastfed children was 69.6% (s.d.: 9.3%) compared to 70.6% (s.d.: 10.7% (P less than 0.001) for non-breast fed children. This confirms that after one year of age, breastfed children tend to be more malnourished than non-breastfed children. Despite this difference in nutritional status, risk of dying, after adjusting for age, was six times higher in non-breastfed malnourished children than in similarly malnourished breastfed children. This suggests that breast feeding beyond one year should be encouraged in communities with a high prevalence of malnutrition, despite the frequently observed association between prolonged breast feeding and malnutrition.

8. Briend, A., Wojtyniak, B. and Rowland, M.G. 1988.
Breast feeding, nutritional state, and child survival in rural Bangladesh.
Br. Med. J. (Clin. Res Ed.). **296**: 879-882.

The effect of breast feeding on nutritional state, morbidity, and child survival was examined prospectively in a community in rural Bangladesh. Every month for six months health workers inquired about breast feeding and illness and measured arm circumference in an average of 4612 children aged 12-36 months. Data from children who died within one month of a visit were compared with those from children who survived. Roughly one third of the deaths in the age, range 18-36 months were attributable to absence of breast feeding. Within this age range protection conferred by breast feeding was independent of age but was evident only in severely malnourished children. In communities with a high prevalence of malnutrition breast, feeding may substantially enhance child survival up to three years of age.

9. Brown, K.H., Robertson, A.D. and Akhtar, N.A. 1986.
Lactational capacity of marginally nourished mothers: infants' milk nutrient consumption and patterns of growth.
Paediatrics. **78**: 920-927.

The consumption of human milk by 58 Bangladeshi infants of marginally nourished mothers was measured during longitudinal studies. Daily milk consumption, as estimated by test weighing, and intakes of energy and protein, as calculated from the measured concentrations of macronutrients in the milk, were related to infant body weight, to internationally recommended intakes of these nutrients, and to the infants' patterns of physical growth. Each of the milk variables, when related to infant body weight, declined significantly with increasing (log) infant age (P less than .001). The average consumption of energy and protein was less than current recommendations at all ages. Nevertheless, the average growth of the Bangladeshi infants approximated the fifth centile of the US National Centre for Health Statistics during the first 4 months of life. By the fourth month, however, the weight increments of more than half the infants (79%) were less than the reference data. The intakes of energy and protein by individual infants less than 90 days of age were related to their patterns of growth. There were significant positive relationships between the change in Z score weight-for-age and weight-for-length and the consumption of breast milk energy (kcal per kilogram of body weight per day) and protein (grams per kilogram per day). Consumptions of 86.5 kcal/kg/day and protein 1.48 g/kg/day were associated with a non changing Z score weight-for-age. Thus, intake of these amounts of nutrients permitted

weight gain comparable to the reference population but did not permit recovery from the existing relative weight deficits.

10. Choudhury, A.F.H. 1989.
Bio-physiologic interactions among nutritional state, breast feeding, maternal fecundity and childhood survival in developing countries: perspectives of epidemiological transition in rural Bangladesh.
Asian Profile. **17**: 437-454.

The population of Bangladesh reflects an extension of the pre-modern pattern of health with a shorter than average life expectancy (around 50 years) and an unusually high childhood death rate. This paper seeks to discern an interactive process between maternal dietary habits, child-feeding and reproductive behaviour on the one hand and infant mortality on the other. It is revealed that women in rural Bangladesh tend to consume less food with the onset of pregnancy; a phenomenon not explicable in purely economic terms, but rather because of a preference for small babies, minimization of physical discomfort in the womb and association of humoural properties and bodily state. This may presage an epidemic incidence of low weight babies with high mortality. Subsequent attention is given to the extent of breast feeding in rural communities and the factors that are responsible for a shift in the mode of infant feeding, female fecundity as affected by reduced or terminated breast feeding, and child survival as affected by the changed mode of infant feeding. Prolonged breast feeding demonstrably depresses fertility performance. A more holistic and multi-level orientation is called for in mother-and-child studies. The following tentative conclusions are reached: in order for small children to survive, the decisive factors are the ability of mothers to lengthen birth interval, feed properly with breastmilk, limit exposure to infection and immunize, and comply with fertility regulations to control parity. Rural women in their pregnancy and lactation stage should consume adequate nutritious food to maintain their own reproductive health as well as to have normal babies at birth.

11. Clemens, J.D., Stanton, B., Stoll, B., Shahid, N.S. and Chowdhury, A.K. 1986.
Breast feeding as a determinant of severity in shigellosis. Evidence for protection throughout the first three years of life in Bangladeshi children.
Am. J. Epidemiol. **123**: 710-720.

12. Clemens, J.D., Harris, J.R., Sack, D.A., Huda, M.N., Chowdhury, S., Ali, M. and Rao, M.R. 1988.
Discontinuation of breast feeding during episodes of diarrhoea in rural Bangladeshi children.
Trans. R. Trop. Med. Hyg. **82**: 779-783.

13. Clemens, J.D., Sack, D.A., Harris, J.R., Khan, M.R., Chakraborty, S., Chowdhury, S., Rao, M.R., van Loon, F.P., Stanton, B.F. and Yunus, M. 1990.
Breast feeding and the risk of severe cholera in rural Bangladeshi children.
Am. J. Epidemiol. **131**: 400-411.

14. Das, D.K., Talukder, M.Q. and Sella, G.E. 1992
Infant feeding practices in rural Bangladesh.
Indian J. Pediatr. **59**: 573-577.

A longitudinal study was done on the infant feeding practices in a rural area. One hundred and ten infants were followed up from birth to one year of age by alternate day home visits, to inquire about the type of food, and frequency of consuming it. It was found that 100% mothers breast-fed their infants from birth to one year, almost every day. Bottles containing various kinds of milk and starchy food were added to 60% of infants diets by three months, and 80% by five months of age. This additional food was given mostly in diluted form, which was more so in case of tinned milk. Family food such as rice and vegetables were given in 30% and 40% child days respectively from six months to one year. Rural people withhold protein food and fruits during infancy. It is concluded, that infant feeding practices in our population are improper and mothers should, therefore, be trained and motivated on weaning practices for timely and adequate supplementation to ameliorate the presently observed dietary deficiency and early malnutrition in rural Bangladesh.

15. Dualeh, K.A. and Henry, F.J. 1989
Breast milk - the life saver: observation from recent studies.
Food Nutr. Bull. **11**: 43-46.

16. Ford, K. and Huffman, S. 1988.
Nutrition, infant feeding and post-partum amenorrhoea in rural Bangladesh.
J. Biosoc. Sci. **20**: 461-469.

17. Glass, R.I. and Stoll, B.J. 1989.
The protective effect of human milk against diarrhoea. A review of studies from Bangladesh.
Acta. Paediatrica Scandinavica. **Supplement 351**: 131-136.

Field studies, made in Bangladesh, with laboratory work performed there and in Goteborg, Sweden, Bethesda, Maryland and in Atlanta, Georgia, that have been aimed at identifying the specific enteric infections most likely to be influenced by breast feeding, are discussed.

18. Glass, R.I., Stoll, B.J., Wyatt, R.G., Hoshino, Y., Banu, H. and Kapikian, A.Z. 1986.
Observations questioning a protective role for breast-feeding in severe rotavirus diarrhoea.
Acta. Paediatrica Scandinavica. **75**: 713-718.

19. Haque, M., Haq, J.A., Rahman, E., Bhuiyan, S. and Azad, A.K. 1989.
Infant feeding practices, relevant events and postpartum amenorrhoea in rural Bangladesh: a community study.
Bangladesh J. Child Health. **11**: 108-113.

20. Hossain, S., Chowdhury, A.G., Sarkar, A., Akhter, K., Begum, S. and Ahmad, M. 1989.
Carbohydrate baby - a comprehensive study.
Bangladesh J. Child Health. **13**: 7-6.

21. Isherwood, R.J., Dimond, C. and Longhurst, S. 1988.
Breast feeding and weaning practices in relation to nutritional status of under-5 children in north Bangladesh.
J. Trop Pediatr. **34**: 28-31.

A survey was made among 200 rural families in north Bangladesh in August 1982 to determine breast feeding and weaning practices, and to relate these to socioeconomic factors and to the nutritional state of children under five years old. Children of landless and near-landless families had a poorer nutritional state than others. Mean age of introduction of solid foods was 13.5 months. Weaning was prolonged and breast feeding usually ceased only when the mother became pregnant again. Use of cows milk as supplementary food was

associated with good nutritional state. Mid-upper arm circumference was a good indicator of low weight-for-height status.

22. Kamal, H. 1991.
The feeding practices of children in Bangladesh: trends and issues.
J. Soc. Dev. **6**: 51-60.

23. Kauser, C.A., Talukder, M.Q-K. 1985.
Longitudinal study of growth in exclusively breastfed infants.
In Workshop on Growth Monitoring in Children.
Dhaka; NNCB: 14-22.

24. Lee, E. 1985.
Asian infant feeding.
Nurs. Mirror. **160**: S14-S15.

25. Mahalanabis, D. 1991.
Breast feeding and vitamin A deficiency among children attending a diarrhoea treatment centre in Bangladesh: a case-control study.
Br. Med. J. **303**: 493-496.

26. Majumder, A.K. 1989.
Breast feeding, birth interval and child mortality in Bangladesh.
Canberra, Australia; Australian National University, Research School of Social Sciences, Department of Demography, International Population Dynamics Program. Research Note on Child Survival. **27CS**.

27. Muttalib, M.A. 1988.
Decline of breast feeding - a socioeconomic catastrophy.
In Touch. **12**: 30-34.

28. Muttalib, M.A., Haq, J.A., Husna, Y., Khan, M.U. and Rahman, M. 1986.
Pattern of feeding in the clinic and home delivered infants in Dacca city during first 4 months of life.
J. Trop Pediatr. **32**: 62-65.

29. Nessay, F. and Rahman, S. 1988
Breast feeding patterns of working women in the Dhaka metropolitan area.
Bangladesh Med. Res. Counc. Bull. **14**: 1-8.

30. Nessay, F., Rahman, S. and Ahmed, A.K.M.A. 1987.
Breast-feeding patterns in Bangladesh and their effect on lactational amenorrhoea.
Bangladesh J. Nutr. **1**: 15-25.

31. Riley, L.W., Waterman, S.H., Faruque, A.S. and Huq, M.I. 1987.
Breast-feeding children in the household as a risk factor for cholera in rural Bangladesh: an hypothesis.
Trop Geogr. Med. **39**: 9-14.

32. Sikder, Z.U. 1990.
Breast feeding Bangladesh.
Private Med. Pract. J. **1**: 97-99.

33. Simmer, K., Ahmed, S., Carlsson, L. and Thompson, R.P. 1990.
Breast milk zinc and copper concentrations in Bangladesh.
Br. J. Nutr. **63**: 91-96.
See Section 2.6, reference 3.

34. Talukder, M.Q-K. and Kawser, C.A. 1986.
Growth pattern of exclusively breast fed infants.
Bangladesh J. Child. Health. **10**: 59-65.

35. Talukder, M.Q-K., Rashid, M.A., Mowla, R. and Yusuf, F.H. 1987.
Moderate to severe anaemia in children from exclusive cows milk based formula.
Bangladesh J. Child Health. **11**: 58-61.

36. United Nations, Department of International Economic and Social Affairs. 1985.
Breast feeding and related aspects of post-partum reproductive behaviour.
New York; United Nations, Department of International Economic and Social Affairs, Population Division 1985. A/P//90.

2.7 Maternal Nutrition and Reproductive Health

1. Ahmed-ul-Ghani, A.K.M. and Chowdhury, M.M.H. 1987.
   Nutrition and fertility.
   Bangladesh J. Nutr. **1**: 81-87.

2. Alam, M.S. 1992.
   Determinants of breast-feeding and post-partum amenorrhoea in an urban setting in Bangladesh: a case study.
   Chittagong; MSc thesis, Chittagong University.

3. Amin, R. and Khan, A.H. 1989.
   Characteristics of traditional midwives and their beliefs and practices in rural Bangladesh.
   Int. J. Gynaecol Obstetr. **28**: 119-125.

4. Bhuiya, A. and Mostafa, G. 1993.
   Levels and differentials in weight, height and body mass index among mothers in a rural area of Bangladesh.
   J. Biosoc. Sci. **25**: 31-38.

This study examined the variation in weight, height and body mass index of 1048 mothers, living in a rural area of Bangladesh, in relation to age, education, number of previous pregnancies, number of dead children, religion, family type, family size, and amount of land owned by the household. Multiple regression analysis revealed a positive relationship of education with all three variables. Moslem mothers were on average in better condition than Hindus. The number of dead children showed a negative relationship with height, weight and body mass index.

5. Bhuyan, M.A.H., Chowdhury, M.M.H. and Malek, M.A. 1988.
   Dietary practices and food taboos among mothers during pregnancy and after delivery in two selected rural locations of Bangladesh.
   Bangladesh J. Nutr. **1**: 105-110.

6. Brown, K. H., Akhtar, N. A., Robertson, A. D. and Ahmed, M. G. 1986. Lactational capacity of marginally nourished mothers: relationships between maternal nutritional status and quantity and proximate composition of milk. Paediatrics. **78**: 909-919.

Longitudinal studies of the nutritional state of 60 lactating Bangladeshi mothers from an underprivileged, periurban community and of the quantity and composition of their milk were made, to investigate relationship between maternal nutritional state and lactational capacity. Daily milk production was estimated by 24 hour test-weighing; the nitrogen, fat, lactose and total energy concentrations of extracted milk samples were analysed at various stages of lactation to estimate total milk nutrient production. Although the mothers were poorly nourished compared with international reference populations, their lactational capacity was not severely impaired. Average milk production reached a peak at 750 g daily when the infants were between five and seven months old. Nitrozen (N) and fat concentrations declined with (log) infant age; lactose concentration increased with (log) infant age. Average concentrations of milk nutrients when the infants were three months old were: N 0.161, fat 2.804 and lactose 7.92 g/100 ml, energy 61.0 kcal/100 ml. Fat and energy concentrations were significantly greater, and fat and energy amounts tended to be greater, for mothers with larger triceps skinfold thickness or arm circumference. Changes in nutritional state within individual women were also significantly correlated with the amount and composition of their milk: within-woman increases in triceps skinfold thickness were associated with increases in fat and energy concentrations and within-woman increases in body weight were associated with increases in the amounts of milk and all major nutrients. Milk production declined significantly during certain months of the year, just before the major harvest period.

7. Brown, K.H., Robertson, A.D. and Akhtar, N.A. 1986. Lactational capacity of marginally nourished mothers: infants' milk nutrient consumption and patterns of growth. *Paediatrics.* **78**: 920-927.
See Section 2.6, reference 9.

8. Chatterjee, M. and Lambert, J. 1989.
Women and nutrition: reflections from India and Pakistan.
Food Nutr. Bull. **11**: 13-28.

The nutritional state of women in India and Pakistan, with occasional references to Bangladesh, is discussed. The apparent contradiction between women's primary responsibility for household nutrition and their own serious malnutrition is examined.

9. Chaudhury, R.H. 1985.
Determinants of nutrient adequacy for lactating and pregnant mothers in a rural area of Bangladesh.
Food Nutr. Bull. **7**: 26-32.

10. Choudhury, A.F.H. 1989.
Bio-physiologic interactions among nutritional state, breast feeding, maternal fecundity and childhood survival in developing countries: perspectives of epidemiological transition in rural Bangladesh.
Asian Profile. **17**: 437-454.
See Section 2.6, reference 10.

11. Choudhury, A.Y., Banu, L.A., Islam, A.K.M.M., Chowdhury, A.M.R. and Faisel, A.J. 1991.
Pre- and post-natal food habits and preferences and birth practices in rural Bangladesh.
Dhaka; Programme for the Introduction and Adaptation Contraceptive Technology.

12. Chowdhury, A.K.M.A.
Maternal nutrition in rural Bangladesh.
In Jain, D. and Banerjee, N. (eds.) Tyranny of the household. Investigative essays on women's work.
New Delhi, India; Shakti Books: 25-37.

The paper presents the findings of an extensive sample survey which show that the women of Bangladesh have traditionally received little additional nutrition in their continuous cycle of pregnancy-lactation-pregnancy. Women of reproductive age, as a group, are therefore

the worst sufferers from malnutrition, whether as a result of lean season scarcity or of increase in poverty.

13. Chowdhury, A.K.M.A. 1987.
    Changes in maternal nutritional status in a chronically malnourished population in rural Bangladesh.
    Ecol. Food Nutr. **19**: 201-211.

A total of 2446 women of ages 15 to 49 years old from 14 villages in rural Bangladesh, had a mean height of 147.8 cm, mean weight of 40.8 kg plus or minus 4.9 kg (plus or minus the Standard deviation) and mean arm circumference of 21.8 cm. Their mean weight was much lower than the weight-for-height standard and was negatively related to age. About 34% had low haematocrit values and about 10% of women had haematocrit values less than 30% even when not pregnant. There was a seasonal pattern of maternal malnutrition with a lean period from August to October; body weight and haematocrit values decreased during that time. The seasonal pattern of maternal weight and arm circumference was correlated with seasonal availability of food. Maternal malnutrition worsened with increasing number of pregnancies.

14. Ford, K. and Huffman, S. 1988.
    Nutrition, infant feeding and post-partum amenorrhoea in rural Bangladesh.
    J. Biosoc. Sci. **20**: 461-469.

15. Ford, K., Huffman, S.L., Chowdhury, A.K., Becker, S., Allen, H. and Menken, J. 1989.
    Birth-interval dynamics in rural Bangladesh and maternal weight.
    Demography. **26**: 425-437.

This article reports on the results of a study conducted in rural Bangladesh on the influence of maternal weight on the components of birth intervals, including gestation and intrauterine mortality, the duration of postpartum amenorrhea, and the duration of waiting time to conception (the menstrual interval). When biological factors (including maternal age, parity, and supplementation practices) and behavioural variables, including religion, education, and occupation, were controlled, maternal weight was found to be related to the risk of intrauterine mortality and to the probability of resuming menses in the postpartum period.

The implications of these findings for policies and programmes in developing countries are discussed.

16. Harriss, B. 1989.

Differential female mortality and health behaviour in India.

Turin, Italy; Centro Studi Luca d'Agliano; Oxford, UK; Queen Elizabeth House, University of Oxford. Ld'A-QEH Development Studies Working Papers. No.**13**.

The essay combines research and discourse from a number of disciplines in order to clarify evidence for India from papers read at a conference held in Dhaka, Bangladesh, on differential female health care and mortality in South Asia. First, time trends in mortality and morbidity are described. Second, spatial patterns of mortality, morbidity and nutrition are compared and attempts to explain them are reviewed. Third, recent studies of small localities shed light on social and economic factors affecting, and affected by, gender bias. Fourth, gender aspects of health behaviour and access to health facilities are examined. Last the conclusions of this heterogeneous body of work are summarized for a research agenda for gender. Under conditions of mortality decline and an aggregate trend toward convergence of life expectation, disequilibria which are comparatively unusual persist. To detect these disequilibria it is essential to disaggregate vital statistics by region and by age group as well as by sex. Female mortality gains after the reproductive period conceal excess female mortality from the post neonatal period to five years and in most regions of South Asia during the reproductive years as well. These imbalances appear to be most exaggerated on the upper Gangetic plain and among communities such as the Jats and Rajputs. These most marked imbalances do not bear a consistent relationship to economic conditions. They may, however, be declining over time. In certain regions of India, most notably in the peripheral south, discrimination against women is not seen in demographic data and has not been for several decades. Male life expectation is being affected by only slow improvement in excess male mortality from age 35 years.

17. Hort, K.P. 1987.

Seasonal variation of birthweight in Bangladesh.

Ann. Trop Paediatr. **1**: 66-71.

Analysis of birthweights of 1772 singleton babies born alive at Kumudini Hospital in rural Bangladesh over two consecutive years, 1983 and 1984, showed a consistent seasonal variation. The highest birthweights occurred in the period March to May (summer) and the

lowest in the September to November period (autumn). This could not be correlated with differences in maternal age or parity, but was correlated with seasonal availability of food and changes in children's nutritional status as recorded in the hospital under-fives clinic. It is concluded that poor maternal nutrition in the last trimester of pregnancies in mothers delivered in the September to November period is the main factor, and recommendations for health education are made accordingly.

18. Hossain, Z. and Choudhury, A.F.H. (undated).
Folk dietary practices and ethnophysiology of pregnant women in rural Bangladesh.
Michigan; Office of Women in International Development, Working Paper.
See Section 2.3, reference 29.

19. Huffman, S.L. and Krasovec, K. 1986.
Maternal risk assessment in Bangladesh.
In Taylor, T.G. and Jenkins, N.K. (eds.) Proceedings of the 13th International Congress of Nutrition, Brighton 18-23 Aug 1985.
London; John Libbey: 100-103.

20. Huffman, S.L., Wolff, M. and Lowel,l S. 1985.
Nutrition and fertility in Bangladesh: nutritional status of nonpregnant women.
Am. J. Clin. Nutr. Oct. **42**: 725-738.

In October 1975 a longitudinal study of over 2000 married women was initiated in Matlab, Bangladesh, to determine the association of fertility with nutritional status. This paper reports the results on nutritional status among nonpregnant women. The average weight and height of the study women was 40.4 kg and 147. cm. Weight fluctuated throughout the 2 two and a half year study period corresponding to seasonal food shortages. Maternal weight (controlling for height) was consistently lower for older, higher parity women, illustrating the negative impact of increasing numbers of births on the mother's nutrient stores. Older women were also shorter than younger women, due to greater deficits in growth during childhood. Older, higher parity women had slightly lower haematocrits than younger women with an overall mean of 35%. Education level was associated positively with height, weight, and haematocrit. Muslims were taller and heavier than Hindus, reflecting their generally higher socioeconomic status. The seasonal pattern of nutritional status is discussed in relation to the seasonality of food availability, activity patterns, and incidence of infectious disease.

21. Huffman, S.L., Ford, K., Allen, H.A., Jr and Streble, P. 1987.
Nutrition and fertility in Bangladesh: breast feeding and post partum amenorrhoea.
Pop. Stud. **41**: 447-462.

22. Islam, M.S., Shahid, N.S. and Haque, M.E. 1984.
Beliefs and practices related to food preference and food avoidance after childbirth in Matlab, Bangladesh.
In Proceedings of the Second National Seminar of the Bangladesh Population Association, Dhaka 22-24 August 1984.
Dhaka; Bangladesh Population Association: 240-246.

23. Hussain, M.A.
Studies on the nutritional status of expectant mothers and newborn babies.
Dhaka; Institute of Nutrition and Food Science, University of Dhaka (undated).

24. John, A.M., Menken, J.A. and Chowdhury, A.K. 1987.
The effects of breast feeding and nutrition on fecundability in rural Bangladesh: a hazards-model analysis.
Pop. Stud. **41**: 433-446.

25. Karim, A., Chowdhury, A.K. and Kabir, M. 1985.
Nutritional status and age at secondary sterility in rural Bangladesh.
J. Biosoc. Sci. **17**: 497-502.

26. Langsten, R. and Huffman, S. 1985.
Determinants of natural fertility in rural Bangladesh reconsidered. Reply.
Pop. Stud. **39**: 153-161; 163-168.

Research has been done into the connection between natural fertility in developing countries and natural nutrition status; the article cites in particular that of Huffman and her colleague, but argues that their data are contaminated by a strong period effect, namely the 1974/75 famine which affected nutrition, breast-feeding behaviour and length of amenorrhoea in their sample. The article describes the Bangladesh famine, discusses its impact on Huffman's data and shows in what ways her conclusion may be biased. Huffman's original field work is described in Population Studies, 34(1980), 337-347: Lactations and fertility in rural Bangladesh.

27. Majumder, A.K. 1989.
Breast feeding, birth interval and child mortality in Bangladesh.
Canberra, Australia; Australian National University, Research School of Social Sciences, Department of Demography, International Population Dynamics Program. Research Note on Child Survival. **27CS**.

28. Majumder, M.S.I., Mohiduzzaman, M. and Ahmad, K. 1987.
Immunocompetence of marginally nourished women on hormonal contraceptives.
Nutr. Rep. Int. **36**: 1285-1290.

Fifty women aged 20 to 35 years old of lower middle class status attending a fertility clinic in Dhaka, Bangladesh, were studied; 30 received medroxyprogesterone acetate or norethisterone enantate and the rest received no contraceptive aid. The number of total T cells in the women on contraceptives was unaltered compared with control women, but phytohaemagglutinin-induced lymphocyte transformation of the same women was depressed significantly. The results suggest that the injectable contraceptives which contain steroidal agents may impair cell-mediated immune response in marginally nourished women.

29. Mannan, M.A. 1990.
Mother and child health in Bangladesh: evidence from field data.
Dhaka; Bangladesh Institute of Development Studies.

30. Pebley, A.R. and Huffman, S.L. 1985.
Intra-uterine mortality and maternal nutritional status in Bangladesh.
Pop. Stud. **39**: 425-440.

31. Riley, A.P., Huffman, S.L. and Chowdhury, A.K. 1989.
Age at menarche and postmenarcheal growth in rural Bangladeshi females
Ann. Hum. Biol. **16**: 347-359.

This study examines the role of chronological age and time since menarche (TSM) as determinants of postmenarcheal growth in height and weight in a chronically malnourished population of rural Bangladeshi females aged 10-20 years. Height and weight measurements were collected for 12 months from 290 postmenarcheal girls, with known times since menarche, and on 118 girls who reached menarche during the one year follow-up. Two stage regression analysis was employed to study the relationship of age and time since

menarche to postmenarcheal growth in height and weight, while adjusting for socioeconomic status. TSM is a more important determinant of postmenarcheal growth in height and weight than is age. For postmenarcheal growth in weight, the regression coefficient for TSM was six times greater then the coefficient for age. The effect of TSM was twice as strong as the age effect for postmenarcheal growth in height. Age had a statistically significant negative influence on statural growth and weight gain, but its practical effect on weight gain was small. An interaction between TSM and age suggests that TSM did not have the same implications for biological maturity for all ages at menarche. The findings demonstrate that Bangladeshi adolescents are still in active growth in height and weight into their late teens and past 20 years in some girls. This extended growth period may pose increased health risks to young mothers and their offspring.

32. Rowshan, N. and Ahmad, K. (undated).
Effect of maternal nutrition and socio-economic factors on birth weight of babies in Bangladesh.
Dhaka; Institute of Nutrition and Food Science.

33. Shahabuddin, A.K.M. 1987.
Maternal nutrition and foetal growth.
Bangladesh Med. J. **16**: 90-95.

34. Sultana, S., Nahar, B. and Quazi, S. 1990.
Dietary intake of micronutrients in normal state and during pregnancy.
Bangladesh J. Nutr. **4**.

35. Talukder, M.Q-K., Das, D.K. and Kawser, C.A. 1988.
Health and nutrition of mothers and children in Bangladesh.
Bangladesh J. Nutr. **1**: 1-11.a)

36. United Nations. 1985.
Breast feeding and related aspects of post-partum reproductive behavior.
Department of International Economic and Social Affairs.
New York; United Nations, Department of International Economic and Social Affairs, Population Division 1985.

2.8 Clinical and Biochemical Studies of Micronutrient Status and Influencing Factors

1. Ahmed, F., Mohiduzzaman, M., Barua, S., Shaheen, N., Margetts, B.M. and Jackson, A.A. 1992.
   Effect of family size and income on the biochemical indices of urban school children of Bangladesh.
   Eur. J. Clin. Nutr. **46**: 465-473.

2. Ahmed, L., Saha, A.R., Mohiduzzaman, M., Malek, A. and Quazi, S. 1990.
   Changes in body weight, blood pressure and serum lipids in men during fasting.
   Bangladesh J. Sci. Res. **8**: 181-188.

3. Ali, S.M.K. and Hossain, M.M. 1986.
   Nutritional status of patients.
   Bangladesh Med Rev. **12**: 12-23.

4. Ali, S.M.K. and Hossain, M.M. 1988.
   Bedside assessment of nutritional status of patients.
   Bangladesh J. Nutr. **1**: 14-56.

5. Aminullah, A.K.M.B. and Ackman, R.G. 1985.
   Marine lipids and their effects on human plasma lipid.
   In Tenth Annual Bangladesh Science Conference, 22-27 March 1985.
   Dhaka; BAAS. 58 pp.

6. Anon. 1985.
   Bangladesh nutritional blindness study 1982-83: vitamin A dosing.
   Bangladesh J. Child Health. **9**: 87-95.

7. Anon. 1985.
   Bangladesh nutritional blindness study 1982-83: key results.
   Bangladesh J. Child Health. **9**: 252-261.

8. Anon. 1982-83.
   Bangladesh nutritional blindness study 1982-83: nutritional findings.
   Bangladesh J. Child Health. **9**: 262-273.

9. Bhuyan, M.A.H.1988.
Epidemiology of endemic goitre and the role of the community in the control programme.
Bangladesh J. Nutr. **1**: 157-163.

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Status of iron deficiency anaemia in Bangladesh subjects.
Bangladesh Armed Forces Med. J. **10**: 1-7.

11. Chowdhury, A.M.R. and Kabir, Z.N. 1988.
Perception about night blindness in rural Bangladesh.
Dhaka; Bangladesh Rural Advancement Committee (unpublished).

12. Cohen, N. 1985.
Blinding malnutrition in Bangladesh: getting priorities right.
Bangladesh J. Child Health. **9**: 87-95.

13. Cohen, N., Jalil, M.A., Rahman, H., Matin, M.A., Sprague, J., Islam, J., Davison, J., Leemhuis de Regt, E. and Mitra, M. 1985.
Landholding, wealth and risk of blinding malnutrition in rural Bangladeshi households.
Soc. Sci. Med. **21**: 1269-1272.

The 1982-1983 Bangladesh nutritional blindness study visited 11,618 rural households and examined 18,660 preschool-age children in an effort to determine the prevalence and determinants of eye lesions and loss of sight due to vitamin A deficiency (xerophthalmia). Risk of xerophthalmia was significantly higher for children care from households without any of the indicators of relative wealth used. Almost 80% of blind children from landless households, and even a very small garden reduced considerably the chances of a household having a xerophthalmic child. Poorer households with access to less than 0.3 acres land or no garden or without a tin roof, wristwatch, radio or cycle were at least twice as likely as their more fortunate neighbours to have a young child with any type of xerophthalmia. Taking account of such socio-environmental risk factors, weightings would direct the scarce resources of intervention programmes to households and children who most need them.

14. Cohen, N., Rahman, H., Sprague, J., Jalil, M.A., Leemhuis de Regt, E. and Mitra, M. 1985

Prevalence and determinants of nutritional blindness in Bangladeshi children. *World Health Stat. Q.* **38**: 317-330.

15. Cohen, N., Jalil, M.A., Rahman, H., Leemhuis de Regt, E., Sprague, J. and Mitra, M. 1986

Blinding malnutrition in rural Bangladesh. *J. Trop Pediatr.* **32**: 73-78.

16. Helen Keller International. 1985.

Bangladesh nutritional blindness study - 1982-1983. Dhaka; Helen Keller International.

17. Institute of Nutrition and Food Science.

Research on anaemia and micronutrients. Dhaka; Institute of Nutrition and Food Science, Dhaka University (undated).

18. Islam, M.N. and Yusuf, H.K.M. 1991.

Socio-economic correlates of child nightblindness in a coastal area of Bangladesh; a critical analysis. Dhaka; University of Dhaka, Department of Statistics, Statistical Research Unit. SRU Working Paper **3**.

19. Kabir, I., Khanum, S. and Rahman, H. 1987.

Xerophthalmia as seen at an out-patient department of an urban nutrition unit, Dhaka. *Bangladesh J. Child Health.* **11**: 6-12.

20. Khan, A.N.G.A., Rahman, Z.A. and Ali, S.M.K. 1988.

Ocular manifestation of malnutrition. *Bangladesh J. Nutr.* **2**: 46-50.

21. Khan, M.U. 1985.

Nutritional blindness and diarrhoea in Bangladesh [reply]. *Br. J. Nutr.* **54**: 778.

22. Khan, M.U., Haque, E. and Khan, M.R. 1985.
Prevalence and causes of blindness in rural Bangladesh.
Indian J. Med. Res. **82**: 257-262.

23. Mahalanabis, D. 1991.
Breast feeding and vitamin A deficiency among children attending a diarrhoea treatment centre in Bangladesh: a case-control study.
Br. Med. J. **303**: 493-496.

24. Mannan, A. and Rahim, A. [eds] 1988.
Zinc in nutrition.
Dhaka; Bangladesh Agricultural Research Council.

25. Mannan, M.A. 1986.
Dietary iodine deficiency in Bangladesh.
In National Symposium on Agricultural Research, 11-13 Feb.
Dhaka; Bangladesh Agricultural Research Council 1986. 2 pp.

26. Mia; Ahmadullah. 1987.
Baseline study for nutritional blindness prevention project, Rangpur & Dinajpur.
Dhaka; Institute of Social Welfare and Research, Dhaka University.

27. Quazi, S., Mohiduzzaman, M., Halim, A., Chowdhury, M.M.H., Ali, S.M.K., Akhtaruzzaman, M. and Malek, M.A. 1987.
Hyperglycaemia and its association with body mass index among the teachers of University of Dhaka.
Bangladesh J. Nutr. **1**: 34-41.

28. Rahman, M.M. 1989.
Protein energy malnutrition and the growth and development of the brain: a review.
Bangladesh J. Child Health. **13**: 50-55.

29. Rahman, M.T., Nahar, N., Begum, H.A., Rashid, A. and Rahman, M.J. 1989
Pattern of anaemia in malnourished children of Bangladesh.
Hygeia. **3**: 87-89.

30. Sikder, Z.U., Henry, F.J., Hussain, M. and Rahman, M. 1988.
Xerophthalmia malnutrition and diarrhoea in urban Bangladesh: a clinic based study.
Indian Pediatr. **25**: 946-951.

31. Stanton, B.F., Clemens, J.D., Wojtyniak, B. and Khair, T. 1986.
Risk factors for developing mild nutritional blindness in urban Bangladesh.
Am. J. Dis. Child. **140**: 584-588.

Mild vitamin A deficiency may be associated with increased morbidity and mortality among children in developing countries. A community-based case-control study was performed to determine risk factors for mild ophthalmologic manifestations of vitamin A deficiency in urban Bangladeshi children. Cases were identified in children less than 14 years of age with night blindness with or without other signs of mild xerophthalmia detected in a house-to-house survey. Controls were randomly selected neighbours who lacked subjective and objective ophthalmologic evidence of vitamin A deficiency. Demographic characteristics that were independently associated with vitamin A deficiency in a logistic model included male gender, greater age (mean, 6.1 years in children with cases and 2.8 years in controls), and a greater number of children living with the family. After controlling for these demographic characteristics, poor intake of locally available vitamin A-rich foods, cessation of breast-feeding, and a recent history of protracted diarrhoea remained associated with vitamin A deficiency. Maternal ignorance of prevention and control of vitamin A deficiency was also associated with increased risk. The results support programmes that educate mothers to breast-feed and to provide appropriate food supplements and suggest that clinicians caring for children with chronic diarrhoea should initiate vitamin A supplementation.

32. Stoll, B.J., Banu, H., Kabir, I. and Molla, A. 1985.
Nightblindness and vitamin A deficiency in children attending a diarrhoeal disease hospital in Bangladesh.
J. Trop Pediatr. **31**: 36-39.

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Serum minerals in adult males and females.
Dhaka Univ. Stud. **5**: 87-92.

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Moderate to severe anaemia in children from exclusive cows milk based formula feeding.
Bangladesh J. Child Health. **11**: 58-61.

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Blood zinc level in children during acute stage and recovery from kwashiorkor.
Bangladesh J. Child Health. **10**: 126-133.

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Studies on manganese and nickel in hair of malnourished children.
Bangladesh J. Nutr. **1**: 98-104.

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Hair chromium concentration in malnourished and healthy preschool children of rural Bangladesh.
Bangladesh J. Nutr. **2**: 1-7.

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Hypokalaemia in children with diarrhoea in rural Bangladesh.
Indian J. Med. Res. **81**: 169-174.

2.9 National Surveys, Surveillance Programmes and ad hoc Anthropometric Studies to Assess the Prevalence of Protein-energy Malnutrition, Child Growth and Factors Found to Influence Them

1. Ahmed, F, Bhuyan, M.A.H., Shaheen, N., Barua, S., Margetts, B.M. and Jackson, A.A. 1991.
   Effects of socio-demographic conditions on growth of urban school children of Bangladesh.
   Eur. J. Clin. Nutr. **45**: 327-330.

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   Growth performance of Bangladeshi affluent school children (5-14 years).
   Indian J. Pediatr. **58**: 209-215.

3. Bairagi, R. 1986.
   On components of variation of estimated weight velocity of children.
   J. R. Stat. Soc. **35**: 178-182.

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   Food crisis, nutrition and female children in rural Bangladesh.
   Pop. Dev. Review. **12**: 307-315.

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   Soc. Sci. **72**: 48-51.

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   Dhaka; Bangladesh Bureau of Statistics, Ministry of Planning 1987.

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   Report of the child nutritional status survey 1989-90.
   Dhaka; Bangladesh Bureau of Statistics, Ministry of Planning 1991.

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Relations between socio-economic status and morbidity, food intake and growth in young children in two villages in Bangladesh.
Ecol. Food Nutr. **18**: 251-264.

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Socio-economic determinants of child nutritional status: boys versus girls.
Food Nutr. Bull. **8**: 3-7.

Multivariate linear models of the relation between child nutritional state and household socioeconomic characteristics were developed separately for boys and girls using data from a rural area of Bangladesh. Mean weight for age was 69.5% for boys and 68.43% for girls. Possession of more than two acres of land and a tax of more than five taka, mother's education, household size, religion and age were significantly correlated to the boy's nutritional state. In addition, possession of more than two acres of land, high tax payment, education of household head, household size, religion and age were significantly related to the girls' nutritional state.

10. Bhuiya A, Zimicki S and D'Souza S 1986.
Socioeconomic differentials in child nutrition and morbidity in a rural area of Bangladesh.
J. Trop Pediatr. **32**: 17-23.

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Iron in tubewell water and linear growth in rural Bangladesh.
Arch. Dis. Child. **65**: 224-225.

The growth of 694 children from rural Bangladesh was studied. Children drinking water containing greater than 1 mg iron/l (n = 628) were significantly taller than those drinking less than 1 mg iron/l (n = 66): their mean (SD) height for age Z score was -2.10 (1.34) compared with -2.45 (1.24), p less than 0.05. This suggests that iron deficiency may contribute to growth retardation in poor communities.

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Lactational capacity of marginally nourished mothers: infants' milk nutrient consumption and patterns of growth.
Pediatrics. **78**: 920-927.
See Section 2.6, reference 6.

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Growth pattern of the urban elite children and the NNC-growth chart.
Bangladesh J. Nutr. **2**: 5-10.

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Protein-energy-malnutrition in Bangladesh - an analysis of its prevalence, causes and prevention.
Bangladesh J. Nutr. **1**: 7-10.

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The State of the World's Children 1985.
Oxford; Oxford University Press 1985 (published for UNICEF).

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Oxford; Oxford University Press. (published for UNICEF).

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Oxford; Oxford University Press. (published for UNICEF).

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Oxford; Oxford University Press. (published for UNICEF).

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Oxford; Oxford University Press. (published for UNICEF).

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Nutritional status of under-12 children of Bangladesh.
Bangladesh J. Nutr. **1**: 1-6.

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Seasonal patterns of food intake in rural Bangladesh: its impact on nutritional status.
Ecol. Food Nutr. **17**: 175-186.

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Child nutrition statistics, 1985-86 (status of female children).
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Nutritional status of under five children in a rural village in Bangladesh.
Bangladesh J. Child Health. **11**: 121-125.

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Nutritional status of school-going girls in Bangladesh.
Bangladesh J. Child Health. **13**: 29-35.

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Pattern of physical growth of children under five in rural Bangladesh.
Bangladesh J. Child Health. **14**: 12-18.

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Socioeconomic factors affecting the nutritional status of preschool children in a rural village in Bangladesh.
Bangladesh J. Child Health. **14**: 125-131.

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Bangladesh J. Child Health. **9**: 206-208.

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Causes of growth disorder in a referral centre - study of 150 cases.
Bangladesh J. Child Health. **11**: 47-50.

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Factors contributing to protein energy malnutrition in urban Dhaka.
Bangladesh J. Child Health. **9**: 80-89.

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Gender aspects of nutrition and mortality among children in rural Bangladesh.
Dhaka; Bangladesh Institute of Development Studies, Research Report No. **63**.

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Social and economic structure of the Sheik Para bustee and the social and economic determinants of child malnutrition.
Report to Save the Children Fund.

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Socio-economic and environmental aspects of undernutrition and ill-health in an urban slum in Bangladesh.
London; PhD thesis, University of London.

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A survey on malnutrition in Mymensingh Medical College.
Hygeia. **2**: 69-72.

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Yunus, M. and Sarder, A. M. 1990.
Post-flood nutritional anthropometry of children in Matlab, Bangladesh.
Ecol. Food Nutr. **24**: 121-131.

The Matlab area was severely affected by the floods of 1988 in Bangladesh. To assess the impact of flooding in Matlab the International Centre for Diarrhoeal Disease Research, Bangladesh, surveyed 600 households. In addition, length, weight and mid-upper arm circumference were measured in children 6 to 35 months old. Baseline economic status seemed to be higher inside the Matlab embankment, where the average material damage was worse. Anthropometry of children from inside and outside the embankment did not differ for degree of flood damage. There was also no difference in these indicators between October and December, when postharvest improvement would normally occur. Analysis of indicators of household socioeconomic status revealed landlessness and lack of maternal education significantly associated with lower values in child anthropometry. Girls and those 12 to 36 months old also had a lower mean percentage of median anthropometric indices.

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Growth pattern of exclusively breast fed infants.
Bangladesh J. Child Health. **10**: 59-65.

39. Talukder, M.Q-K. and Das, D.K. 1987.
State of Bangladeshi children.
Bangladesh J. Child Health. **11**: 104-107.

40. UNICEF. 1987.
An analysis of the situation of children in Bangladesh.
Dhaka; UNICEF.

41. UNICEF. 1988.

Asian and Pacific atlas of children in national development.
East Asia and Pakistan Regional Office.
Bangkok; United Nations Childrens' Fund, East Asia and Pakistan Regional Office 1987 **(E/ICEF/EAP/87-2)**.

42. UNICEF. 1990.

Annual report.
Dhaka; United Nations Childrens' Fund 1990.

43. West, K. P., Jr. 1986.

Peri-urban malnutrition in Bangladesh: differential energy, protein, and growth status of children.
Ecol. Food Nutr. **19**: 99-112.

A sample of 292 children 12 to 59 months old in 2 large squatter camps near Dhaka, Bangladesh, underwent nutritional assessment during July and August 1979. Anthropometric measurements included weight, height, left mid-upper arm circumference, and skin folds at four sites (triceps, biceps, subscapular and supra-iliac). Upper arm indicators included muscle and fat areas were derived as estimators of body composition. Findings were compared with previous anthropometric survey data from rural Bangladesh and with normative data from the USA. Of camp children 23% were moderately to severely wasted, less than 80% weight for height (WH) and 34% were severely stunted, less than 85% height for age. Wasted children of both sexes were of similar body composition though above 90% WH girls were significantly fatter than boys. Relatively fatter body composition seemed greater than expected for normal sexual dimorphism, but it was not associated with any statural advantage for girls. For both sexes, stature was more strongly associated with musculature than with fatness, a finding which is consistent with numerous other studies in developing countries.

2.10 Methodological Studies on the use of Anthropometry to Assess Nutritional Status, Mortality Risk and Growth Performance in Bangladesh

1. Alam, N., Wojtyniak, B and Rahaman, M.M. 1989.
   Anthropometric indicators and risk of death.
   Am. J. Clin. Nutr. **49**: 884-888.

Six anthropometric indicators based on weight, height, arm circumference (AC), and age were examined to predict mortality risk of children aged 12-59 months in a rural area of Teknaf, Bangladesh. In the period 1981-85, 9861 measurements at six month intervals were made on 2449 children. For all indices, mortality risk was greater in the first three months than in the second three months in severely malnourished children. Mortality discriminating power of the indicators in terms of sensitivity and specificity was highest for AC and AC for age and lowest for weight-for-height. Logistic regression analysis showed that the predictive power of weight, height, age-based indicators improved after adding AC whereas the predictive power of AC did not improve after adding weight-based indicators. The relative risk of death in children with ACs measuring less than or equal to 120 mm was 12 times higher than in those whose ACs measured greater than 140 mm.

2. Bairagi, R. 1985.
   Why the mortality discriminating power of anthropometric indicators differs among populations [letter]
   J. Trop Pediatr. **31**: 63-64.

3. Bairagi, R. 1987.
   A comparison of five anthropometric indices for identifying factors of malnutrition.
   Am. J. Epidemiol. **126**: 258-267.

Five anthropometric indices were compared for identifying factors of nutritional status of children: weight-for-age; height-for-age; weight-for-height; weight velocity; and height velocity. Data come from Matlab, the field station of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). Weights and heights on approximately 1,400 children aged 12-60 months were taken 11 times at two-month intervals. Dwelling floor space, a proxy for socioeconomic status, is considered a long-term factor; the 1974-1975 Bangladesh famine, a medium-term factor; and season, a short-term factor of nutritional status. The figures of the indices by socioeconomic status at different times show their

power to identify the factors visually; the regression analyses test statistical significance of the factors; and the standardized regression coefficients provide relative power of the indices to identify the factors. Weight-for-age and height-for-age appear best for identifying long-and medium-term factors; weight velocity, for identifying short-term factors. Weight-for-height is third in identifying long- and medium-term factors, second for identifying short-term factors. Height velocity identifies short-term factors only. The effect of short-term factors on height velocity appears approximately four months later than it appears on weight velocity. This study clarifies why certain indices do not predict mortality in this study population and others.

4. Bairagi, R., Chowdhury, M.K., Kim, Y.J. and Curlin, G.T. 1985.
Alternative anthropometric indicators of mortality.
Am. J. Clin. Nutr. **42**: 296-306.

The ability of anthropometric indicators, weight-for-age, height-for-age, weight-for-height, weight velocity, and height velocity to discriminate mortality during a one-year period is examined for three time frames beginning in different seasons. Data on approximately 1,000 children of one to four years of age come from the Matlab, International Centre for Diarrhoeal Disease Research, Bangladesh. The indicators' mortality-discriminating power is assessed in terms of the magnitude of difference between the mean indicator values of living and dead children expressed in standard deviation units and of the maximum sum of sensitivity and specificity. The indicators' mortality curve by nutritional status shows the discriminating power visually; the t test indicates its statistical significance. Weight-for-age and height-for-age perform better than weight velocity and height velocity as discriminators of mortality during a one-year period. The ability of weight and height velocity to discriminate short-term mortality is examined by comparing the mean velocity of the last two bimonthly intervals of the dead children. Weight velocity is likely to be a good indicator of short-term mortality.

5. Bairagi, R., Edmonston, B. and Khan, A.D. 1987.
Effects of age misstatement on the utility of age-dependent anthropometric indicators of nutritional status in rural Bangladesh.
Am. J. Public Health. **77**: 280-282.

The effects of age error on usefulness of weight-for-age and height-for-age for assessing and screening malnutrition, and for identifying factors of malnutrition in 679 children aged 22-59

months in Companiganj, in rural Bangladesh. Overreporting and random error in age and correlation of age error with each of the anthropometric indices are observed. As a result, the proportion of children having less than or equal to 60% of median weight-for-age is overestimated by five percent age points and the proportion having less than 80% of median height-for-age is overestimated by six points. The loss in sensitivity (proportion of malnourished children correctly identified) for the above cutoff points is 20% for weight-for-age and 28% for height-for-age, compared to the situation in the absence of age error. Although mother's education is not a significant determinant of weight-for-age and height-for-age, age error makes mother's education appear artificially significant in the analysis of variance.

6. Briend, A. 1988.
Using anthropometry to identify children with a high risk of dying.
Indian Pediatr. **25**: 930-938.

7. Briend, A. 1989.
Use of anthropometry for the detection of children with a high risk of death.
Utilisation de l'anthropometrie pour la detection des enfants ayant un haut risque de deces.
In Lemonnier, D. and Ingenbleek, Y. (eds.) Journees Scientifiques Internationales du GERM, Nianing (Senegal) 4-9 October 1987.
Paris, France; Karthala et ACCT 1989: 30-38.

Results of a series of recent studies in Bangladesh indicate that arm circumference is the most sensitive and specific anthropometric measurement for detecting children with a high mortality risk. Prediction is not improved by correcting arm circumference for age or height but can be improved by shortening the period in which the prediction is made. A pilot study in Matlab, Bangladesh, using monthly measurements of arm circumference for 5000 infants, aged 6 to 36 months old, during six months indicated that sensitivity of the technique in predicting mortality risk was almost double that reported in previous studies using more complex anthropometric values.

8. Briend, A. and Bari, A. 1989.
Critical assessment of the use of growth monitoring for identifying high risk children in primary health care programmes.
Br. Med. J. **298**: 1607-1611.

9. Briend, A. and Zimicki, S. 1986.
Validation of arm circumference as an indicator of risk of death in one to four year old children.
Nutr. Res. **6**: 249-261.

The quality of the evaluation by measurement of arm circumference in children one to four years old as an indication of the risk of death, was estimated from archive data of the International Centre for Diarrhoeal Disease Research, Bangladesh. The relevance of a correction for age or for height was also tested. Anthropometric measurements of 49 children who died in the six months after nutritional assessment were compared with those of 873 controls who were measured at the same time in the same conditions. Although height, height for age, arm circumference for age and arm circumference for height were significantly lower in the group of children who died than in the controls, when tested individually, a series of logistic equations showed that all those variables had virtually no effect on the quality of the prediction of outcome when arm circumference was already included in the model. Prediction of death by arm circumference without correction for age or height compared favourably, in terms of specificity and sensitivity, with other anthropometric indices tested in similar studies.

10. Briend, A., Dykewicz, C., Graven, K., Mazumder, R.N., Wojtyniak, B. and Bennish, M. 1986.
Usefulness of nutritional indices and classifications in predicting death of malnourished children.
Br. Med. J. (Clin Res Ed). **293**: 373-375.

The usefulness of nutritional indices and classifications in predicting the death of children under five years old was evaluated by comparing measurements of 34 children with diarrhoea who died in a Dhaka hospital with those of 318 patients who were discharged in a satisfactory condition. In a logistic regression analysis, mid-upper arm circumference was found to be as effective as other nutritional indices in predicting death. Combinations of different indices did not improve the prediction. Arm circumference might be preferable to more complex criteria for predicting the death of malnourished children.

11. Briend, A., Rowland, M.G. and Wojtyniak, B. 1987.
Measures of nutritional status [letter]
Lancet. **1(8541)**: 1098-1099.

12. Briend, A., Wojtyniak, B. and Rowland, M.G. 1987.
Arm circumference and other factors in children at high risk of death in rural Bangladesh.
Lancet. **2(8561)**: 725-728.

Mid upper arm circumference (MUAC) was measured monthly for six months in about 500 children aged 6-36 months from rural Bangladesh. Children who would die within one month of screening could be identified with 94% specificity and 56% sensitivity, almost twice the sensitivity achieved by other anthropometric screening schemes for this level of specificity. Specificity was slightly improved when the absence of breast-feeding, concurrent diarrhoea, oedema, and acute respiratory infection were taken into account. Children at high risk of death can be detected by monthly measurement of MUAC, which may be used in poor communities where interventions have to be selective.

13. Briend, A., Hasan, K.Z., Aziz, K.M,. Hoque, B.A. and Henry, F.J. 1989.
Measuring change in nutritional status: a comparison of different anthropometric indices and the sample sizes required.
Eur. J. Clin. Nutr. **43**: 769-778.

The usefulness of different anthropometric indices to detect nutritional changes at the community level, i.e., in a number of children considered as a group, was compared by using data from a longitudinal study from rural Bangladesh, which followed up quarterly, an average of 413 children aged 6-35 months, from December 1984 to December 1987. Weight change, mid-upper arm circumference and weight-for-height responded most quickly to seasonal variations of the food situation. Height-for-age was more responsive to long-term variations. Although similar conclusions were reached when proportions of children below a cut-off point or mean indices were compared, the comparison of mean indices required a smaller sample size to detect changes. The difference in sample size needed ranged from 48 to 61 per cent. All indices varied significantly with age, which suggests that precise knowledge of age is essential for proper interpretation of nutritional surveillance data.

14. Kabirullah, M. 1985.
Experience on the use of growth charts in Jurian Nutrition Project.
In Workshop on growth monitoring in children 18 July 1985.
Dhaka; NNCB: 29-34.

15. Khan, M.M. 1986.
Comments on anthropometry, nutritional status and energy intake.
Food Nutr. Bull. **8**.

16. Henry, F.J. and Dualeh, K.A. 1987.
Measuring malnutrition: limits to interpretation. A brief review.
Bangladesh J. Child Health. **11**: 13-19.

17. Huque, F. and Hussain, A.M. 1991.
Detection of low birth-weight new born babies by anthropometric measurements in Bangladesh.
Indian J. Pediatr. **58**: 223-231.

18. Talukder, M.Q-K. 1985.
Growth monitoring in Bangladesh: a hope for child survival.
Bangladesh J. Child Health. **9**: 186-191.

2.11 Nutritional Status, Morbidity and Mortality

1. Aaby, P. 1988.
Malnutrition and overcrowding/intensive exposure in severe measles infection: review of community studies.
Rev. Infect Dis. **10**: 478-491.

Most hospital studies of measles mortality suggest that high case fatality ratios are associated with malnutrition. However, no community study has documented this association. On the contrary, several community studies from Africa and Asia have found no relationship between nutritional status and the risk of severe or fatal measles. Instead, overcrowding and intensive exposure may be more important determinants of measles mortality. Clustering of several cases in the family and/or intensive exposure were associated with high measles mortality in community studies in West Africa, Bangladesh and England. Thus sociocultural factors that concentrate many susceptible children in the home may increase the case-fatality ratio in measles. Conversely, this ratio will be lower when measles cases are dispersed.

Siblings in rural areas, where long intervals separate epidemics, run a higher risk of contracting measles simultaneously than do their urban counterparts. Measles vaccination increases herd immunity and diminishes the clustering of several cases in a family. Vaccination may therefore reduce mortality even among unvaccinated children who contract measles. Crowding and intensive exposure may partly explain regional and historical variations in measles mortality; community studies suggest that mortality is high when a high proportion of measles patients have secondary cases (acquired through exposure at home).

2. Ahmed, F., Clemens, J.D., Rao, M.R., Sack, D.A., Khan, M.R. and Haque, E. 1992. Community-based evaluation of the effect of breast-feeding on the risk of microbiologically confirmed or clinically presumptive shigellosis in Bangladeshi children.
Pediatrics. **90**: 406-411.

To assess the association between breast-feeding and the risk of microbiologically confirmed or clinically presumptive shigellosis, the authors performed a case-control analysis of Bangladeshi children younger than three years of age, who were followed up for one month after exposure to Shigella in their residential neighbourhoods. Two hundred sixty-nine cases with culture-confirmed shigellosis (n = 119) or clinically presumptive shigellosis (culture-negative dysentery, n = 150) were compared with 819 controls without Shigella diarrhoea or other invasive diarrhoeal illnesses. The odds ratio relating breast-feeding to confirmed or presumptive shigellosis, adjusted for potentially confounding variables, was 0.48 (95% confidence interval = 0.32 to 0.72; P less than .001), suggesting a substantial protective effect. The protective association decreased with age but was still significant during the third year of life if appeared to be directly related to the degree of stunting and was equivalent for confirmed and presumptive shigellosis. Notably, the protective association remained substantial against episodes due to Shigella which were resistant to at least one of the antibiotics customarily used for treatment of Shigella diarrhoea (age-adjusted odds ratio = 0.40; 95% confidence interval = 0.22 to 0.74; P less than .01). These data suggest that breast-feeding confers a high level of protection against shigellosis throughout the first three years of life, especially among nutritionally compromised children, and thereby underscore the importance of promotion of breast-feeding as a central component of Shigella control programmes in less developed settings.

3. Bairagi, R., Chowdhury, M.K., Kim, Y.J., Curlin, G.T. and Gray, R.H. 1987. The association between malnutrition and diarrhoea in rural Bangladesh. *Int. J. Epidemiol.* **16**: 477-481.

The interaction between diarrhoeal disease and nutritional status measured by anthropometry was investigated in approximately 1000 children aged one to four years during April to December 1976 in a rural area of Bangladesh. Data on diarrhoeal disease were provided by the mothers interviewed at seven-day intervals. Weight and height data were collected bimonthly. Children classified using anthropometric criteria, weight-for-age, height-for-age and weight-for-height, were prospectively evaluated for incidence and duration of diarrhoea during a short (two-month) period and a long (eight-month) period. Incidence of diarrhoea was not found to be related to nutritional status, measured by any of the anthropometric criteria for any of the periods. But duration of diarrhoea was found to be related consistently to nutritional status measured by weight-for-age and weight-for-height. Diarrhoea in the short term affected weight increment in the short term, but not in the long term and did not affect height increment for any of these periods. Diarrhoea in the long term affected both weight increment and height increment in the long term.

4. Baqui, A.H., Black, R.E., Sack, R.B., Yunus, M.D., Siddique, A.K. and Chowdhury, H.R. 1992.

Epidemiological and clinical characteristics of acute and persistent diarrhoea in rural Bangladeshi children.

Acta Paediatr. **81 (Suppl 381)**: 15-21.

A community-based longitudinal study of acute and persistent diarrhoea in 705 children less than five years old was carried out for a year in a rural area of Bangladesh. Diarrhoea morbidity data were collected from each study child every fourth day by home visit. Clinical features of diarrhoeal episodes and diarrhoeal management information were documented. The overall diarrhoeal incidence rate in the study children was 4.6 episodes per child per year. The incidence of persistent diarrhoea was 34/100 child-years. Persistent diarrhoea was positively associated with young age and more severe illness, characterized by the presence of clinical dehydration or blood in the stool in the first week. The use of oral-rehydration therapy (ORT) in the first week was positively associated and use of an antibiotic was negatively associated with the occurrence of persistent diarrhoea. Reduced breast-feeding and consumption of cows milk at some time during the episode were also positively associated with persistence. This would suggest that appropriate fluid and dietary

management for all episodes should be the goal. Children with more severe initial illness characterized by the presence of blood in the stool or clinical dehydration should have more careful follow-up to identify persistent episodes and adverse nutritional effects. Breast feeding should be continued during acute diarrhoea, but the role of ORT, antibiotics and cows milk deserves further investigation.

5. Baqui, A.H., Black, R.E., Sack, R.B., Chowdhury, H.R., Yunus, M. and Siddique, A.K. 1993.

   Malnutrition, cell-mediated immune deficiency, and diarrhoea: a community-based longitudinal study in rural Bangladeshi children.

   Am. J. Epidemiol. **137**: 355-365.

A community-based longitudinal study was conducted in Matlab, a rural area of Bangladesh, from May 1988 to April 1989 to examine the associations among malnutrition, cell-mediated immune deficiency, and the incidence of diarrhoea in children under age five years. A cohort of 705 children was followed for a year; illnesses were ascertained every fourth day by home visits, anthropometric status was evaluated monthly, and cell-mediated immune status was assessed by a multiple antigen skin test at baseline and every three months. The diarrhoea incidence rate was 4.6 episodes per year. Approximately three quarters of the children were below -2 Z score weight for age and height for age, and about a third were below -2 Z score weight for height. There was a modest association between undernutrition and the incidence of diarrhoea. About 10-20% of the study children were anergic, and these children experienced a 50% increased incidence of diarrhoea compared with their immunocompetent counterparts. This association persisted after controlling for the effects of age, nutritional status, socioeconomic status, and history of diarrhoea in the previous three months. Malnutrition and cell-mediated immune deficiency were important independent risk factors for the occurrence of diarrhoea and must both be considered in the design of interventions for the control of this condition.

6. Becker, S., Black, R.E. and Brown, K.H. 1991.

   Relative effects of diarrhoea, fever and dietary energy intake on weight gain in rural Bangladeshi children.

   Am. J. Clin. Nutr. **53**: 1499-1503.

7. Bennish, M.L. and Wojtyniak, B.J. 1991.
Mortality due to shigellosis: community and hospital data.
Rev. Infect. Dis. **13 (Suppl 4)**: S245-S251.

Almost all fatal cases of shigellosis occur in developing countries, and data on mortality are generally compiled from three sources: investigations of epidemics caused by *Shigella dysenteriae* type 1, surveillance of endemic diarrhoeal disease, and reports from hospitals. Attack rates during epidemics of dysentery due to infection with *S. dysenteriae* type 1 have ranged from 1% to 33%, and case-fatality rates have ranged from 1% to 7%. In Matlab, a rural district in Bangladesh, most diarrhoea-related deaths and approximately 25% of all deaths among children from one to four years of age are attributable to dysentery. In 1984, an epidemic of dysentery was associated with a 42% increase in the death rate in that age group. At the Dhaka Treatment Centre of the International Centre for Diarrhoeal Disease Research, Bangladesh, the fatality rate for 970 inpatients with shigellosis was 11% in 1988, with most deaths occurring among malnourished children who were infected with *Shigella flexneri*. Control of mortality from shigellosis will require prevention of epidemic *S.dysenteriae* type 1 disease and endemic *S. flexneri* infections in children who live in countries with a high prevalence of malnutrition.

8. Bennish, M.L., Azad, A.K., Rahman, O. and Phillips, R.E. 1990.
Hypoglycemia during diarrhoea in childhood. Prevalence, pathophysiology, and outcome.
N. Engl. J. Med. 10. **322**: 1357-1363.

To determine the frequency and outcome of hypoglycemia during diarrhoea in childhood, were screened 2003 consecutive patients less than 15 years of age who were admitted to a diarrhoea treatment centre in Dhaka, Bangladesh. Hypoglycemia, defined as a blood glucose concentration less than 2.2 mmol per litre, was found in 91 patients (4.5%), 39 (42.9%) of whom died. We also measured the plasma concentrations of glucoregulatory hormones and gluconeogenetic substrates in 46 of the patients with hypoglycemia, who were 2 to 15 years old and in 25 normoglycemic patients, matched with them for age and weight. The patients with hypoglycemia had diarrhoea for less time than the normoglycemic patients (median was 12 hours for normoglycemic patients and 72 hours for hypoglycaemic patients; P less than 0.05), and their last feeding had been 18 hours before admission, as compared with 9 hours for the normoglycemic patients (P less than 0.05). The groups were similar in terms of nutritional status, the proportion of patients who had fever, and the types of

pathogens recovered from stool samples. The plasma C-peptide concentrations were low (less than 0.30 mmol per litre) in all the hypoglycaemic patients. As compared with the normoglycemic patients, the patients with hypoglycemia had elevated median plasma concentrations of glucagon (44 pmol/litre as apposed to 11 pmol per litre; P = 0.001), epinephrine (3400 vs. 1500 pmol per liter; P = 0.012), norepinephrine (7500 vs. 2900 pmol per liter; P = 0.002), and lactate (3.5 vs. 2.1 mmol per liter; P = 0.020) and similar alanine and beta-hydroxybutyrate concentrations. Eighteen hypoglycemic patients with severe malnutrition had been ill longer than 26 better-nourished patients with hypoglycemia (median duration of illness, 18 hours us apposed to 10 hours; P = 0.023) and had lower median plasma concentrations of lactate (1.9 vs. 3.9 mmol per liter; P = 0.021) and alanine (173 vs. 293 micromol per liter; P = 0.040). The conclusion is that hypoglycemia is a major cause of death in association with diarrhoea. As the glucose counterregulatory hormones were appropriately elevated in the children with diarrhoea and hypoglycemia, whereas the gluconeogenetic substrates were inappropriately low, it is further concluded that the hypoglycemia observed in such patients is most often due to the failure of gluconeogenesis.

9. Bhandari, N. and Bhan, M.K. 1989.
Association of antecedent malnutrition with persistent diarrhoea: a case-control study.
Br. Med. J. **298**: 1284-1287.

10. Bhuiya, A. 1989.
Factors affecting child survival in Matlab, Bangladesh.
Canberra; PhD thesis, Department of Demography, Australian National University.

11. Bhuiya, A., Zimicki, S. and D'Souza, S. 1986.
Socioeconomic differentials in child nutrition and morbidity in a rural area of Bangladesh.
J. Trop Pediatr. **32**: 17-23.

12. Bhuiya, A., Wojtyniak, B. and Karim, R. 1989.
Malnutrition and child mortality: are socioeconomic factors important?
J. Biosoc. Sci. **21**: 357-364.

The influences of household economic condition, maternal education, sex, and nutritional status of children on mortality were examined using multivariate analyses. Weights of around

1700 children aged 2-60 months in five villages of Matlab, Bangladesh, were taken during the first half of 1981. The children were followed for 18 months and their survival was recorded. The severely malnourished children had a risk of death nine times that of their counterparts with better nutritional status. Female children had a higher risk of death than the males. Mother's education and economic condition of household also showed negative relationships with the risk of death, but the effect of mother's education was modified by economic condition and sex of the children.

13. Briend, A. 1988.
    Vitamin A and diarrhoea. Reducing the risk
    Dialogue on Diarrhoea. **June(33)**: 4-5.

14. Briend, A., Bari, A. 1989.
    Breast feeding improves survival, but not nutritional status, of 12-35 months old children in rural Bangladesh.
    Eur. J. Clin. Nutr. **43**: 603-608.
    See Section 2.6, reference 7.

15. Briend, A.; Wojtyniak, B.; Rowland, M.G. 1988.
    Breast feeding, nutritional state, and child survival in rural Bangladesh.
    Br. Med. J. (Clin Res Ed). **296**: 879-882.
    See Section 2.6, reference 8.

16. Briend, A., Hasan, K.Z., Aziz, K.M. and Hoque, B.A. 1989.
    Are diarrhoea control programmes likely to reduce childhood malnutrition? Observations from rural Bangladesh.
    Lancet. **2(8658)**: 319-322.

Growth of rural Bangladeshi children aged 6-35 months was examined in relation to the history of diarrhoea in 1772 three-month intervals. Weight gain and linear growth were lower in intervals with a history of diarrhoea than in intervals without diarrhoea. However, comparison of weight and height gains in intervals during which diarrhoea occurred at the beginning or at the end showed that after non-bloody diarrhoeas children catch up and that deficits in weight gain and linear growth were no longer apparent a few weeks later. These findings suggest that the effect of diarrhoea on growth is transient and that efforts to control diarrhoea are unlikely to improve children's nutritional status in the long term.

17. Briend, A., Hasan, K.Z., Aziz, K.M. and Hoque, B.A. 1989.
Diarrhoea and malnutrition [letter].
Lancet. **2(8658)**: 1150.

18. Choe, A,K. and Razzaque, A. 1990.
Effect of famine on child survival in Matlab, Bangladesh.
Asia-Pacific Pop. J. **5**: 53-72.

19. Chowdhury, A.K.M.A. 1988.
Child mortality in Bangladesh: food versus health care.
Food Nutr. Bull. **10**: 3-9.

The paper evaluates child mortality in terms of maternal literacy using demographic surveillance data and field data, both from villages near Matlab, Bangladesh. Only children of one to four years of age were considered because this group shows the most variation in mortality by socioeconomic status. Of a total regional population of 175, 887, 12.3% were one to four years old. 58.5% of these children had mothers under 25 years old, and 76% of the mothers had no formal education. During 1978-80 the major causes of death for children in this age-group were dysentery (25%), measles, fever, drowning and nutritional oedema. Statistical tests showed that children of illiterate women had higher mortality rates than those of literate women, and illiterate women also had a higher proportion of severely malnourished children.

20. Chowdhury, M.K., Gupta, V.M., Bairagi, R. and Bhattacharya, B.N. 1990.
Does malnutrition predispose to diarrhoea during childhood? Evidence from a longitudinal study in Matlab, Bangladesh.
Eur. J. Clin. Nutr. **44**: 515-525.

It is posited that diarrhoeal illness during one period has influence on diarrhoeal illness in a subsequent period. There may also be a relationship between malnutrition and subsequent diarrhoea. To test this, data on cross-sectional anthropometry was analysed in combination with data on diarrhoeal morbidity, collected longitudinally in a community-based study of 1262 children (aged 6-60 months) during March-December, 1976, in Matlab, Bangladesh. The results confirmed the posited relationship between diarrhoeal morbidities in two consecutive periods and showed that the risks of diarrhoeal attack and longer diarrhoeal illness increased more than threefold following diarrhoeal illness during the preceding two

months (previous diarrhoea). Children with no previous diarrhoea indicated a positive association between malnutrition and subsequent diarrhoea, but the pattern found among children with previous diarrhoea was not clear. Logistic regression analyses performed separately for younger and older children showed that, controlling for effects of previous diarrhoea, maternal illiteracy and household poverty, severe malnutrition as assessed by weight-for-age was found to be strongly associated with the risk of longer diarrhoeal illness in a two month interval in the age group 24-60 months; in the same age group the association with the risk of diarrhoeal attack was significant at the 10% level. No such association for malnutrition, however, was found in the 6-23 months age group.

21. Clemens, J.D., Stanton, B., Stoll, B., Shahid, N.S. and Chowdhury, A.K. 1986.
Breast feeding as a determinant of severity in shigellosis. Evidence for protection throughout the first three years of life in Bangladeshi children.
Am. J. Epidemiol. **123**: 710-720.

22. Clemens, J.D., Harris, J.R., Sack, D.A., Huda, M.N., Chowdhury, S., Ali, M. and Rao, M.R. 1988.
Discontinuation of breast feeding during episodes of diarrhoea in rural Bangladeshi children.
Trans R. Trop Med. Hyg. **82**: 779-783.

23. Clemens, J.D., Sack, D.A., Harris, J.R., Khan, M.R., Chakraborty, S., Chowdhury, S., Rao, M.R., van Loon, F.P., Stanton, B.F. and Yunus, M. 1990.
Breast feeding and the risk of severe cholera in rural Bangladeshi children.
Am. J. Epidemiol. **131**: 400-411.

24. Costello, A.M., Kumar, A., Narayan, V., Akbar, M.S., Ahmed, S., Abou-Zeid, C., Rook, G.A., Stanford, J. and Moreno, C. 1992.
Does antibody to mycobacterial antigens, including lipoarabinomannan, limit dissemination in childhood tuberculosis?
Trans. R. Soc. Trop Med. Hyg. **86**: 686-692.

Serum immunoglobulin (IgG) responses to a variety of mycobacterial antigens were measured in children from the UK, in children with tuberculosis from Hyderabad, India and Dhaka, Bangladesh, classified according to whether the disease was disseminated or localized, and in non-tuberculous controls. Anti-lipoarabinomannan (LAM) IgG responses in UK children

showed a marked trough between six months and three years coincident with the reported peak incidence of disseminated tuberculosis. Geometric mean IgG responses to sonicates of slow-growing mycobacteria (rich in LAM) in 36 children with disseminated tuberculosis were markedly lower than in 99 children with localized tuberculous lesions (for *Mycobacterium scrofulaceum* $P < 0.01$, for *M. tuberculosis* $P < 0.01$, and for *M. vaccae* $P < 0.01$). Responses to purified LAM were also lower in the disseminated tuberculosis group ($P < 0.05$) but there was no difference between the groups in their response to mycobacterial 65 kDa protein. Multiple regression analysis showed that the reduced response to sonicated mycobacterial antigens and to LAM in children with disseminated disease was independent of age, nutritional status, skin test reactivity, duration of previous symptoms, and city of origin. There was no evidence for sequestration of the antibodies to immune complexes. These findings are compatible with the hypothesis that children with low levels of antibodies to sonicated mycobacterial antigen and to LAM, or those who cannot mount an antibody response, are predisposed to dissemination. A role for antibodies in preventing disseminated forms of tuberculosis in childhood has implications for the development of improved vaccines and for the optimum timing of vaccination with bacille Calmette-Guerin.

25. Fauveau, V., Briend, A., Chakraborty, J. and Sarder, A. M. 1990.
The contribution of severe malnutrition to child mortality in rural Bangladesh: implications for targeting nutritional interventions.
Food Nutr. Bull. **12**: 215-219.

The contribution of severe malnutrition to child mortality was examined in a rural Bangladeshi population of 200 000 under intensive demographic surveillance. In 1986/87 one-third of all the deaths in children between 6 and 36 months of age were associated with severe malnutrition, and 79% of those deaths were associated with persistent diarrhoea. The relative risk of dying from diarrhoea among severely malnourished children, as opposed to those who were not severely malnourished, was 17%. The attributable risk was 49%. For all causes of death combined, the relative risk was 8% and the attributable risk 30%. Of all deaths in this age group 60% occurred during the five post-monsoon months. The risk of dying from severe malnutrition was more than twice as high among girls as among boys. The specific mortality due to severe malnutrition was significantly lower in 50% of the surveillance area covered by an intensive mother-child health and family planning (MCH-FP) programme than in the 50% covered by the regular national health services, suggesting that the programme was effective. Supplementary feeding programmes are thus able to reduce the incidence and prevalence of, and fatality due to, malnutrition if a number of conditions

such as good targeting, good supervision, and good logistics are met.

26. Fauveau, V., Koenig, M.A. and Wojtyniak, B. 1991.
Excess female deaths among rural Bangladeshi children: an examination of cause-specific mortality and morbidity.
Int. J. Epidemiol. **20**: 729-735.

Excess female mortality over male mortality during childhood, well known in the northern Indian subcontinent, is particularly marked in rural Bangladesh. While the determinants of this phenomenon and the respective roles of cultural and economic factors are still debated, little data exist on cause-specific mortality, to identify the specific causes of death producing this differential. In 1986-1987 in Matlab, a study area under intensive demographic surveillance in rural Bangladesh, female children aged one to four years had a risk of dying 1.8 times higher than male children (95% confidence interval: 1.5-2.1). The causes of death which contributed the most to this excess female mortality were severe malnutrition and diarrhoeal diseases. The risks of dying were 2.5 and 2.1 higher for female than for male children for these two causes, respectively. Possible mechanisms were examined using data on incidence of selected diseases and admission rates to curative facilities. There was no gender difference in incidence of severe diarrhoeal diseases, but female children with diarrhoea were taken to the hospital significantly less often than male children. In contrast, there was a higher incidence of severe malnutrition in female than male children, and a lower rate of hospital admission. The data suggest that gender differentials in mortality may not be as much affected by preventive measures against diarrhoea as by efforts to provide equivalent curative services to female and male children.

27. Fauveau, V., Yunus, M., Zaman, K., Chakraborty, J. and Sarder, A.M. 1991.
Diarrhoea mortality in rural Bangladeshi children.
J. Trop Pediatr. **37**: 31-36.

Diarrhoeal mortality and hospital admissions for diarrhoea are described among children under the age of five years in a large rural Bangladeshi community during 1986-87. Acute watery (dehydrating) diarrhoea was associated with 11% of all deaths among infants aged one to eleven months and 5% among children aged one to four years. Acute non-watery diarrhoea, including bloody dysentery and diarrhoea with mucoid stools, was associated with 16% of all deaths among children aged one to four years. In this age group, persistent diarrhoea, particularly when accompanied by recent and/or severe wasting, was associated

with 63% of all diarrhoeal deaths and 34% of all deaths. These data suggest that exclusive emphasis on oral rehydration therapy (ORT) will have little impact on diarrhoea mortality among children in rural Bangladesh. A broader strategy, both preventive and curative, including measles immunization, nutrition education, dietary management of diarrhoea, and the treatment of dysentery in the community, carries a greater potential.

28. Fauveau, V., Henry, F.J., Briend, A., Yunus, M. and Chakraborty, J. 1992.
Persistent diarrhoea as a cause of childhood mortality in rural Bangladesh.
Acta. Paediatr (NORWAY). **81 Suppl 381**: 12-14.

To determine the importance of persistent diarrhoea in childhood mortality a multiple-step verbal autopsy method was used to study 1934 deaths in Matlab, Bangladesh. It was found that most of the deaths from acute watery diarrhoea occurred in infancy, whereas the peak of non-watery diarrhoea deaths was in children over 12 months of age. Children suffering from persistent diarrhoea and malnutrition were at highest risk of dying during their third year of life. Children with infectious diseases have a two to four times higher risk of dying if they are malnourished, and for diarrhoea the risk, is 17 times as high. Forty-nine percent of the diarrhoeal deaths were in children with malnutrition associated with persistent diarrhoea. These results imply that fluid and dietary management are key aspects in the treatment of diarrhoea, particularly for those episodes which persist. We conclude that attempts to reduce diarrhoeal deaths with vertical oral rehydration therapy (ORT) programmes will not have a major impact unless other interventions are directed to the persistent diarrhoea-malnutrition complex.

29. Fauveau, V., Stewart, M.K., Chakraborty, J. and Khan, S.A. 1992.
Impact on mortality of a community-based programme to control acute lower respiratory tract infections.
Bull. World Health Organ. **70**: 109-116.

Acute lower respiratory tract infections (ALRIs) are a major cause of death among young children in developing countries. A targeted programme designed to treat children with ALRI was implemented in 1988 in a primary health care project in rural Bangladesh. In the two years preceding the introduction of the programme (1986-87), non-ALRI-specific health services were provided, including promotion of oral rehydration therapy, family planning, immunization of children and mothers, distribution of vitamin A, referral of severely sick children to field clinics, and nutritional rehabilitation of malnourished children. The targeted

ALRI programme, which was in place in 1988-89, was based on systematic ALRI case detection and management by community health workers, who were linked to a referral system for medical support. These two levels of intervention have been evaluated by comparing the ALRI-specific mortality in the programme area and a neighbouring control area during the two periods. During the first phase (1986-87), the ALRI mortality among under-five-year-olds was 28% lower in the intervention than in the comparison area (P less than 0.01). During the second phase (1988-89), the ALRI mortality was 32% lower in the intervention area than during the preceding phase, while there was no significant difference for the comparison area. These findings suggest that in the study region the combination of specific and nonspecific interventions can reduce ALRI mortality by as much as 50% and the overall mortality among under-five-year-olds by as much as 30%.

30. Gilman, R.H., Brown, K.H., Visvesvara, G.S., Mondal, G., Greenberg, B., Sack, R.B., Brandt, F. and Khan, M.U. 1985.

    Epidemiology and serology of *Giardia lamblia* in a developing country: Bangladesh.

    Trans. R. Soc. Trop Med. Hyg. **79**: 469-473.

The age-specific prevalence of *Giardia lamblia* was determined in two Bangladeshi villages and malnourished children in hospital in Dhaka City. Age-specific acquisition rates, the duration of infection and age-specific sero-positivity to (immunofluorescent assay) *G. lamblia* trophozoites were determined. Infection was acquired early (less than one year) and in 16% of infected children persisted for longer than three months. Prevalence was higher in five to 10-year-old village children (21%) and one to five-year-old malnourished children (51%). Over 40% of the children much less than seven years acquired *G. lamblia* within 18 months; acquisition rates did not change with age. Positive antibody titres were acquired between six months and one year and the prevalence of sero-positivity remained high in all age groups. No association was found between positive antibody titres and positive stool examinations. In developing countries serum antibodies are useful epidemiologically, but are not diagnostic in the individual patient.

31. Gilman, R.H., Partanen, R., Brown, K.H., Spira, W.M., Khanam, S., Greenberg, B., Bloom, S.R. and Ali, A. 1988.

    Decreased gastric acid secretion and bacterial colonization of the stomach in severely malnourished Bangladeshi children.

    Gastroenterology. **94**: 1308-1314.

To assess the effect of malnutrition on gastric acidity and gastric bacterial colonization, we studied 35 severely malnourished Bangladeshi children before (0 week) and after (3 week) they received nutritional rehabilitation for 3 weeks. These results were compared with those obtained from a similarly examined group of 20 better-nourished Bangladeshi children. Gastric acid output, both basal and after betazole stimulation, was significantly lower in the malnourished group at 0 week compared with the better-nourished children (p less than 0.01): basal 0.22 vs. 0.52 mEq HCl/h and stimulated 0.90 vs. 2.5 mEq HCl/h. Both the concentration of acid and the rate at which gastric juice was secreted were decreased in the malnourished group but serum gastrin levels were not significantly different. After 3 weeks, the malnourished children had improved from 61% (± 9.0%; SD) to 81% (± 8.1%) of expected weight-for-height and were not significantly different than the better-nourished group (86% ± 11%). Nevertheless, gastric acid concentration remained depressed in the 3 week group, although the rate of gastric juice secretion equalled levels observed in better-nourished group. None of the better-nourished children had detectable gram-negative bacterial colonization of their gastric juice. In contrast, 26 of 32 (81%) malnourished children at 0 week were colonized, even after betazole stimulation, 11 of 33 (33%) gastric juice samples yielded viable organisms, suggesting that the decrease in gastric acid output greatly reduced the gastric acid barrier. Interestingly, only 9 of 20 (45%) better-nourished children had gastric juice with basal pH values below 4.0, suggesting that the gastric acid barrier may be an intermittent defense factor in Bangladeshi children.

32. Glass, R.I. and Stoll, B.J. 1989.
The protective effect of human milk against diarrhoea. A review of studies from Bangladesh.
Acta. Paediatrica Scandinavica. **(Supplement 351)**: 131-136.

Field studies, made in Bangladesh, with laboratory work performed there and in Goteborg, Sweden, Bethesda, Maryland and in Atlanta, Georgia, that have been aimed at identifying the specific enteric infections most likely to be influenced by breast feeding, are discussed.

33. Glass, R.I., Stoll, B.J., Wyatt, R.G., Hoshino, Y., Banu, H. and Kapikian, A.Z. 1986.
Observations questioning a protective role for breast-feeding in severe rotavirus diarrhoea.
Acta. Paediatr. Scand. **75**: 713-718.

34. Glass, R.I., Svennerholm, A.M., Stoll, B.J., Khan, M.R., Huda, S., Huq, M.I. and Holmgren, J. 1989.

Effects of undernutrition on infection with Vibrio cholerae O1 and on response to oral cholera vaccine.

Pediatr. Infect. Dis. J. **8**: 105-109.

The association between undernutrition and the risk of colonization and disease with *Vibrio cholerae* O1, concentrations of salivary IgA and the serologic response to infection and to orally administered cholera B subunit were examined prospectively in a family study in Bangladesh. Children ages one to eight years, who were family contacts of patients hospitalized with culture-confirmed cholera, were visited within 24 hours of the hospitalization and daily for 10 days, queried for the presence of diarrhoea and cultured for *V. cholerae* O1. On day one each child was weighed and saliva was collected to measure total IgA. On days one and 21 blood was taken to assess vibriocidal and antitoxin titres, and on days one and two, B subunit or placebo was given orally as part of a trial to look for a toxin-blocking effect. Of 412 children enrolled in the study 35% (143) became infected with *V. cholerae* O1 and 49% (70) of these developed diarrhoea. Undernutrition, defined in a child as weight less than 70% of the Harvard reference weight-for-age, was not associated with colonization, disease or the duration or severity of cholera. Moreover well-nourished children did not differ from undernourished children in their concentrations of salivary total IgA, initial serum antitoxin or vibriocidal antibodies or in their serologic response to colonization, disease or B subunit. The immune system in its response to cholera appears to be quite resistant to nutritional insults. The good antitoxin response to B subunit among undernourished children is of particular importance in considering the use of future oral cholera vaccines in areas where such undernutrition is common.

35. Hall, A. 1985.

Nutritional aspects of parasitic infection.

Prog. Food Nutr. Sci. **9**: 227-256.

36. Henning, B., Stewart, K., Zaman, K., Alam, A.N., Brown, K.H. and Black, R.E. 1992.

Lack of therapeutic efficacy of vitamin A for non-cholera, watery diarrhoea in Bangladeshi children.

Eur. J. Clin. Nutr. **46**: 437-443.

Vitamin A deficiency has been postulated as increasing childhood mortality, possibly through increasing the severity and case-fatality of infectious diseases like diarrhoea. A clinical trial was conducted to measure the effect of vitamin A therapy on the severity and duration of acute episodes of non-cholera, watery diarrhoea. 83 children with less than 48 hour of illness were randomized to receive vitamin A (200,000 IU of retinyl palmitate) orally or placebo during hospitalization at the International Centre for Diarrhoeal Disease Research in Bangladesh. The patients were similar initially with regard to age, nutritional status and severity of diarrhoea prior to admission. No adverse effects of vitamin A were detected. During hospitalization there were no differences between groups in duration of illness or stool output. Thus, vitamin A can be given safely during diarrhoeal illness to augment hepatic reserves and possibly provide a beneficial effect in regard to subsequent episodes of diarrhoea and other infections, but this supplementation should not be expected to have a therapeutic effect on a current episode.

37. Henry, F.J. 1991.
The epidemiologic importance of dysentery in communities.
Rev. Infect. Dis. **13 Suppl 4**: S238-S244.

This paper explores the epidemiologic importance of dysentery with use of several community studies that demonstrate its prevalence and incidence as well as its association with pathogens, nutritional status, persistent diarrhoea, and death. Results of these studies showed that while watery diarrhoea was most prevalent in children aged 6-11 months, the prevalence of dysentery peaked between 18 and 23 months of age. Severely stunted children were found to have significantly prolonged episodes of dysentery. Shigella and persistent diarrhoea were more frequent in children with dysentery than in those with nonbloody diarrhoea. A striking feature was that watery diarrhoea, dysentery, persistent diarrhoea, and malnutrition each account for less than 5% of all deaths among children aged less than 5 years. However, persistent diarrhoea in association with malnutrition causes 13% of deaths in children aged 0-4 years and 27% of deaths in those aged 1-4 years. These data suggest that a more balanced strategy for diarrhoeal control is required simply because most diarrhoeal deaths occur among malnourished children with prolonged diarrhoea, which is mainly due to dysentery. Results of the studies also suggest that methods to control dysentery in the community should focus on improved hygiene and antimicrobial treatment with use of appropriate algorithms. Recognition of the synergism between dysentery and persistent diarrhoea accompanied by malnutrition is crucial in formulating effective programmes for control of diarrhoea.

38. Henry, F.J., Alam, N., Aziz, K.M. and Rahaman, M.M. 1987.
Dysentery, not watery diarrhoea, is associated with stunting in Bangladeshi children.
Hum. Nutr. Clin. Nutr. **41**: 243.

To study the interaction between diarrhoea and malnutrition, an average of 300 children aged 5-24 months were followed from January 1981 to January 1983 in Teknaf, Bangladesh. Diarrhoea episodes, differentiated according to stool appearance, were recorded weekly while weight and height measurements were taken every six months. Results showed no relationship between the nutritional indicators and diarrhoea incidence recorded within 60 d after anthropometric assessment. However, the duration of dysentery was significantly longer in the severely malnourished children who were stunted, but not for those who were wasted. Although many children with watery diarrhoea had episodes of long duration, these were not associated with any nutritional indicator. We conclude that the key factors in this interaction are the invasive type of pathogen and chronic malnutrition.

39. Henry, F.J., Huttly, S.R., Patwary, Y. and Aziz, K.M. 1990.
Environmental sanitation, food and water contamination and diarrhoea in rural Bangladesh.
Epidemiol Infect. **104**: 253-259.

This study examined the role of food and water contamination in a health impact evaluation of a water and sanitation intervention project. Although lower diarrhoea rates were found in the improved area, no consistent difference in food and water contamination was observed. Furthermore, no relationship was found between contamination and diarrhoea in either area, even after controlling for the nutritional status of children. These results imply that other vehicles of transmission might be more important than food and water in diarrhoeal transmission. The focus of interventions should therefore be on changing behaviours to improve overall hygiene.

40. Hossain, A.M.M.M. 1988.
Possible role of Ascaris in protein digestion and absorption in Bangladeshi children.
Bangladesh J. Nutr. **1**: 117-121.

41. Islam, S.S. and Khan, M.U. 1986.
Risk factors for diarrhoeal deaths: a case-control study at a diarrhoeal disease hospital in Bangladesh.
Int. J. Epidemiol. **15**: 116-121.

The study of diarrhoeal mortality risk has been limited to descriptive epidemiological investigations. This is the first case-control study in this area, and results show that certain risk factors are predictive of diarrhoeal deaths. The disease history, associated complications, signs, symptoms and laboratory values of 346 patients who died on the medical wards of Dhaka Hospital and that for 346 matched controls were compared to identify the risk factors for mortality. Patients presenting with oedema, severe dehydration or convulsion were found to have a risk of mortality two times higher than controls. Several laboratory results were compared by a matched pair analysis, demonstrating that hyponatraemia (less than 130 mmol/l), hypobicarbonaemia (less than 20 mmol/l) and raised anion gap (greater than 14.9 mmol/l) were moderately associated with mortality. However, hypoproteinaemia (less than 50 gm/l) was strongly associated. For children less than 10 years of age, both hyper- and hyponatraemia were found to be associated with mortality, and the nutritional status of the children modified the effect of hypernatraemia on diarrhoeal mortality. The strong association between diarrhoeal death and hypoproteinaemia may be due to the effect of the pre-existing malnutrition of these patients and/or their loss of protein during shigella infection. The various risk factors that we have identified could be used as a prognostic guide by physicians treating such patients.

42. Islam, S.S. and Shahid, N.S. 1986.
Morbidity and mortality in a diarrhoeal diseases hospital in Bangladesh.
Trans. R. Soc. Trop. Med. Hyg. **80**: 748-752.

43. Jalil, M.A., Rahman, H. and Cohen, N. 1985.
Nutritional blindness and diarrhoea in Bangladesh [letter]
Br. J. Nutr. **54**: 777-778.

44. Karim, M.R. and Ali, S.M.K. 1988.
Malnutrition related diabetes mellitus.
Bangladesh J. Nutr. **2**: 46-50.

45. Khan, M.U. and Ahmad, K. 1986.
Withdrawal of food during diarrhoea: major mechanism of malnutrition following diarrhoea in Bangladeshi children.
J. Trop. Pediatr. **32**: 57-61.

46. Koster, F.T. 1988
Mortality among primary and secondary cases of measles in Bangladesh.
Rev. Infect. Dis. **10**: 471-473.

Data were reviewed from an intensive 1975-1976 survey in two Bangladeshi villages that experienced a high incidence of measles. Mortality among secondary cases (four of 50, 8.0%) was significantly higher than that among primary cases (six of 290, 2.1%). In every case in which there was a death in a household with more than one case, it was the youngest patient who died. All children with secondary cases who died had a pre-illness weight-for-height status above the population mean. Measles mortality in Bangladesh appears to be determined by three factors: age, superinfections, and having a secondary case. The last two factors may be due to increased intrafamilial exposure to both the measles virus and the superinfecting pathogens.

47. Koster, F.T., Palmer, D.L., Chakraborty, J., Jackson, T. and Curlin, G.C. 1987.
Cellular immune competence and diarrhoeal morbidity in malnourished Bangladeshi children: a prospective field study.
Am. J. Clin. Nutr. **46**: 115-120.

A year-long prospective study of 152 Bangladeshi children with mild to moderate protein-calorie malnutrition related nutritional status and cellular immune defects to morbidity due to diarrhoeal, respiratory, and febrile diseases. In children older than 36 months, wasting correlated with skin test anergy to three recall antigens and with inability to initiate hypersensitivity to dinitrochlorobenzene. In this older age group, anergy was associated with a 58% increased attack rate and an 83% increased duration of diarrhoeal diseases, but not with febrile or respiratory infections. In stepwise regression analysis, this anergy effect was independent of the small negative impact of poorer nutritional status on morbidity. Ninety-three percent of diarrhoeal illnesses lasting at least 14 days were among anergic children. Cellular immune incompetence, indicated by anergy of unknown etiology, is associated with increased diarrhoeal morbidity and may promote the vicious cycle of repeated infections and deteriorating nutritional status.

48. Mahmud, S. 1987.
Gender aspects of nutrition and mortality among children in rural Bangladesh.
Dhaka; Bangladesh Institute of Development Studies. Research Report No. **63**.

49. Majumder, M.S.I., Mohiduzzaman, M. and Ahmad, K. 1987.
Immunocompetence of marginally nourished women on hormonal contraceptives.
Nutr. Rep. Int. **36**: 1285-1290.
See Section 2.7, reference 28.

50. Molla, A.M. and Molla, A. 1985.
Nutritional impact of diarrhoea and other infections.
In Workshop on growth monitoring in children, 18 July 1985.
Dhaka; NNCB: 23-28.

51. Molla, A.M., Molla, A. and Rahaman, M.M. 1986.
The impact of acute diarrhoea of different aetiologies on food intake in children.
In Walker-Smith, J.A. and McNeish, A.S. (eds.) Diarrhoea and malnutrition in childhood.
London; Butterworths: 14-18.

52. Northop, C.A., Lunn, P.G., Wainwright, M. and Evans, J. 1987.
Plasma albumin concentrations and intestinal permeability in Bangladeshi children infected with Ascaris lumbricoides.
Trans. R. Soc. Trop. Med. Hyg. **81**: 811-815.

53. Riley, L.W., Waterman, S.H., Faruque, A.S. and Huq, M.I. 1987.
Breast-feeding children in the household as a risk factor for cholera in rural Bangladesh: an hypothesis.
Trop. Geogr. Med. **39**: 9-14.

54. Roy, S.K., Alam, A.N., Majid, N. and Khan, A.M. 1989.
Persistent diarrhoea: a preliminary report on clinical features and dietary therapy in Bangladeshi children.
J. Trop. Pediatr. **35**: 55-59.

55. Ruzicka, L.T. and Kane, P. 1985.
Nutrition and child survival in South Asia.
In Srinivasan, K.; Mukerji, S. (eds.) Dynamics of population and family welfare. Bombay; Himalaya Publishing House: 333-357.

56. Ruzicka, L.T. and Kane, P. undated
Nutritional deficiencies as a factor in differential infant and child mortality: the experience of the countries on the Indian sub-continent.
In Hansluwka, H.; Lopez, A.D.; Porapakkham, Y.; Prasartkul, P. (eds.) New developments in the analysis of mortality and causes of death.
Thailand; World Health Organization, Global Epidemiological Surveillance and Health Assessment and Mahidol University, Faculty of Public Health, Institute for Population and Social Research. UNFPA Project. **INT/80/P09**: 257-294.

57. Samadi, A.R., Chowdhury, A.I., Huq, M.I. and Shahid, N.S. 1985.
Risk factors for death in complicated diarrhoea of children.
Br. Med. J. (Clin Res Ed). **290**: 1615-1617.

A total of 1330 children with complicated diarrhoea who were admitted to the general ward of the International Centre for Diarrhoeal Diseases Research, Bangladesh Health Complex, during 1979 were examined. The risk of death by complication of diarrhoea, aetiology, age, and nutritional state was analysed by a logit regression model. Serum sodium concentration and coma were found to be significant predictors of death, death being related directly to coma and inversely to serum sodium concentration. An earlier study had shown that the incidence of hyponatraemia was directly related to the degree of malnutrition, but the results of logit regression analysis did not show the nutritional state to be a predictor of death. Owing to lack of data, however, serum albumin concentration could not be taken as a variable in the logit regression analysis. To determine the relation of serum albumin concentration to hyponatraemia and the cause of death in hyponatraemia, further prospective studies would be necessary.

58. Sikder, Z.U., Henry, F.J., Hussain, M. and Rahman, M. 1988.
Xerophthalmia malnutrition and diarrhoea in urban Bangladesh: a clinic based study.
Indian Pediatr. **25**: 946-951.

59. Stoll, B.J., Banu, H., Kabir, I. and Molla, A. 1985.
Nightblindness and vitamin A deficiency in children attending a diarrhoeal disease hospital in Bangladesh.
J. Trop. Pediatr. **31**: 36-39.

60. Talukder, M.Q-K. and Das, D.K. 1987.
Nutrition status and acute respiratory tract infection.
Bangladesh J. Child Health. **11**: 104-107.

61. Zaman, K., Islam, M.R., Baqui, A.H. and Yunus, M. 1985.
Hypokalaemia in children with diarrhoea in rural Bangladesh.
Indian J. Med. Res. **81**: 169-174.

2.12 Fisheries and Nutrition

1. Coulter, J.P. and Disney, J.G. 1987.
The handling, processing and marketing of fish in Bangladesh.
London; Overseas Development Natural Resources Institute. ODNRI Bulletin. **1**.

2. FAP 16 Environmental Study. 1993.
Nutritional Consequences of Fisheries Bio-Diversity (draft).
Dhaka; ISPAN/FAP16, March.

Fisheries are important as a source of food and employment for the rural poor living in floodplain areas of Bangladesh. The resources on which these fisheries depend may be seriously affected by planned flood control interventions and methods for assessing their importance are required. The study carried out household surveys and seasonal monitoring of fish consumption in order to establish baseline data on fish consumption by people living in floodplain areas, measure involvement in fishing activities, assess potential impacts of FCD/I on fish consumption and develop methods for assessing household fish consumption. From the household surveys and monitoring carried out in four areas of Bangladesh covering three different periods of the year, fish was seen to be the most commonly consumed food after rice and vegetables. Important regional variations were clear, the average per capita fish consumption varying between 12 and 34 g per day. Important seasonal variations in fish consumption were also highlighted. Study of the diversity of fish species consumed revealed

that between 56 and 73 different species are consumed depending on the region. Recommendations are made for a more thorough consideration of fisheries issues in the planning of future FCD/I interventions.

3. Natprach, P. 1986.
Fisherwomen's activities in Bangladesh: a participatory approach to development. *Bay of Bengal News June*. **22**: 18.

The paper describes a pilot project that used the participatory approach to development to improve the living standards of fisherwomen from two villages in Chittagong, Bangladesh. Income-generating activities such as net making, fishculture, poultry and goat rearing, were introduced among groups of fisherwomen. Activities to improve nutritional status, the disbursement of loans and launching a savings scheme were the project's other components. The paper discusses the project methodology, problems, achievements and failures, and lessons for the future.

4. Natpracha, P. and Williams, B. 1986.
Working with fisherwomen in Bangladesh.
In 1985 training for agriculture and rural development.
Rome; Food and Agriculture Organization, Economic and Social Development Series. **38**: 39-45.

The Bay of Bengal Programme (BOBP), an FAO project funded by the Swedish International Development Authority (SIDA), aims at improving the working and living conditions of fisherfolk engaged in small scale fishing. Of necessity this means some focus on women in the fishing villages who, although they do not go to sea, are heavily engaged in fish marketing and who must cope with family living in a stressful environment of extreme poverty. In late 1981 a BOBP pilot project, Fisherwomen's Activities (FWA), was initiated in the small village of Juldia-Shamirpur, 20 km south of Chittagong. The purpose of the project was to experiment with and discover ways of assisting the mostly illiterate, poor fisherwomen to organize into groups in order to work together to improve their living conditions and to build community strength. The FWA project was based on the assumption that development that leads to self reliance must be based on a participatory approach. The specific objectives of the project were to assist the fisherwomen in identifying and implementing income-earning activities and to strengthen their ability to improve family health, nutrition and sanitation.

5. Nilsson, L. and Nycander, L. 1986.
Food, nutrition and society. A study in two fishing communities in south-east India.
Stockholm; Development Study Unit, Department of Social Anthropology, University of Stockholm. Working Paper. **2**.

The report is based on a two-month's study in India, financed by the Minor Research Task programme (MRT) of the Swedish International Development Authorities (SIDA). The host programme in India was the Bay of Bengal Programme (BOBP). The BOBP, which has existed since 1978, is partially funded by SIDA and administered by FAO. The aim of the programme is to improve the standard of living and to develop small-scale fisheries in 'traditional' fishing communities in India, Bangladesh, Sri Lanka, Malaysia and Thailand. Some of the ways in which the programme attempts to achieve this goal are to introduce mechanized fishing boats and new types of nets, organize women for the purpose of obtaining bank loans and non-formal adult education. The aim of the study was to look into the food and nutrition situation in two fishing communities in the south-east coastal states of Tamil Nadu and Andhra Pradesh. It describes the food situation and assesses the nutritional status of a sample of the population and determines the relative significance of some socioeconomic factors related to the nutrition situation. These issues are also compared between the two villages. An edited version of this report will be published by the BOBP in their miscellaneous series.

6. Rahman, S.H. and Roy, D.K. 1990.
Consumption demand for fish in Bangladesh: an empirical analysis with cross-sectional data.
Dhaka; Bangladesh Institute of Development Studies.

7. Sadeque, S.Z. 1992.
Capture fisheries and other common property resources in the flood plains of Bangladesh.
Journal of Social Studies (Dhaka). **55**: 20-34.

Capture fisheries in the form of common property and open access resources constitute a vital component of the agro-ecosystem of rural Bangladesh. They are also a very important source of household welfare for millions of poor rural households. They contribute towards the nutritional state of rural women and children, and the income and employment

opportunities are significant. However, capture fishery yields have declined due to resource use conflict, improper infrastructure, lack of restocking, indiscriminate pesticide use and overfishing. The following sub-sections are dealt with: capture fisheries; common property resources; livelihood security; access, equity and conflict resolution; mode of production; ecological sustainability; resource conservation and equity; fisheries development; the decline of common property resources; decline of common reserves due to increased land use intensity (this sub-section deals with a number of projects - the Dakatia project, the Muhury irrigation project, impact of submersible embankments, impact of coastal embankments, the Chalan *Beel* Polder 'D' sub- project, and the Hail *Haor* sub-project). Finally, the potential for flood plain agriculture is briefly assessed.

2.13 General Studies and Reports Including those on Health and Development Programmes which Contain a Nutrition Component

1. Ahmed, R., Wanmali, S., Kumar, S.K., Braun, J. von, Sabot, R.H., Vosti, S.A., Celis, R. and Von Braun, J. 1988.
   Infrastructure and agricultural development policy issues/research priorities. Washington, D.C.; International Food Policy Research Institute. IFPRI Policy Briefs. **3**.

The role of infrastructure in agricultural development is discussed. The effects of infrastructural development in fostering a greater division of labour in rural areas and increasing the participation of the category of low income earners in the process of economic growth are discussed, paying particular attention to improvements in employment, income and nutritional consequences of such growth. The briefs of some research findings are drawn from longer studies on the effects of rural infrastructure on agricultural production, employment and income in Bangladesh (R. Ahmed), the degree of provision and use of infrastructural services in India and Zambia (S. Wanmali); effects on nutrition in Bangladesh and Zambia of rural infrastructural development (S.K. Kumar); infrastructure, agricultural commercialization and food security in Guatemala (J. von Braun); education and infrastructure investment in rural areas (R.H. Sabot); adoption of modern farm technology and rural electrification in Brazil (S.A. Vosti); and costs and benefits of infrastructural development in Costa Rica (R. Celis).

2. Akbar, M.S. and Roy, S.K. 1988.
Combating nutritional disorders: what promises?
Dhaka Shishu. (children) Hosp. **4**: 18-25.

3. Alam, J. 1988.
Organizing the rural poor and its impact: the experience of selected non-governmental and governmental organizations in Bangladesh.
Economic Bulletin for Asia and the Pacific. **39(1)**: 33-42.

This paper evaluates the impact of interventions made by non-governmental organizations (NGOs) and governmental organizations (GOs) on the socioeconomic conditions of Bangladesh's rural poor. Three important NGOs, namely, the Bangladesh Rural Advancement Committee, Proshika and Swanirvar Bangladesh, and two important GOs, namely, Grameen Bank and Rural Poor Programme of BRDB, are covered. Observations suggest that the NGOs/GOs have had a substantial, positive impact on the level of income, poverty and income inequality of the poorest section of the rural population. Benefits are recognized in terms of improvements in education, health, sanitation, family planning and nutritional state of the target groups (the poor landless). NGOs and GOs have been particularly successful in enhancing the skills, economic capabilities, income and productive employment of poor rural women. Such programmes were, however, less intensive in areas covered by cooperatives. Greater use needs to be made of the cooperative structure to extend these projects.

4. Anon. 1985.
Diarrhoeal diseases: combating the long-term effects: treating the whole child.
Dialogue on Diarrhoea. **Jun (21)**: 4-5.

5. Aziz, K.M.A., Hoque, B.A. and Huttly, S.R.A. 1990.
Water supply, sanitation and hygiene education: report of a health impact study in Mirzapur, Bangladesh.
Washington, D.C.; UNDP/World Bank. WASH Report Series, Water and Sanitation Program. **1**.

A study of the health impact of an integrated project comprising handpumps, improved latrines, and hygiene education in a rural area of Bangladesh in the Mirzapur region is reported. In all, 148 Tara handpumps (1 for every 33 inhabitants) were installed to supply

drinking water and, one year later, pour-flush latrines of an experimental double-pit design were provided in every household. A hygiene education programme using household visits, group discussion and training sessions was implemented. The project resulted in greatly improved defecation habits amongst the villagers. A significant impact on childhood diarrhoeal disease was noted. The prevalence of Ascaris infection was reduced by more than one third. However, no impact was detected on the nutritional state of small children.

6. Kumar, S.; *et al* 1985.
   Effects on nutritional status of food for work programmes.
   Dhaka; BAN/BIDS TP/Dev/CJ.

7. Bangladesh Rural Advancement Committee. 1987.
   The health, family planning and nutrition programme of the Manikganj Integrated Project.
   Dhaka; Bangladesh Rural Advancement Committee 1987 (internal document).

8. Briend, A., Hasan, K.Z., Aziz, K.M. and Hoque, B.A. 1989.
   Are diarrhoea control programmes likely to reduce childhood malnutrition? Observations from rural Bangladesh.
   Lancet. **2(8658)**: 319-322.
   See Section 2.11, reference 16.

9. Brownrigg, L. 1985.
   Home gardening in international development: what the literature shows (including an annotated bibliography, and inventories of international organizations involved in home gardening and their projects).
   Washington, D.C., USA; League for International Food Education.

Literature on home gardens and gardening projects worldwide is reviewed and the activities of major international organizations concerned with home food production systems documented. In the first section the review discusses the different ways that the home garden has been defined in the literature. The historical development of home gardening and gardening traditions in and between major world cultures are reviewed and for each garden 'type' a table of the major plants raised in it in English, Latin and the local language is given. The second part then considers economic and nutritional studies that have been conducted on home gardening and their implications for home gardeners and gardening

projects in the USA and overseas. It discusses where and how gardening shows up in international development programmes; gives detailed case histories of a major gardening project in Nigeria, Chile and Mauritania; profiles three projects in Bangladesh, Senegal and Haiti, and discusses the successes and failures of each. Several special issues relevant to gardening projects are highlighted, including the relationship of home to school and market gardens, the role of women as home gardeners, and research that needs to be undertaken to exploit the potential of home gardening as a development technology.

10. Center on Integrated Rural Development for Asia and the Pacific. 1985.
    Kitchen gardening and home-level processing of food (phase 1): an experiment in Comilla, Bangladesh, December 1984 to September 1985.
    Bangladesh; Centre on Integrated Rural Development for Asia and the Pacific. CIRDAP Training Series. **23**.

This is a report of the kitchen gardening and home-level food processing project carried out in two villages in Comilla Sadar Upazila, Bangladesh. The general objective of the project, which was sponsored by CIRDAP and implemented by the Bangladesh Academy for Rural Development in Comilla, was to involve poor women in the villages in the development process by exploring new areas for generating employment and income. Specifically, the project aimed to train the women to make maximum use of space available for kitchen gardens, to train them in efficient systems of food processing and preservation, to make them aware of the nutritional requirements of their families, and to generate income by developing entrepreneurship in the field of food production and processing. The report reviews the activities of the first phase of the project and identifies its successes and problems. Recommendations are made for supporting its continuation in an improved manner, including better access to credit, the provision of further food processing equipment, and technical supervision provided by a resident food scientist.

11. Choudhury, A.Y. and Bhuiyan, A. 1990.
    Periodic crisis, public health intervention and severe malnutrition among children in a rural area of Bangladesh.
    Dhaka; Programme for the Introduction and Adaptation of Contraceptive Technology.

12. Fauveau, V., Briend, A., Chakraborty, J. and Sarder, A.M. 1990.
The contribution of severe malnutrition to child mortality in rural Bangladesh: implications for targeting nutritional interventions.
Food Nutr. Bull. **12**: 215-219.
See Section 2.11, reference 29.

13. Fauveau, V., Wojtyniak, B., Chakraborty, J., Sarder, A.M. and Briend, A. 1990.
The effect of maternal and child health and family planning services on mortality: is prevention enough?
Br. Med. J. **301**: 103-107.

14. Fauveau, V., Stewart, M.K., Chakraborty, J. and Khan, S.A. 1992.
Impact on mortality of a community-based programme to control acute lower respiratory tract infections.
Bull World Health Organ. **70**: 109-116.
See section 2.10, reference 29.

15. Fugelsang, A. and Chandler, D. 1987.
The paradigm of communication in development: from knowledge transfer to community participation - lessons from the Grameen Bank, Bangladesh.
Rome; Food and Agriculture Organization of the United Nations. Development Communication Case Study.

16. Hanman, F. H. 1986.
Alternative ways of incorporating women concerns in farming systems research sites.
In: Report of the Asian Rice Farming Systems Working Group. 17th Asian Rice Farming Systems Working Group meeting, 5-11 October 1986.
Manila, Philippines; International Rice Research Institute: 216-233.

This paper first reviews the current place of women in Bangladesh's agriculture. Research and development institutions concerned with the welfare of women farmers are briefly presented, and the role of women in the farm household (referred to as the homestead) is discussed. The paper outlines various strategies for improving the general welfare of women at both homestead and village levels. It recommends the setting up of a 'Comprehensive Women Development Program' (CWPD), with the functions of: (1) integrated development

packages; (2) coordinating the activities of all research and development institutions; and (3) identifying areas of cooperation between local government officials and village leaders. With specific reference to farming systems research projects, the CWPD will tackle issues of institutional development, socioeconomic improvement, development of appropriate technology, education, health, nutrition and population control.

17. Hasan, K.Z., Briend, A., Aziz, K.M., Hoque, B.A., Patwary, M.Y. and Huttly, S.R. 1989.
    Lack of impact of a water and sanitation intervention on the nutritional status of children in rural Bangladesh.
    Eur. J. Clin. Nutr. **43**: 837-843.

The nutritional impact of a water and sanitation intervention in a rural community of Bangladesh, comprising the provision of handpumps, construction of latrines and hygiene education was assessed. During three years, the quarterly anthropometric measures of about 200 children aged 12-35 months from the intervention community were compared with those of a similar number of children from a control area. The interventions reduced the incidence of diarrhoea by 25% among the children less than five years of age. There was no significant difference in nutritional status, however, between the two groups of children. Moreover, within the intervention area, indicators of water and latrine use were not significantly related to the children's nutritional status. This suggests that either the obtained reduction of diarrhoea was not large enough to have an impact on nutritional status or that diarrhoea is not an important cause of malnutrition in this community.

18. Henry, F.J., Huttly, S.R., Patwary, Y. and Aziz, K.M. 1990.
    Environmental sanitation, food and water contamination and diarrhoea in rural Bangladesh.
    Epidemiol Infect. **104**: 253-259.
    See Section 2.11, reference 39.

19. Hossain, M.M. 1986.
    Bangladesh seeks to strike child survival revolution.
    In Touch. **10**: 3-6.

20. Hossain, M.A. and Begum, S. 1988.
Studies on impact of integrated approach for solution of nutritional problems with self-help.
Bangladesh J. Nutr. **1**: 43-60.

21. Hudgens, R.E., Abedin, M.Z. and Khan, M.H. 1987.
Homestead in FSR: strategies and experiences from Bangladesh.
How systems work. Proceedings of Farming Systems Research Symposium, 1987. Kansas; Kansas State University. Farming Systems Research Paper Series **15**: 259-281.

This paper describes the strategies and institutional coordination involved in efforts to improve homestead (household unit) agricultural production in Bangladesh. The differentiation of homesteads within each agroclimatic zone on the basis of resource base and urban influences is presented, along with an overview of gender issues in decision making and the allocation of family labour within the homestead. Specific attention is given to crops, livestock and forestry products, as well as the principal interactions within homestead production systems. The impact of farming system research (FSR) activities on nutrition and income generation in homesteads is noted. Operational constraints to FSR intervention are highlighted. The future role of FSR is also discussed.

22. Lieberherr-Gardiol, F. 1987.
Women in development: a society project. Analyses of projects of the Directorate for Cooperation in Development and Humanitarian Aid (DDA).
Le developpement au feminin: un projet de societe. Analyses de projets de la Direction de la cooperation au developpement et de l'Aide humanitaire (DDA).
Switzerland; Annuaire Suisse-Tiers Monde, Institut Universitaire d'Etudes du Developpement. **7**: 243-259.

The article focuses on the role of women, the difficulties faced by them and the constraints placed on their participation in developing countries. Consideration is given to the inequalities and ambiguities which exist with regard to women and development, for example, between female participation in economic production and their invisibility in economic statistics. Ambiguities are even found to exist in the objectives and terminology employed in development projects, which may further contribute to amplifying women's marginalization in society. An overview is given of the various projects undertaken by the

DDA to promote female participation and integration through areas such as health, nutrition, education and training in an integrated rural development perspective, and to encourage their active participation in international conferences. Further, the article focuses on two projects which, supported by the DDA, highlight the difficulties and limitations of encouraging female integration in development. The first is the creation in 1964 of the CFPA (Agricultural Professional Training Centres) in Chad, designed to promote integrated rural development and the adoption of technical progress in agriculture. The second is the Bangladesh Rural Advancement Committee which aimed to improve health in rural areas. Consideration is given to the objectives, strategies and effects of each project specifically as they relate to female participation.

23. Mahtab, N. 1989.

Health, education and nutrition of rural women in Bangladesh: the household interface.

In Krishnaraj, M.; Chanana, K. (eds.) Gender and the household domain: social and cultural dimensions.

New Delhi, India; Sage Publications India (Pvt) Ltd: 209-232.

The paper discusses three basic aspects of development with respect to rural women in Bangladesh, namely health, education and nutrition. Based mainly on secondary sources, the paper evaluates the policies adopted by the government to achieve the objectives set out in the Second Five Year Plan, and aims at revealing the extent to which the pronounced goals of the government have been met. The major factors which cause inappropriate policies are the cultural and structural aspects of the households in which women live. Whether related to health, nutrition or education, development efforts are negated since all three aspects are influenced by the position of women in the household and the values that determine their roles, responsibilities, and entitlements to family and social resources. These factors are often ignored when devising policies which could redress the gender imbalances. State policy often tends to reinforce the gender biases already existing at family and social levels.

24. Mellor, J.W. and Sobhan, R. 1985.

Technical papers: development impact of the Food-for-Work program in Bangladesh.

AID Research and Development Abstracts. **13,2,053.**

The development impact of the Food-For-Work (FFW) programme in Bangladesh is examined. Specifically, the report documents the impact of five types of agricultural infrastructure on agricultural production, household income and capital formation, the labour market, employment, consumer expenditures, and nutritional state. Results indicate that FFW projects, if properly selected, designed, implemented, and maintained, can have a substantial and positive impact on village economies and should thus be regarded as a way to build long-term rural infrastructures rather than solely as a vehicle for short-term economic relief. Results also indicate that the impact of agricultural infrastructure is greatly strengthened by improvements in the agricultural technology and more general infrastructure; the latter, accordingly, should be focused in areas where FFW projects create larger potential for agricultural development. The study also shows that: the success of an FFW project depends on the quality of its management; ongoing local maintenance is essential to the continued usefulness of rural infrastructures; and local governments have critical roles to play in mobilizing project resources.

25. Midmore, D.J., Ninez, V. and Venkataraman, R. 1991.
Household gardening projects in Asia: past experience and future directions.
Technical Bulletin - Asian Vegetable Research and Development Center **(19)**.

Market gardens and household gardens are a valuable source of income in developing countries, especially for women who have limited access to land resources. This report summarizes the discussions and recommendations of an international workshop on household garden projects, held in Bangkok, Thailand, on 13-15 May 1991. Participants from Asia and Latin America analysed the relevance and effectiveness of household food production. The focus of this particular report is on Asia, in an attempt to define alternative strategies for providing nutrition to low-income groups. Institution building required for the strategy is reviewed and lessons are drawn from past experiences with similar projects. Reference is made to case studies in the Philippines, Bangladesh and Thailand in the course of the analysis.

26. Natpracha, P. 1986.
Fisherwomen's activities in Bangladesh: a participatory approach to development.
Bay of Bengal News June. **22**: 18.
See Section 2.12, reference 3.

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27. Natpracha, P. and Williams, B. 1986.
Working with fisherwomen in Bangladesh.
In 1985 training for agriculture and rural development.
Rome; Food and Agriculture Organization. Economic and Social Development Series.**38**.
See Section 2.12, reference 4.

28. Nilsson, L. and Nycander, L. 1986.
Food, nutrition and society. A study in two fishing communities in south-east India.
Stockholm; Development Study Unit, Department of Social Anthropology, University of Stockholm. Working Paper **2**.
See Section 2.12, reference 5.

29. Pinstrup-Andersen, P. 1988.
Assuring food security and adequate nutrition for the poor.
In Bell, D. E. and Reich, M.R. (eds.) Health, nutrition and economic crises. Approaches to policy in the Third World.
Dover, Massachussetts, USA; Auburn House Publishing Company: 147-175.

A wide variety of food price subsidies and food distribution programmes in different countries are examined. The programmes use different methods and concentrated on different commodities. These programmes were found to contribute significantly to the real income of the poor, as is shown by evidence from Sri Lanka, Egypt, Bangladesh, Kerala State (in India), Mexico, the Philippines, and elsewhere. Food price subsidies and distribution programmes may, therefore, have a useful place in protecting low-income families against the adverse effects of economic adjustment programmes. It is not easy, however,to design them in ways that will simultaneously reach the most needy groups, fit within tight budgets, and attract continuing political support.

30. Quanine, J. 1989.
Women and nutrition: the Grameen Bank experience.
Food Nutr Bull. **11**: 64-66.

The Grameen Bank was set up in Bangladesh in 1983 with the primary objective of raising the income and standard of living in the most disadvantaged sections of the rural

community. Access to credit is provided for the landless poor who previously were barred from formal lending institutions because of lack of collateral. Women have benefitted particularly, as there has been a noticeable rise in their status in the family and community, as well as improvements in their homes and the nutritional state of their children.

31. Rabbani, G.H. 1985.
Intestinal helminth infection and malnutrition: the role of individual versus mass chemotherapy.
Bangladesh J. Child Health. **9**: 45-52.

32. Rogers, B.L. and Youssef, N. 1988.
The importance of womens' involvement in economic activities in the improvement of child nutrition and health.
Food Nutr. Bull. **10**: 33-41.

33. Stanton, B.F., Clemens, J.D. and Khair, T. 1988.
Educational intervention for altering water-sanitation behaviour to reduce childhood diarrhoea in urban Bangladesh: impact on nutritional status.
Am. J. Clin. Nutr. **48**: 1166-1172.

We evaluated whether an educational intervention that was effective in reducing childhood diarrhoea also improved childhood nutritional status. Fifty-one communities of 38 families each were randomized to receive the intervention or no intervention. During one year of follow-up the rate of diarrhoea (per 100 week) in children less than six year in the intervention group was 5.89 episodes whereas that in the nonintervention group was 7.55 episodes (protective efficacy 22%; p less than 0.0001). During the same follow-up period children in both groups exhibited comparable patterns of weight gain; one year after the intervention the mean weight for age of children in both groups was 76% of the NCHS standard. No significant differences were observed in the proportion of each group that experienced a major deterioration or improvement of nutritional status. We conclude that an intervention that reduces rates of childhood diarrhoea may not necessarily also improve nutritional status.

34. Sternin, J. 1989.
Stirrings of new life: as village women join hands in Bangladesh.
Future (New Delhi). **26-27**: 59-62.

The Bangladeshi village woman is the most disadvantaged and undervalued member of the community, considered an economic burden and a non-productive family member. The Women's Programme of Save the Children (USA), an integral component of a comprehensive, community based integrated rural development programme, has now been introduced into 21 villages to assist 60 000 villagers to acquire the material and human resources required to assume the primary responsibility for improving their lives and those of their children. The ultimate objective is to help women broaden their social and economic horizons, thus enabling them to assert control over their lives, to encourage a change in the community's perceptions and attitudes towards women, and to address the tragic inequalities. The establishment of Women's Savings Groups, as part of this Women's Programme, is also designed to enable women to join together, to save and invest money, to acquire new skills including bookkeeping, money management and literacy, as well as to provide them with a sense of competence. Indeed, since the programme's inception, over 5000 women have joined together in more than 520 savings groups. It is concluded that these programmes, designed exclusively for women, have enabled women to demonstrate their ability to contribute directly to their families' welfare, have led to their improved nutritional status and enhanced survival, and promoted a dramatic increase in the perceived value attached to female life.

35. Thilstead, S. 1989.
Nutrition status and intervention in the urban slums.
Paper presented at BRAC seminar: Nutrition Situation in Bangladesh, October 3. Dhaka.

36. Tomkins, A. 1987.
Improving nutrition in developing countries: can primary health care help.
Trop. Med. Parasitol. **38**: 26-32.

37. Torres, A.B.de. and Hall, A.J. (De Torres, A.B.) 1989.
A community-based action research project for rural children and their families: a monitoring and evaluation system.
Dhaka, Bangladesh; Centre on Integrated Rural Development for Asia and the Pacific. CIRDAP Action Research Series. **6**.

During 1984-86, CIRDAP launched the Integrated National Action for Rural Children and their Families Project in three member countries, namely Bangladesh, Nepal and Sri Lanka,

with a view to increasing welfare and socioeconomic development. The project was subsequently evaluated during 1987/88 period, and findings are presented. In Bangladesh, the project initially attracted the support and participation of the target population, especially rural children and women. The participating agencies' support was also ensured. In the absence of any major thrust to improve the socioeconomic condition of the target families, apprehension has been expressed about the retention of initial enthusiasm over time. The Sri Lankan project has also been, with a lone exception, successful. The rural mothers and their children did benefit from the project activities in terms of enhanced enrolment, nutrition education and better sanitation and health facilities. Income-generating activities were also initiated. The active support and participation of the local people infused them with a sense of confidence. The Children's Secretariat was crucial to the success of the project. Nepal, on the other hand, presents a relatively discouraging picture because the project was not very successful in creating a sense of continued enthusiasm among the target population. Some income-generating, health and family planning activities were initiated but they were not properly followed-up. The varying experiences gathered from the project nevertheless point to the continued importance of community participation for successful implementation of an integrated rural development project of this nature.

38. Torres, A.B. de (De Torres, A.B.) 1989.
Kitchen garden and homebased productive activities in rural Bangladesh. Dhaka, Bangladesh; Centre on Integrated Rural Development for Asia and the Pacific. CIRDAP Action Research Series. 7.

The report focuses on small scale home-based productive activities in Bangladesh with emphasis on vegetable gardening as entry point, and its implication for nutrition and income-generating activities. The introduction describes the major shift in policy in developing homestead-based productive activities at the household and community level with people's participation and with greater use of local inputs. The importance of kitchen (vegetable) gardening and its role in increasing food production, income and in enhancing the nutritional state at the household and community level are described. The vegetable production status, potential and constraints in Bangladesh are also dealt with. Finally, an analysis of the work done on a kitchen garden project in two villages in Comilla, Bangladesh, is presented with summary, conclusions and recommendations for necessary remedial actions. The slow and gradual awakening and the socioeconomic interest of women target beneficiaries will initiate a follow-up action on a set of integrated development activities.

39. USAID

Executive summaries of evaluations and special studies conducted for AID in Asia and Near East in fiscal year 1986.

Washington; USA, Agency for International Development, Office of Development Planning, Bureau for Asia and the Near East.

In keeping with the emphasis of the US Agency for International Development (AID) on using evaluation findings to improve project planning and implementation, the Asia and Near East Bureau have prepared a collection of summaries of evaluations and special studies of AID-supported projects and programmes in Asia and the Near East during 1986 fiscal year. 83 reports are summarized. They deal with: agricultural research; agriculture; irrigation; rural development; health and population; family planning; nutrition; education and human resources; social forestry; energy; watershed development; and private voluntary organizations. The reports are arranged by the countries in which the projects were implemented, namely: Bangladesh, Egypt, India, Indonesia, Italy, Jordan, Morocco, Nepal, Oman, Pakistan, Philippines, Portugal, Sri Lanka, Thailand, Tunisia and Yemen.

40. World Health Organization, Regional Office for South-East Asia. 1985.

The Pyongyang conference. Primary health care in action.

SEARO Regional Health Papers, Regional Office for South-East Asia, World Health Organization **6**.

The book is based on recommendations and papers presented at a conference in Pyongyang, Korea Democratic People's Republic, in September 1983. Reports on primary health care from 19 countries are presented, as well as technical papers on national and international health development. Countries covered are Afghanistan, Bangladesh, Bhutan, Burma, China, Ethiopia, India, Indonesia, Iran, Jamaica, Korea Democratic People's Republic, Maldives, Malta, Mongolia, Nepal, Sri Lanka, Thailand, Tanzania and Yugoslavia. Case studies highlighting practical activities related to primary health care are also included, eg. maternal and child health, environmental health, nutrition, immunization, disease control and treatment, health education, and essential drugs.

2.14 Nutrition Rehabilitation

1. Ahmed, S.M., Islam, M.R. and Kabir, I. 1988.
Efficacy of oral rehydration solution in correcting serum potassium deficit of children in Bangladesh.
J. Trop. Pediatr. **34**: 24-27.

2. Alam, A.N., Khanum, S., Khatun, M., Molla, A. and Rahaman, M.M. 1985.
Acceptability and digestibility of a wheat syrup.
Nutr. Rep. Int. **31**: 463-468.

A wheat grain extract (carbohydrates 87, protein 11.5, fat 0.5, ash 1.8% and 3.99 kcal/g) was prepared as syrup and given to 15 children 3 to 6 years old recovering from severe malnutrition in a nutrition unit in Dhaka, Bangladesh. The syrup was well accepted and coefficients of absorption were 90.3 plus or minus 3.1% for energy and 78.8 plus or minus 4.1% for nitrogen.

3. Alam, A.N., Sarker, S.A., Molla, A.M. and Rahaman, M.M. 1987.
Hydrolysed wheat based oral rehydration solution for acute diarrhoea.
Arch. Dis. Child. **62**: 440-444.

4. Ali, S.M.K. and Hossain, M.M. 1988.
Bedside assessment of nutritional status of patients.
Bangladesh J. Nutr. **1**: 14-56.

5. Bari, A., Rahman, A.S.M.M., Molla, A.M. and Greenough, W.B., III. 1989.
Rice-based oral rehydration solution shown to be better than glucose-ORS as treatment of non-dysenteric diarrhoea in children in rural Bangladesh.
Journal of Diarrhoeal Diseases Research. **7**: 1-7.

Mothers living in rural Bangladesh were provided with rice-based oral rehydration solution (rice-ORS) (group A) or glucose-ORS (group B) for treating non-dysenteric diarrhoea in children under 5 years old. Mothers living in a third area (group C) were advised to use locally available treatment facilities, mainly unregistered medical practitioners. The incidence and duration of diarrhoea was recorded in all children during 2 years. The

outcome of each episode was recorded as a success if the mother reported her child had recovered or as a failure if the child died or was admitted to hospital. Mothers in group A used rice-ORS as the only treatment for 71% of episodes of non-dysenteric diarrhoea, mothers in group B used glucose-ORS as the only treatment in 60% of episodes, while mothers in group C used drugs alone in 55% of episodes. Almost all children recovered but the duration of diarrhoea differed significantly between groups: in the group treated with rice-ORS, 60% of children recovered within 3 days and less than 1% had diarrhoea which lasted for more than 14 days. By the criteria of early recovery and low rate of prolongation of diarrhoea, rice-ORS was better than glucose-ORS.

6. Greenough, W.B. and Khin-Maung-U. 1991.
Cereal-based oral rehydration therapy. II. Strategic issues for its implementation in national diarrhoeal disease control programs.
J. Pediatr. **118**: S80-S85.

Field studies in Bangladesh demonstrated that after proper training, village mothers were able to prepare and use rice-based, salt-enriched oral rehydration solutions containing safe concentrations of sodium, and were capable of achieving significantly fewer treatment failures and a reduction in the duration of diarrhoea than with glucose-based oral rehydration solutions (ORS). An additional longitudinal study showed that improved growth and weight gain occurred with the consistent use of ORS; the effect was greater when rice-based ORS were used. In addition, the following possible limitations and benefits of cereal-based oral rehydration therapy, which are relevant to the strategies for its implementation in national diarrhoeal disease control programs, are discussed: safety, osmolarity, hypernatremia, spoiling, effectiveness, rehydration ability, reduction in diarrhoea volume and duration, nutritional effects, effect on food intake, acceptance and usage by care givers, training of health workers, self-reliance of families, effect on other child survival activities, costs, potential problems in changing to cereal-based ORS, and the role of industrial production in packaged cereal-based ORS.

7. Henning, B., Stewart, K., Zaman, K., Alam, A.N., Brown, K.H. and Black, R.E. 1992.
Lack of therapeutic efficacy of vitamin A for non-cholera, watery diarrhoea in Bangladeshi children.
Eur. J. Clin. Nutr. **46**: 437-443.
See Section 2.11, reference 36.

8. Khanum, S. and Kabir, I. 1989.
Survival and growth of severe protein-energy-malnutrition (PEM) children 2 years after nutrition rehabilitation in an urban nutrition centre in Bangladesh [letter]
J. Trop. Pediatr. **35**: 138-139.

9. Khanum, S., Diamond, H., Rahman, H. and Kabir, I. 1987.
Severe protein-energy malnutrition in urban Dhaka and response to treatment.
Bangladesh J. Nutr. **1**: 1-8.

10. Khanum, S., Alam, A.N., Anwar, I., Akbar Ali, M. and Mujibur Rahaman, M. 1988.
Effect of zinc supplementation on the dietary intake and weight gain of Bangladeshi children recovering from protein-energy malnutrition.
Eur. J. Clin. Nutr. **42**: 709-714.

Sixty severely malnourished children aged between 5 and 60 months were studied during nutritional rehabilitation. They all received a rice-based diet ad libitum plus vitamins and iron supplementation. Thirty children received zinc supplements (10 mg/kg/day for those weighing less than 6 kg and 50 mg daily for those over 6 kg) on a random basis. Zinc was started from the 15th hospital day when they were free of infection and continued for a period of 3 weeks. Both groups had a mean energy intake of 200 kcal/kg/day, but the majority of the supplemented children had a better rate of weight gain: 66 per cent of the supplemented compared with 33 per cent of the controls gained more than 10 g/kg body weight/day. Moreover, 76 per cent of the supplemented children compared with 23 per cent of the controls were over 90 per cent of Harvard median weight for height on discharge. It appears from this study that zinc supplementation promotes growth and enhances the rate of clinical recovery from severe PEM.

11. Mizanur Rahman, A.S.M., Bari, A. and Molla, A.M. 1991.
Rice-ORS shortens the duration of watery diarrhoeas. Observation from rural Bangladesh.
Trop. Geogr. Med. **43**: 23-27.

In rural Bangladesh, standard glucose based oral rehydration salt (glucose-ORS) and rice based oral rehydration salt (rice-ORS) were compared as home treatment for watery diarrhoea. Using identical supply systems, packaged glucose-ORS was provided in 1 area and packets of rice-ORS in another. Mothers of less than 5 children in each area were

trained in the preparation and use of the respective ORS. A third area, where no ORS was provided from the study source, served as comparison. In two years of surveillance and follow-up, about 10 000 diarrhoeal episodes were detected in each area, one-third of which were watery diarrhoea. Rice-ORS alone was used to treat 74% of these episodes and glucose-ORS alone for 65% of the episodes in the respective areas. Drugs were the main treatment regimen used in the comparison area. Results of the study showed that rice-ORS treated episodes of watery diarrhoea ended with shorter duration (median duration two days vs. four days) and fewer hospitalisations (0.1 vs. 0.5%) compared to those treated with glucose-ORS. Although these differences were statistically significant, diarrhoeal mortality was unaffected by the use of either ORS under the study situation.

12. Molla, A.M. and Molla, A. 1991.
Effect of antibiotics on food intake and absorption of nutrients for children with diarrhoea due to Shigella.
Rev. Infect. Dis. **13**: S347-S350.

13. Molla, A.M., Molla, A. and Khatun, M. 1986.
Does oral rehydration therapy alter food consumption and absorption of nutrients in children with cholera?
J. Trop. Med. Hyg. **89**: 113-117.

In order to estimate consumption of food and absorption of nutrients, a metabolic balance study was conducted in 47 children between one and five years old, suffering from acute cholera. Twenty-two of the children were treated by intravenous solution (IV) only and 25 others by oral rehydration along with intravenous solution (ORS/IV) when necessary. After initial rehydration a nonabsorbable charcoal marker was fed to the patients followed by a typical Bangladeshi home food of known composition offered ad libitum. Appearance of the first marker in the faeces was taken as zero hour (0 hour); at 72 four a second marker was fed. Faeces, urine and vomitus were collected up to the appearance of the second marker. Intake of IV fluid, ORS and any other fluid or food were recorded accurately. Samples of faeces, urine and vomitus were analysed for energy, fat and nitrogen. Consumption of nutrients and absorption in both groups were calculated. There was no significant difference in the intake or absorption of energy or carbohydrate between the two groups. The consumption of fat and protein was slightly, but significantly, lower in the ORS/IV group during the acute stage of diarrhoea than in the IV group. Absorption of nitrogen was significantly lower in the ORS/IV group, but absorption of fat was not significantly impaired.

Vomiting was significantly higher in the ORS/IV group. The differences in the consumption and absorption of nutrients between the two groups were transient and came to the same level within two weeks after recovery.

14. Molla, A.M., Molla, A., Rohde, J. and Greenough, W.B. III. 1989.
Turning off the diarrhoea: the role of food and ORS.
J. Pediatr. Gastroenterol Nutr. **8**: 81-84.

15. Molla, A.M., Nath, S.K., Molla, A. and Khatun, M. 1989.
Food-based oral rehydration salt solution for acute diarrhoea.
Lancet. **2**: 429-431.

16. Molla, A.M., Molla, A., Khatun, N. and Khatun, M. 1990.
Feeding in diarrhea during the acute stage and after recovery: experience in developing countries.
In Lifschitz, C.H.; Nichols, B.L. (eds.) Malnutrition in Chronic Diet-Associated. Infantile Diarrhea: Diagnosis and Managements
San Diego; Academic Press: 293-303.

17. Nielsen, C.C., Islam, M.A., Thilsted, S.H. and Ishrat, F. 1992.
Why do some families become defaulters in a hospital based nutrition rehabilitation follow-up programme?
Trop. Geogr. Med. **44**: 346-351.

18. Rahman, A.M. and Bari, A. 1990.
Feasibility of home treatment of diarrhoea with packaged rice-ORS.
Journal of Diarrhoeal Diseases Research. **8**: 18-23.

19. Roy, S.K., Alam, A.N., Majid, N., Khan, A.M., Hamadani, J. and Shome, G.P. 1989.
Persistent diarrhoea: a preliminary report on clinical features and dietary therapy in Bangladeshi children.
J. Trop. Pediatr. **35**: 55-59.

Twenty-six infants and children aged 2-24 months suffering from diarrhoea for more than two weeks were studied in the ICDDRB's Dhaka Treatment Centre. They presented with

watery diarrhoea and the majority had moderate dehydration. A stool pathogen was isolated in only one infant. Systemic infections co-existed in half of the subjects. Subjects between 4 and 12 months of age were moderately malnourished. The remainder were severely malnourished. A range of therapeutic diets were given according to the clinical progress of the subjects. Three children improved with a milk-based diet, two with a soya-based proprietary diet, eight with a rice-based diet, 12 with comminuted chicken, and one with yoghurt. Response to various diets appeared to be age related. Body weight of 21 subjects deteriorated before cessation of diarrhoea. Case fatality rate was 11% due to septicaemia and bronchopneumonia. Most persistent diarrhoea patients without severe concurrent systemic infections were effectively treated using various locally prepared diets.

20. Roy, S.K., Haider, R., Akbar, M.S., Alam, A.N., Khatun, M. and Eeckels, R. 1990. Persistent diarrhoea: clinical efficacy and nutrient absorption with a rice based diet. *Arch. Dis. Child.* **65**: 294-297.

21. Samadi, A.R., Ahmed, S.M., Bardham, P.K., Huq, M.I., Islam, M.R. and Wahed, M.A. 1985.
Treatment of infantile diarrhoea with standard oral rehydration solution and early introduction of milk feeds.
J. Trop. Pediatr. **31**: 162-166.

22. Simmer, K., Khanum, S., Carlsson, L. and Thompson, R.P. 1988.
Nutritional rehabilitation in Bangladesh--the importance of zinc.
Am. J. Clin. Nutr. **47**: 1036-1040.

The aim was to investigate whether zinc deficiency becomes apparent during nutritional rehabilitation and limits the rate of weight gain. Twenty-five severely malnourished children, who were admitted to the Children's Nutrition Unit in Bangladesh, were alternately allocated to two groups. Their mean dietary Zinc (Zn) intake was 3.7 mg/day and mean calorie intake greater than 150 kcal kg^{-1} day^{-1}; one group received a daily Zn supplement of 50 mg for two weeks. During the first week, weight gain was similar in the two groups, but during the second week, weight gain was 73% more in the Zn-supplemented group (8.83 ± 1.56 vs 5.09 ± 1.62 g kg^{-1} day^{-1}). The 95% confidence limits were 0.88 less to 8.36 $g.kg^{-1}$ day^{-1} more gain in children receiving Zn supplements. The results strongly suggest that Zn supplements are important to severely malnourished children during nutritional rehabilitation. Polymorphonuclear (PMN) cell Zn increased in the group receiving Zn supplements (p less

than 0.001), confirming that the Zn content of PMN cells reflects available Zn.

23. Stanton, B.F., Phillips, N., Clemens, J.D., Wroot, B., Gafur, Z., Fleischman, J. and Khair, T. 1987.
An urban nutrition education and rehabilitation centre: a description of the programme and change in nutritional status of children who were enrolled.
Trop. Geogr. Med. **39**: 287-295.

A report on a community-based day care nutrition rehabilitation and education centre which was established by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) in a slum in Dhaka, Bangladesh. Between March-December, 1985 approximately 10 children aged one to five years with a percent weight for height (% wt/ht) of 60 to 85 were enrolled in each of nine sessions which were three to five weeks long. The children were fed five meals and two snacks daily made from locally available inexpensive foods. A nutrition education programme, developed with input from several feeding centres in Dhaka, included daily lessons, participatory cooking and personal hygiene sessions. Of the 85 children entering the programme, 82 (95%) completed three or more weeks. Relative to baseline, a median increase of 8.7% wt/ht was observed at five weeks (p less than 0.001), with the greatest improvement occurring in those children presenting with the lowest weights. Median increases of 7.2 and 7.4% wt/ht were noted 6 and 10 months after admission, respectively. Gender and minor illness did not have a significant impact on change in nutritional status. Poor performance of mothers in assigned chores was associated with inferior improvement in nutritional status five weeks but not six months post-admission. These results suggest that the intervention implemented by the centre may have been effective in improving nutritional status and that more rigorous evaluation of participants in relation to suitably matched concurrent controls should be performed.

24. Stanton, B., Clemens, J,, Khair, T. and Shahid, N.S. 1986.
Follow-up of children discharged from hospital after treatment for diarrhoea in urban Bangladesh.
Trop. Geogr. Med. **38**: 113-118.

To determine the subsequent mortality of urban children in Bangladesh after an episode of diarrhoea 74 children aged two to five years were visited in their homes four months after they had received treatment for diarrhoea at the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). Parents and health workers were questioned about their

perceptions of the nutritional status of the children at this time. Although 43% of the children were severely malnourished and 28% were moderately malnourished at the time of presentation to ICDDR,B only two deaths (3%) had occurred in the cohort during follow-up. No deaths were noted for the severely malnourished two year old group, which contrasts with the high post-discharge mortality (33%) in similarly malnourished two year old Bangladeshi children living in rural areas ($p = 0.004$). At the time of follow-up parents were significantly ($p = 0.02$) less likely than health workers to recognize malnutrition in the children. It is suggested that there may be substantial rural-urban differences in the survival of children after receiving treatment for diarrhoea. Further, it is noted that parental under-recognition of malnutrition may impede the nutritional rehabilitation that is necessary to avert much of the morbidity and mortality that ensues after an episode of diarrhoea.

25. Talukder, M.Q-K. and Das. D.K. 1986.
Recovery of severely malnourished children with diarrhoea with full energy feeding from the beginning of management.
Bangladesh J. Child Health. **10**: 119-125.

26. Talukder, M.Q-K., Kabir, A.M.R.L. and Kawser, C.A. 1988.
Feeding pattern, sociodynamics, clinical spectrum and recovery of severely malnourished children,
Bangladesh J. Child Health. **12**: 14-21.

27. Uddin, M.B. 1989.
Planning exercise for preparing a balanced food chart for an individual.
Bangladesh J. Nutr. **2**: 25-37.

2.15 Supplementation and Fortification Studies

1. Ahmad, K., Jahan, K. 1988.
Protein-energy supplementation of 0-2 year old children.
Bangladesh J. Nutr. **1**: 35-42.

2. Alwang, J. 1991.
A literature review of public food distribution in Bangladesh.
Washington D.C.; International Food Policy Research Institute. Working Paper **1**.

3. Fauveau, C., Siddiqui, M., Briend, A., Silimperi, D.R., Begum, N. and Fauveau, V. 1992.

Limited impact of a targeted food supplementation programme in Bangladeshi urban slum children.

Ann. Trop. Paediatr. **12**: 41-46.

An energy-dense supplementary food, together with nutrition education, was given to a group of moderately malnourished children aged 6-12 months in a poor slum community of urban Bangladesh. An age- and sex-matched control group received only nutrition education. Both groups were followed monthly with respect to weight gain and morbidity. The purpose of the study was to assess the differential impact of a targeted supplementary feeding programme with nutrition education and a nutrition education programme alone on monthly weight gain during six months. During the first three months of the intervention, the monthly weight gain of the supplemented children was 205 g versus 159 g in the control children (p less than 0.05). In the following three months, differences in weight gain were no more significant. Several possible explanations for this transient impact are discussed. It is suggested that nutrition education in the control group may have been responsible for the limited difference between the two groups, but seasonal and epidemiological factors may also have played a part.

4. Henning, B., Stewart, K., Zaman, K., Alam, A.N., Brown, K.H. and Black, R.E.

Lack of therapeutic efficacy of vitamin A for non-cholera, watery diarrhoea in Bangladeshi children.

Eur. J. Clin. Nutr. **46**: 437-443.

See Section 2.11, reference 36.

5. Kabir, M.H. 1986.

Breastfeeding supplements in urban and rural areas of Bangladesh.

Rur. Demogr. **13**: 1-11.

6. Kabirullah, M., Ahmed, R. and Khan, S.A. 1988.

Fish protein concentrate (FPC). Part 3. Studies on the nutritive value of Bangladesh FPC type-B and its potency to supplement a cereal-pulse basal diet.

Bangladesh Journal of Scientific Ind Res. **23**: 12-23.

Nutritive value of Bangladesh fish protein concentrate (FPC) type-B and its value as a

supplement to a cereal-pulse basal diet (CP diet) was studied. Addition of 8% FPC in the CP diet (CPF diet) increased growth of rats more than FPC or skim milk (SMP diet) alone or the CP diet supplemented with SMP (CPS diet). In the regrowth of protein-malnourished rats, FPC was not different from the SMP diet and the CPF diet gave better growth than the SMP diet. The protein efficiency ratio of the CPF diet was less than that of CPS and SMP diets and higher than that of the other diets. Net protein utilisation of the CPF diet was higher than the CP diet, the same as the FPC diet and less than the other diets. Digestibility of the CPF diet was the same as the CPS diet. But the biological value of the CPF diet was higher than the FPC and CP diets, the same as the SMP diet and less than the CPS diet. The overall nutritive value of the CPF and CPS diets was higher than that of FPC and SMP diets, respectively, indicating that a mixture of an animal protein and plant proteins may give better results than animal protein alone. FPC as a source of quality protein with SMP to combat protein malnutrition is discussed.

7. Kabirullah, M., Mullick, N.I. and Faruque, O. 1990.
   Preparation of fish protein concentrates (FPC): determination of nutritive value of the FPC and the supplementary effect on cereal leguminous proteins.
   In Directory of abstracts of completed researches related to health, Research Scientists and Researchers of Bangladesh.
   Dhaka; Bangladesh Medical Research Council.

8. Kabirullah, M., Ahmed, R., Khan, S.A., Rubbi, S.F. and Faruque, O. 1991.
   A comparative study on the nutritive value of Bangladesh FPC type-B and Norwegian FPC type-B and their potency to supplement a cereal-pulse diet.
   Bangladesh Journal of Scientific and Industrial Research. **26**: 8-18.

Fish protein concentrate type-B from Bangladesh (BFPC) and Norway (NFPC) was fed to growing rats to study its nutritive value and potential to supplement a cereal-pulse (CP) diet. BFPC and NFPC had protein efficiency ratio (PER) values of 2.00 plus or minus 0.00 and 2.04 plus or minus 0.08, respectively, compared with 3.04 plus or minus 0.03 for milk protein. Supplementation of pulse protein about 5.3 g in the CP diet with FPC and milk protein significantly improved PER value, growth of normal rats, allowed compensatory growth of protein-malnourished rats and in some cases biological values. Results indicate that both FPC are comparable in their overall nutritive value. A combination of an animal protein with a plant protein increased the nutritive value of diets beyond that of animal protein fed alone. It is concluded that FPC may replace milk in supplementation of a CP

diet and provide a protein-rich food for vulnerable groups.

9. Kabirullah, M., Ahmed, R., Khan, S.A. and Shahjahan, M. 1991.
A comparative study on the nutritive value of Bangladesh FPC type-B and Norwegian FPC type-B and their potency to supplement a cereal-pulse diet.
In: Proceedings of the 5th Bangladesh Nutrition Seminar, **March: 54.**

10. Khanum, S., Alam, A.N., Anwar, I., Akbar Ali, M. and Mujibur Rahaman, M. 1988.
Effect of zinc supplementation on the dietary intake and weight gain of Bangladeshi children recovering from protein-energy malnutrition.
Eur. J. Clin. Nutr. **42**: 709-714.

Sixty severely malnourished children aged between 5 and 60 months were studied during nutritional rehabilitation. They all received a rice-based diet ad libitum plus vitamins and iron supplementation. Thirty children received zinc supplements (10 mg/kg/day for those weighing less than 6 kg and 50 mg daily for those over 6 kg) on a random basis. Zinc was started from the 15th hospital day when they were free of infection and continued for a period of three weeks. Both groups had a mean energy intake of 200 kcal/kg/day, but the majority of the supplemented children had a better rate of weight gain: 66% of the supplemented compared with 33% of the controls gained more than 10 g/kg body weight/day. Moreover, 76% of the supplemented children compared with 23% of the controls were over 90% of Harvard median weight for height on discharge. It appears from this study that zinc supplementation promotes growth and enhances the rate of clinical recovery from severe PEM.

11. Mannan, M.A. 1985.
Improvement of nutritional status with soybean.
In Touch. **9**: 24-27.

12. Martens, R.W. 1985.
Soybean: a rich source of protein.
In Touch. **9**: 18-21.

13. Mohiduzzaman, M., Chowdhury, M.I.H., Quazi, S. and Malek, M.A. 1988.
Fortification of chappati with added vitamin A.
Bangladesh J. Nutr. **2**: 8-12.

14. Nahar, B., Sayeed, S., Chowdhury, R. and Quazi, S. 1991.
Effect of diet counselling during pregnancy on the nutritional status of the newborn.
Dhaka University Studies. **Part E 6**: 17-24.

15. Saha, A.R. and Ahmad, K. 1989.
Iron and micronutrient supplementation after deworming: an effective measure to raise hemoglobin level of anemic children in rural Bangladesh.
Bangladesh J. Nutr. **2**: 1-7.

16. Simmer, K., Khanum, S., Carlsson, L. and Thompson, R.P. 1988.
Nutritional rehabilitation in Bangladesh--the importance of zinc.
Am. J. Clin. Nutr. **47**: 1036-1040.

See Section 2.14, reference 22.

2.16 Vitamin a Deficiency Prevention Programmes

1. Ahmad, K., Jahan, K. and Amin, M.N. 1988.
Studies on oral administration of retinol and a-carotene for raising serum retinol levels and cure of xerophthalmia in children with protein energy malnutrition.
Bangladesh J. Biol. Sci. **14-16**: 13-19.

2. Bangladesh National Nutrition Council 1987.
Proceedings of the national planning meetings for vitamin A programme, 28 March - 1 April. Dhaka.

3. Bangladesh Rural Advancement Committee. 1988.
The vitamin A capsule distribution programme: a coverage survey in six rural areas of Bangladesh.
Dhaka; Bangladesh Rural Advancement Committee.

4. Chowdhury, A.Y., Banu, L.A., Sultana, R. and Laila, R.A. 1990.
Formative research to aid communication development for promotion of vitamin A rich foods and capsules.
Dhaka; Programme for the Introduction and Adaptation Contraceptive Technology.

5. Cohen, N., Rahman, H., Mitra, M., Sprague, J., Islam, S., Leemhuis, de Regt, E. and Jalil, M.A. 1987.
Impact of massive doses of vitamin A on nutritional blindness in Bangladesh.
Am. J. Clin. Nutr. **45**: 970-976.

Impact of 6-monthly massive dosings of preschool-age children with oral vitamin A (VAC: 200,000 IU of oil soluble retinyl palmitate with 40 IU vitamin E) was evaluated in Bangladesh. In 100 sites, 11,889 households were visited and eyes of 22,335 children aged 3-71 months were examined. About half the rural target population and less than 20% urban slum population were being reached. Risk of night blindness was halved for children reportedly given VAC, although 2.5% of the reportedly protected population were still night blind. There was no significant reduction in prevalence of Bitot's spot. Risk of corneal ulcers or keratomalacia (X3A/B) was 2.7 times higher in children not given VAC. Based on reported coverage, efficacy of protection against potentially blinding corneal lesions was 63%. For maximum impact on eye lesions, massive dosing with vitamin A at ideally less than six-monthly intervals needs to be combined with other nutrition and health interventions.

6. Darnton-Hill, I. 1989.
Vitamin A deficiency in Bangladesh: prevention and control.
Dhaka, Helen Keller International and Voluntary Health Services Society.

7. Darnton-Hill, I., Sibanda, F., Mitra, M., Ali, M.M., Drexler, A.E., Rahman, H. and Khan, M.A.S. 1988.
Distribution of vitamin-A capsules for the prevention and control of vitamin-A deficiency in Bangladesh.
Food Nutr. Bull. **10**: 60-70.

The Nutritional Blindness Prevention Programme of Bangladesh (BPPB), within the Institute of Public Health, Nutrition and Dietetics (IPHN), is distributing vitamin A capsules via primary health care workers to improve children's diets in rural areas and to reduce prevalence of blindness and xerophthalmia. It appears to be generally accepted that the

system, comprising distribution, monitoring and assessment, is not working well. One of the problems identified is the relatively low priority given to the programme, especially compared with competing demands on the health system's time. Too few staff, apparently low motivation and awareness, insufficient local supervision, and lack of transport have all been cited as constraints. Recent anecdotal reports suggest, for example, that where the Expanded Programme of Immunization is taking place, vitamin-A distribution has been effectively halted. One of the likely effects of these problems is that the children who are most difficult to reach and who may also be those most at risk are the ones most likely not to be reached.

8. Helen Keller International. 1986.
Blindness prevention and child survival 1985/86. Annual report.
Dhaka; Helen Keller International.

9. Helen Keller International. 1986.
Directory of blindness prevention, eye hospitals and care of the blind in Bangladesh.
Helen Keller International and Royal Commonwealth Society for the Blind.
Dhaka; Royal Commonwealth Society for the Blind and Helen Keller International.

10. Institute of Public Health and Nutrition/United Nations Childrens Fund. 1990.
Nutrition blindness prevention programme evaluation report 1989.
Dhaka; Institute of Public Health and Nutrition/United Nations Childrens Fund.

11. Mia and Ahmadullah. 1986.
An interim evaluation of the WIF pilot project on Nutritional Blindness, Bangladesh.
Dhaka; Institute of Social Welfare and Research, Dhaka.

12. Mia and Ahmadullah. 1987.
Baseline study for nutritional blindness prevention project, Rangpur & Dinajpur.
Dhaka; Institute of Social Welfare and Research, Dhaka University.

13. Mohiduzzaman, M., Chowdhury, M.I.H., Quazi, S. and Malek, M.A. 1988.
Fortification of chappati with added vitamin A.
Bangladesh J. Nutr. **2**: 8-12.

14. Mushtaque, A., Chowdhury, R. and Kabir, Z.N. 1989.
Prevention of night-blindness in rural Bangladesh.
World Health Forum. **10**: 241-242.

15. Rahman, M.H. 1988.
History, current status and future strategy of nutritional blindness prevention programme of Bangladesh.
Bangladesh J. Nutr. **1**: 16-22.

2.17 Nutrition Education Programmes

1. Bhuiyan, S.A., Rahman, A.J., Rahman, M., Begum, J. and Akhter, S. 1989.
Assessment of a mobile training programme on nutrition for Bangladesh rural development board (BRDB) women's programme in Bangladesh.
Bangladesh Med. Res. Counc. Bull. **15**: 20-26.

About half of the total population of the country are women and without their active participation no development programme can be achieved. This study involved a total number of 690 trainees from 23 upazilas of different districts in Bangladesh. The results obtained from both pre and post tests were compared and analyzed to find out the impact of the mobile training programme on nutrition. The mean age of the trainees was 29.54. The mean number of children per trainee was 3.73 and the mean income was close to Taka 1048.26. Analysis of the results regarding knowledge of the training about nutrition at pre and post training stages reveal that at post training stage they were more aware of the importance of nutrition. The difference in knowledge level at pre-and post-training stages was statistically significant (P less than .001).

2. Bhuyan, M.A.H., Malek, M.A., Ahmed, N., Khan, M.N.U. and Chowdhury, M.M.H. 1988.
Performances of the selected rural women nutrition volunteers in nutrition education programmes.
Bangladesh J. Nutr. **2**: 13-17.

3. Brown, L., Ahmad, A. and Zeitlin, M. 1988.
Draft report of BRAC's nutrition education intervention: message development through behavioural trial methodology.
Dhaka; Bangladesh Rural Advancement Committee (unpublished).

4. Brown, L.V., Zeitlin, M.F., Peterson, K.E., Chowdhury, A.M., Rogers, B.L., Weld, L.H. and Gershoff, S.N. 1992.
Evaluation of the impact of weaning food messages on infant feeding practices and child growth in rural Bangladesh.
Am. J. Clin. Nutr. **56**: 994-1003.

In rural Bangladesh, a community-based weaning intervention used volunteers to teach complementary feeding to families of 62 breast-fed infants aged 6-12 months. Over five months, treatment children gained on average 0.46 SD (approximately 460 g) more in weight-for-age (WAZ) than the 55 control subjects, and were approximately 0.5 kg heavier at the final measure. The differences were statistically significant ($P < 0.001$). The percent median weight-for-age (WAPM) of treatment children held steady at 76% of the National Center for Health Statistics' reference, whereas the WAPM of control subjects dropped from 78% to 72%. The increase in percentage points of severe malnutrition (below -3 WAZ) was only 5% in the treatment group compared with 26% in the control subjects. Treatment children consumed a significantly greater percent of their energy and protein requirements from complementary foods than did control subjects. The affordable complementary foods consisted mainly of cereal porridge with oil and brown sugar. These findings suggest that educational interventions teaching families to feed hygienic, simple, cheap, energy-enriched complementary foods to breast-fed infants after 5-6 months can improve child growth, even under impoverished conditions.

5. Chowdhury, A.Y., Banu, L.A., Sultana, R. and Laila, R.A. 1990.
Formative research to aid communication development for promotion of vitamin A rich foods and capsules.
Dhaka; Programme for the Introduction and Adaptation Contraceptive Technology.

6. Chowdhury, M.M., Bhuyan, M.A. and Malek, M.A. 1987.
A study on the effect of nutrition education in changing knowledge, attitude and practice on food and related behaviour.
Bangladesh J. Nutr. **1**: 10-14.

7. Chowdhury, M.M., Bhuyan, M.A., Khan, M.N., Ahmed, N. and Malek, M.A. 1989.
Effect of retraining on nutrition among tribal women volunteers in Bangladesh.
Bangladesh Med. Res. Counc. Bull. **15**: 73-80.

Training programme on Nutrition was carried out on 42 tribal women nutrition volunteers from Rangamati, Khagrachari and Banderban districts of Chittagong Hill Tracts during July 1987 to June 1988. There were a basic training for 10 days and five retrainings of six days on the same group. Assessments on the level of their knowledge before and after each training were conducted by a standard questionnaire. Mean score obtained by the trainees initially was 46.28% which increased to 97.23% in the last round. Although the knowledge gain was found statistically significant in each retraining but the retention of knowledge in pre-test of each retraining was found statistically significant (P less than 0.001) up to second round (i.e. first retraining) and thereafter the retention was found insignificant (P greater than 0.05).

8. Edib, K. and Ahmad, K. 1989.
Effect of nutrition education on maternal diet during pregnancy and its impact on birth weight of babies in a low income group of mothers in Dhaka city.
Bangladesh J. Nutr. **2**: 27-32.

9. Faruque, A.J.M.O., Mullick, N.I., Begum, F. and Khan, N. 1991.
Promotion of home-made weaning foods in rural areas of Bangladesh: a comprehensive report.
Dhaka; Institute of Food Science and Technology, Bangladesh Council of Scientific and Industrial Research.

10. Hossain, A.M.M.M., Hafez, A. and Begum, N.Z. 1990.
The impact of nutrition education on intrafamilial distribution of food among literate and illiterate groups of women in a village of Bangladesh.
Bangladesh Med. J. **19**: 86-91.

11. Kabirullah, M., Ali, M.M. and Ibrahim, M. 1988.
Non-formal applied nutrition education programme with a group of students attending a vocational rehabilitation centre.
Bangladesh J. Nutr. **1**: 22-27.

12. Lindenbaum, S., Chakraborty, M. and Elias, M. 1985.
The influence of maternal education on infant and child mortality in Bangladesh. Dhaka; International Centre for Diarrhoeal Disease Research. ICDDR,B special publication **23**.

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Health, education and nutrition of rural women in Bangladesh: the household interface.
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The paper discusses three basic aspects of development with respect to rural women in Bangladesh, namely health, education and nutrition. Based mainly on secondary sources, the paper evaluates the policies adopted by the government to achieve the objectives set out in the Second Five Year Plan, and aims at revealing the extent to which the pronounced goals of the government have been met. The major factors which cause inappropriate policies are the cultural and structural aspects of the households in which women live. Whether related to health, nutrition or education, development efforts are negated since all three aspects are influenced by the position of women in the household and the values that determine their roles, responsibilities, and entitlements to family and social resources. These factors are often ignored when devising policies which could redress the gender imbalances. State policy often tends to reinforce the gender biases already existing at family and social levels.

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The Department of Agricultural Extension in Bangladesh has employed an increasing number of women since the mid-1980s in order to fulfill the technology needs of rural women. This article is based on a study aimed at assessing the extent of training needed by the female

block supervisors (FBSs) of the Department of Agricultural Extension (DAE) in Mymensingh district. An attempt was also made to explore the relationship between the selected characteristics of FBSs and their training needs. It was revealed that 46% of the FBSs felt a medium need for training while the rest demanded a greater extent of training in seven areas of their job responsibilities. The areas were: agricultural extension, motivation, leadership, homestead gardening and nutrition, backyard poultry development, food processing and preservation and beekeeping. The Chi-square test showed that characteristics of the respondents such as age, level of education, training received, mass media contact and problem confrontation of the FBSs had a significant positive relationship with their extent of training need.

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We evaluated whether an educational intervention that was effective in reducing childhood diarrhoea also improved childhood nutritional status. Fifty-one communities of 38 families each were randomized to receive the intervention or no intervention. During one year of follow-up the rate of diarrhoea (per 100 weeks) in children less than six years in the intervention group was 5.89 episodes whereas that in the nonintervention group was 7.55 episodes (protective efficacy 22%; p less than 0.0001). During the same follow-up period children in both groups exhibited comparable patterns of weight gain; one year after the intervention the mean weight for age of children in both groups was 76% of the NCHS

standard. No significant differences were observed in the proportion of each group that experienced a major deterioration or improvement of nutritional status. We conclude that an intervention that reduces rates of childhood diarrhoea may not necessarily also improve nutritional status.

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