LEVELS AND DIFFERENTIALS IN CHILD NUTRITIONAL STATUS AND MORBIDITY IN A RURAL AREA OF BANGLADESH

By

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DECLARATION

Except where otherwise indicated, this thesis is my own work.

December, 1983. Abbas Bhuiya

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ABSTRACT

This study investigates the levels and differentials in child nutritional status and morbidity in five villages of Bangladesh. Data for this study came from surveys conducted in 1981.

Anthropometric measurements of weight, height, and arm circumference are used to assess child nutritional status. Morbidity information is retrospective, covering the thirty days preceding the survey. Differentials in child nutritional status and morbidity have been examined for different household characteristics and sex of the children.

Malnutrition was highly prevalent among the children of the study villages. As regards morbidity, 65% of the children had some sort of illnesses in the week preceeding the survey. Differentials in child nutritional status for most of the household characteristics were found to exist, but for morbidity no such relationship was observed. The adverse effect of illness during the week preceding the survey on nutritional status was also found. The nutritional status of the children coming from lower status households was relatively more affected by illness episodes in the week prior to the survey. With regard to sex differentials, girls were found to be relatively more malnourished than boys, and the difference increased as the status of the household increased.

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CHAPTER 1

INTRODUCTION

1.1 The nutrition factor : its importance in human life.

The factor of nutrition begins playing a role when life begins in the mother's womb, as the fetus is able to synthesize its own carbohydrates, proteins and fats from glucose, amino-acids and other blood-borne metabolites obtained from the mother (Page, 1969 : 378). Modifications in the maternal hormonal system help to maintain the availability of nutrients to the foetus relatively independent of alterations in the maternal diet. When the maternal dietary intake reaches a critically low level, however, the present maternal nutrient intake, the past nutritional status of the mother, and the efficiency of conversion of maternal tissue into nutrient become crucial in affecting the birth weight of the newborn infant (Lechtig et al., 1979 : 79) and consequently the growth and development of the child (Burke and Stuart, 1948 : 119).

Malnutrition during the foetal period and infancy is associated with intellectual impairment. Severely malnourished children have brains smaller than average size (Monckeberg, 1969). Studies on both animal and human populations suggest that various parts of the brain have a once-only opportunity to grow properly during the late prenatal period and the first two years of post natal life. During that period even mild to moderate malnutrition may produce irreversible damage to the brain (Winick, 1969 : 667). It is quite probable that

satisfactory brain development during that critical period is a pre-requisite for satisfactory subsequent physical growth (Dobbing, 1974 : 2 ; Dobbing and Sands, 1973 : 757).

Malnutrition in childhood interferes with the ability to learn and concentrate and causes loss of learning time due to frequent illness during the most critical periods of learning. Available findings suggest that antecedent severe malnutrition in infancy is strongly associated with sub-optimal performance in the school age years (Cravioto and Delicardie, 1973 : 16). One study was of 36 severely malnourished Serbian children, aged 4 to 24 months, who were completely rehabilitated and subsequently examined between 7 and 14 years of age. It was found that their mean I.Q. level was significantly lower than their counterparts of the same age and same socio-economic background (Cabak and Najdanvic, 1965 : 532). A second study, by Klein et al. (1973, cited in Manocha, 1975 : 414) revealed that relatively taller children in the same age group performed better in I.Q. tests than their counterparts. A study of a group of Indonesian malnourished children, aged 2 to 4 years, with vitamin A deficiency also documented their significant lagging in I.Q. levels after rehabilitation (Liang et al., 1967 : 1290).

Birch (1972 : 773), after critically examining the effect of malnutrition on learning and intelligence, commented that malnutrition directly affects intellect by producing central nervous system damage, causing losses in learning time due to frequent illness and reducing responsiveness for a prolonged period after recovery. In most cases a malnourished child becomes apathetic and unresponsive to maternal and other stimulation. Sometimes the mother herself loses interest and

pays less attention to the child, and also becomes a victim of nutritionally induced lethargy (Berg, 1973 : 11; Whyte, 1974 : 134).

Though heredity is the key to the ultimate size that a child can attain, nutrition greatly determines how close the child gets to his genetic potential. In countries like Japan improvement in nutritional status has resulted in increase in stature (Greulich, 1957 : 489). According to Bengoa (1967) short stature in a population is now regarded as an indication that malnutrition exists, despite genetic differences and other disease factors. Shortfall in size may be related to shortfall in performance and often reflects other disabilities (Berg, 1973 : 11).

Protein energy malnutrition (PEM) is the most important nutrition-related problem in the developing world. It is highly prevalent in its moderate form among children in the developing countries. Protein energy malnutrition includes many different clinical syndromes, all of which are accompanied by retardation of growth and development. The clinical and metabolic changes vary according to the severity and duration of the nutritional deficiency. The milder form, which is highly prevalent, is indicated by fewer clinical symptoms but causes retardation in growth and development (WHO, 1971 : 36). Apart from the effect on growth and development, protein energy malnutrition in its mild or moderate form renders infants and young children susceptible particularly to respiratory and gastro-intestinal infections. The incidence of such diseases is much higher in malnourished than well-nourished children. The mortality experience is also worse among the malnourished than the

well-nourished (Chen, 1980 : 1836). Mortality among under-fives is 10 to 20 times higher in the developing than in the developed countries (WHO, 1977 : 8) and the widespread prevalence of malnutrition among the children of the developing countries in association with other factors may have resulted in such a situation.

The malnutrition factor has further importance to human life for its influence on adult capacities, working life span, and so forth. There is evidence that improvements in clearly inadequate human diets have often increased work output (see for example, Lowenstein, 1968 and Areskog et al., 1969 : 471). The working life span is influenced by nutrition not only through reducing mortality and morbidity but also by shortening the period of ailment and the length of recovery period after serious infections, wounds, and surgery. Better nutrition also affects the national economy of a country through savings on medical costs, reducing productivity losses, and extending working years.

Nutrition of both children and mothers also has relevance for the fertility issues of a country. Better nutrition may result in more births in a noncontracepting population by reducing pregnancy wastage and lengthening the reproductive period. But the possibility of success of family planning programs could be enhanced by improving the nutritional status of both mothers and children. The present population dilemma in the developing countries is the outcome of the combined desire for adult children and the recognition of high child mortality (Berg, 1973 : 33). Initially, the effect of lowering child mortality will be an increase in population growth, but in the long run it will make a major contribution toward lowering the

population growth rate. Experience in the developed countries also suggests that a reduction of the death rate may be a pre-requisite to the reduction of the birth rate.

1.2 Objectives of the study.

In view of the importance of nutrition in human life the present study sets out to examine the levels of child nutritional status and morbidity in rural Bangladesh. Differentials in both nutritional status and morbidity by various household characteristics and sex of the children will also be examined. An attempt will also be made to develop a conceptual framework indicating the relationships among nutritional status, morbidity, and household characteristics. Analyses will also be directed to evaluate the hypothesised framework in the light of findings of the present study.

1.3 Socio-economic status, nutrition and morbidity : a review of the literature.

1.3.1 Introduction.

The proper maintenance of human bodily functions requires an intake of the optimum quantity of a balanced diet. Normally good nutrition is the outcome of a balanced mixture of (a) foods containing essential nutrients, and (b) proper digestion and absorption capacity by the individual. Individual diet is, however, determined by a wide range of circumstances: culture and tradition; religion;

socio-economic status (income and education in particular); and willingness to adopt innovations. The nutritional situation in a community is primarily the outcome of historical, geographical, socio-economic and cultural factors prevailing in that community which in turn influence diet, differences in food intake, and other nutrition related behaviour. It also depends upon how much the community can satisfy the member's needs from its own production of foodstuffs and how much it can obtain in exchange for its other products and services. Attempts have been made by many investigators to identify different factors having a bearing on nutrition. A brief review of some of those studies will be attempted below.

1.3.2 Socio-economic status and nutrition.

A study of the factors affecting malnutrition in different regions by Monckeberg (1970, cited in Manocha, 1975 : 417) has revealed that there is a particular cultural, economic, or social setting in which malnutrition or undernutrition is generally widespread. This setting generally involves illiteracy, low income, bad sanitary conditions and deep rooted cultural or other prejudices. These factors have their base predominantly at the household level and altogether reflect community characteristics. The socio-economic status of the household includes a wide variety of factors that influence nutrition, especially that of the children. Some of them (income, land ownership, occupation of household members and education of household head) are related to the nutritional status of individual members through hygienic practices and environment, which act through food intake or food absorption.

The positive relationship of household landholding and income with food intake has been documented in many studies (White, 1954 : 856; Gunosekera, 1958 : 107). For Bangladesh a similar relationship has been noted by the Institute of Nutrition and Food Science (1977 : 156). In Nigerian villages it was observed that most of the children with better nutritional status (measured by weight for age) come from successful farming families owning more land and from owner-operator families (Morley, 1968 : 164). Studies in four rural Guatemalan villages documented a positive relationship between occupation of father, land availability for cultivation, and the nutritional status of two-and-three years old children (Valverde, 1977 : 1). Among the children of skilled workers and merchants the prevalence of moderate malnutrition was the lowest. The relative risk of suffering from moderate malnutrition was found to be 2.3 times greater among the children of families with access to less than 1.4 hectares of land than among those with more than 3.5 hectares of land. Studies of malnutrition among Hong Kong children indicate that those in lower-and-middle class families grow more slowly than in the higher socio-economic groups. However, by the age of eighteen years there was no significant difference in height and weight among the Chinese of different socio-economic groups (Chang, 1963 : 497).

A study of the malnourished child outpatients at the Nutrition Rehabilitation Unit in Kampala (Uganda) documented a relationship between recovery and different features of the home environment. A child's rate of recovery from malnutrition was estimated from his/her weight gain based on at least four measurements over a period of three months. Eight independent variables were identified in stepwise regression analysis to explain 69% of the variation in recovery among

rural children. Among the eight variables the amount of household land available was found to have the maximum positive influence on recovery (McDowel and Hoorweg, 1977 : 23).

The effect of socio-economic status on the early growth of 16,850 white and 17,405 black American children was studied by Stanley and others (1978 : 51). They found that socio-economic differences are paralleled by differences in body size at all ages from birth to the age of seven years. Data from a semi-longitudinal study of the growth of children up to five years of age in a rural area of Jamaica (Desai, 1970 : 133) indicated a very strong relationship between socio-economic status and growth. (The socio-economic status of the households was measured by an index based on the quality of housing, the amount of land under cultivation, the education of parents or guardians, and the employment status of the members of the family.)

A study in rural northern Ghana (with a sample of 196 children) has also documented the relationship between the farming and trading status of the parents and the nutritional status of the children aged 4 to 60 months (Tripp, 1982 : 3). Anthropometric data on height, weight, and arm circumference were recorded between December 1976 and March 1977. It was observed that 44% of the farming units worked more than one bush farm and the majority (62%) of the children of such units are of above average (median) weight for age. In relation to trading status it was observed that out of 148 fathers 21% are long distance traders or wage earners and the majority (68%) of their children are of average (median) weight for age. In cases where the mother is the trader (29% of all mothers), the effect is even more

pronounced, with 72% of their children having weight for age above the median.

A study in Central America and Panama between 1965 and 1967 showed that less than one-third of children under the age of five could be considered as normal according to the Gomez classification, while 48% were mild and 20% were moderately or severely malnourished. The higher proportions of normal and mild cases were found in the higher socio-economic groups, and the proportion of moderate and severe cases in the lower socio-economic group was more than double that of the higher socio-economic group (Arroyave et al., 1976, cited in Solimano and Vine, 1982 : 86)

The educational status of all household members including parents is often associated with the nutritional status of the children. Among Malawi children whose mothers had received some education, the prevalence of protein calorie malnutrition was found to be significantly less than among those with mothers having no formal education (Burgess and Wheeler, 1970, cited in Schofield, 1979 : 94). The Bangladesh Nutrition Survey 1975-1976 (INFS, 1977 : 157) has examined the relationship between household educational scores and food intake. The educational scores of the household were calculated by assigning scores to the household head and other members according to their educational levels. A score of zero was assigned to illiterate household heads and a maximum of ten for university graduates or equivalents. For other members of the household a maximum of five was assigned for the level of secondary school certificate or above. To arrive at the educational score for the

household the average score per person was added to the score of the household head. It was found that, except for cereals and vegetables, the food intake was positively correlated with the educational score.

In the same survey the relationship between average per capita monthly income of the household and per capita food intake per day was examined. It was observed that the food intake (gm/person/day) tended to increase with the increase of household income. The relationship between education and nutrition is not straightforward. Higher income may be reflected in the better educational status for a household. On the other hand educated members may have better knowledge of nutrition and health and may be free from traditional attitudes towards foods. Fertility behaviour also may be different in the case of educated members. All these factors may work in a favourable way to result in the better nutrition of household members, especially children. In reviewing the factors responsible for nutritional differences within a given village, Schofield (1979 : 94) commented on the impact of education at the household level: "especially in culturally stable environments that permit 'natural learning', failures to use culturally acceptable foods are usually due to fuel or labour shortages or low income rather than ignorance". However, for Bangladesh the question of labour shortages may not be relevant but the question of low income and fuel shortage may arise.

1.3.3 Family structure and nutrition.

Family size and family type have been found to have some influence on the nutritional status of children. In rural Uganda children from extended families were nutritionally in a more

advantageous position (McDowel and Hoorweg, 1975 : 91). Rao and Gopalan (1971 : 339) studied the nutrient intake of children controlling for household income. They found that families with three or less children have a better nutritional intake than families with four or more children. On the other hand, in a rural community in Mexico no differences were observed between the family size of well-nourished children and malnourished children. However, it was observed that in the families of well-nourished children there were more adults than children while in the families of malnourished children there were more children than adults (De Chavez, 1974 : 223).

Sex of the children may sometimes be an important determinant of nutritional status. Many cultures show preference for male children and therefore intrafamily food distribution and parental care may be biased toward the male offspring. Consequently, female children may have worse nutritional status and relatively more growth impairment compared with male children (Ballweg, 1972 : 230; McGregor, 1968 : 341). A study by Chen et al., (1980 : 55) in a rural area of Bangladesh documented sex discrimination against females in the intrafamily allocation of food : a dietary survey among 130 families found that per capita food intake for males was higher than for females at all ages, and as a result the prevalence of malnutrition was higher among female children than among male children. The Bangladesh nutrition survey (INFS, 1977 : 102) also documented similar sex biases in child nutritional status.

1.3.4 Infection and nutrition.

The most straightforward relationship between infection and nutrition is the adverse effect of infection on nutrition. Infectious diseases influence nutritional status mainly by altering the absorption, metabolism, and excretion of specific nutrients on the one hand, and reducing food intake by affecting the appetite of the host on the other. Bacterial infections of the intestinal tract interfere with the absorption of nitrogen, cause an increased urinary loss of nitrogen, and also reduce food intake. As a result protein energy malnutrition is frequently precipitated by an attack of an acute diarrhoeal disease (Scrimshaw et al., 1968). Jelliffe et al. (1960 : 922) have found that outbreaks of infectious diarrhoea in southern Trinidad were followed three to four weeks later by outbreaks of 'Kwashiorkor' (a protein deficiency disease).

Martorell et al. (1975 : 1296) have quantified the relationship between diarrhoea and growth among rural Guatemalan children and found that children in a group with a high prevalence of diarrhoea grew less than those in a low prevalence group. However, the influences of fever and respiratory illness on growth were not significant. A study investigating the role of infection in determining the nutritional status of children in a Gambian village has documented a highly significant negative relationship between gastroenteritis and both weight and height gains. Malaria was also found to have a similar relationship to weight gain (Rowland et al., 1977 : 441). It has been observed in Uganda that the incidence of 'Kwashiorkor' reaches a peak about a month after the peak incidence of measles, malaria, lower respiratory tract infection, and diarrhoea (Poskitt, 1972 : 931).

Whooping cough can also lead to prolonged poor weight and marasmus (Morley, 1973; cited in Chen, 1979 : 49). Among the many communicable diseases that affect child nutrition, measles is often the most important one, particularly in economically poorer areas of the developing world. Morley (1969 : 297) observed that measles often precipitate 'Kwashiorkor'.

Another possible nutrition and infection relationship is the effect of nutrition on subsequent infection. Perhaps, the most important effect of malnutrition on infection is on the immune status of an individual. It has been observed that whereas the antibody formation in animals is affected by malnutrition, humoral antibodies in man are relatively normal in the malnourished. But prenatal and perinatal malnutrition might significantly affect the neonate's antibody responses. Cell-mediated immunity, on the other hand has been found to be profoundly affected by malnutrition (Keusch and Katz, 1979 : 307; Solimano and Vine, 1982 : 94).

The synergistic effect of nutrition and infection has been demonstrated in many studies. An attack of an infectious disease nearly always makes co-existing malnutrition worse, and the consequences of infection are likely to be more serious in a malnourished host than in a well-nourished host. Malnutrition is almost always synergistic with infectious diseases, caused especially by bacteria, rickettsia, intestinal helminths and intestinal protozoa. The effect may be different from case to case depending on the types of malnutrition. General inanition almost always interacts synergistically with infection. In most cases, protein deficiency produces synergistic effects with infections. In the context of

vitamin deficiency, vitamin A has always been found to be synergistic with infection. The same is usually found to be true for vitamin C but not for vitamin D. The effect of vitamin B deficiency may be either synergistic or antagonistic depending on the host agent combination and the type of B vitamin in question (Schrimshaw et al., 1968; Solimano and Vine, 1982 : 93).

Social, behavioural, and health practices sometimes make the effect of infection on nutrition worse. Food is often withheld and the diet may be changed during an attack of an infectious disease. The reduced food intake and altered metabolism with poor diet during convalescence may result in growth impairment in children, especially among those who are malnourished to begin with (Gordon, 1976 : 193). In the developing world diarrhoea continues to be an important disease in terms of morbidity and mortality, particularly among infants and young children during and after the weaning period, when diarrhoea and malnutrition may exist synergistically. The situation is aggravated not only because of shifting the child from breast milk to adult types of food but also due to environmental conditions which tend to expose the child to large doses of micro-organisms present in water and food supplies. Phillips et al. (1969 : 167) demonstrated that feeding utensils as well as prepared foods were contaminated with bacteria, especially fecal organisms. In Bangladesh, diarrhoea exists where sanitation and potable water are inadequate. The prevailing sociocultural tradition of treating diarrhoea by withholding normal food further aggravates the impact on nutrition (Guerrant and Cash, 1973 : 91).

1.4 Nutrition, morbidity, and household characteristics : setting of a conceptual framework.

The identification of malnourished children in a community does not lead to any solution of the problem, at least in terms of preventive measures. Isolation of different factors and a knowledge of the relationships among them are of crucial importance for any rational intervention program to eradicate malnutrition from the society. In this study an attempt has been made to develop a conceptual framework showing the relationship of child nutrition, morbidity and different household characteristics, and this is presented in Figure 1. The empirical findings of relevant studies reviewed in section 1.3 served as the rationale for developing the hypothesised framework.

It is assumed that the economic condition of the household determines the educational status of the household members and the hygienic and living environment of the household. However, education (especially of the head of household) can also influence the economic status and hygienic environment in the household. It is further hypothesised that all these four household variables influence the morbidity of the children. The better the household status in terms of these variables the lower would be the morbidity rate, and the higher the morbidity rate the lower would be the nutritional status of the children. However, household economic status is assumed to have a direct effect on nutritional status, mainly through food intake. The better the economic condition the better would be the child nutritional status.

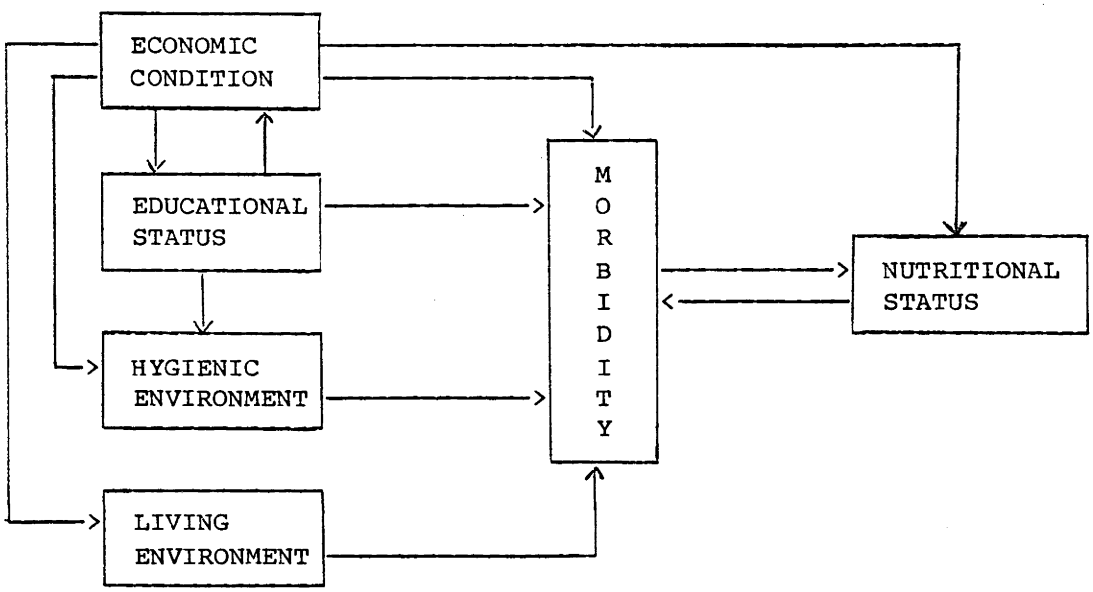


FIGURE 1

RELATIONSHIPS AMONG CHILD NUTRITIONAL STATUS, MORBIDITY, AND HOUSEHOLD CHARACTERISTICS : A CONCEPTUAL FRAMEWORK

Although the relationship among household variables is traced in the model the extent of the relationship will not be investigated in the present study. The influence of nutritional status on morbidity, which was shown earlier to have considerable importance, also will not be investigated due to the limitations of the available data.

CHAPTER 2

THE STUDY AREA AND THE DATA SET

2.1 The study area and selection of villages.

The data for this study come from five villages of Matlab thana (adminstrative unit below a district), Bangladesh. The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) has been operating a Demographic Surveillance System (DSS) in this area since 1966. Details of that field operation have been reported elsewhere (CRL, 1978). Other activities of the ICDDR,B in the study area included a diarrhoea treatment programme, but nutrition interventions had not yet been started.

The Matlab field research area is in the low-lying deltaic plain of Bangladesh, situated 45 kilometers southeast of Dhaka. Temperatures in the area vary from 10 to 35 degrees centigrade. The area is relatively dry during the months of December to February with very low rainfall. May to September is the monsoon season when the water table rises and inundates most of the nonresidential lands.

The five villages purposively selected for the present study were Tatua, Baishpur, Dhakirgaon, Machuakhal and Khidirpur. The nearest of these villages is situated within one mile of the Matlab health centre and the farthest two at a distance of seven miles. The rationale behind selecting these villages was that they have been included in other nutrition-related studies over the past ten years.

Bangladesh Map Showing the Location of Matlab Demographic Surveillance System

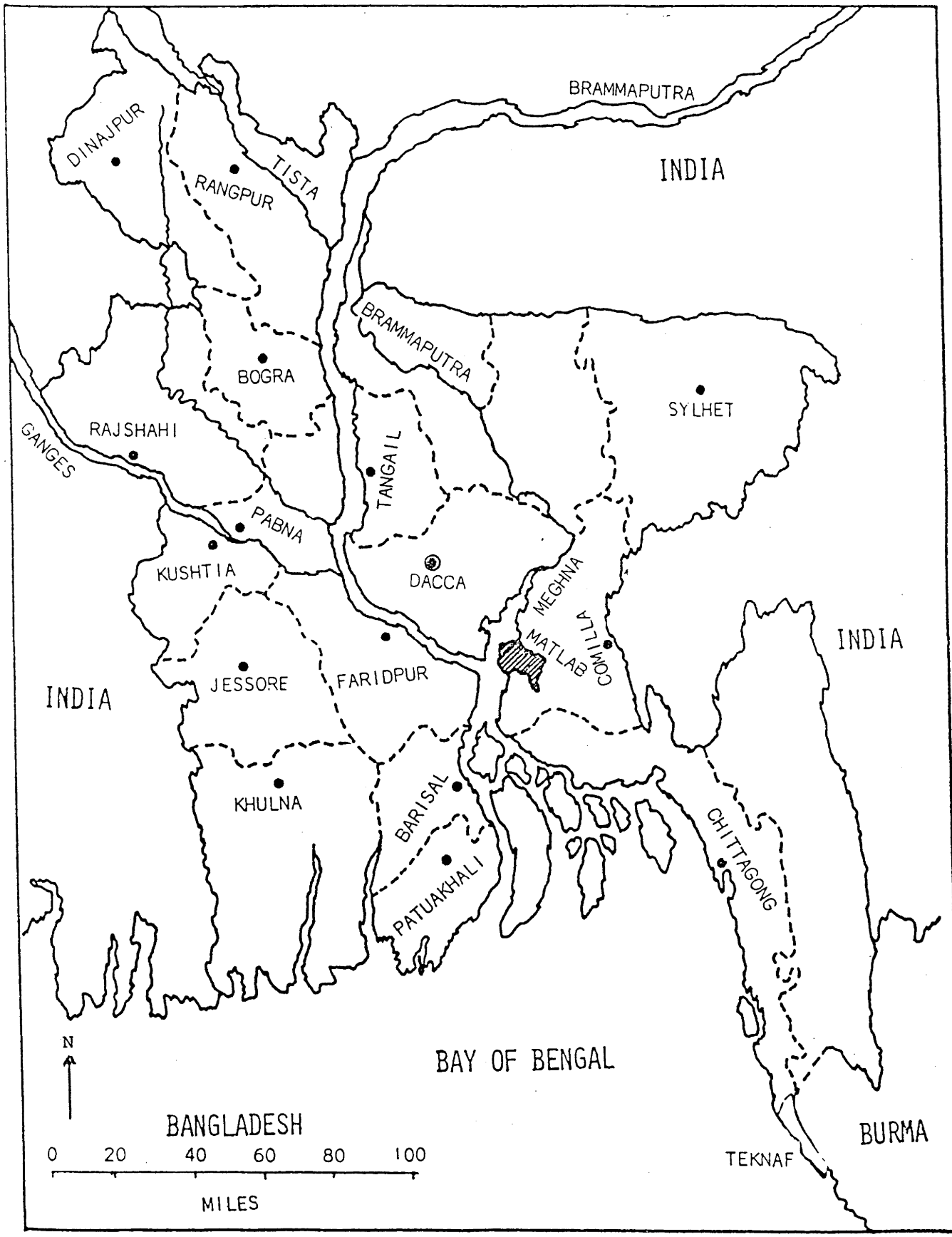
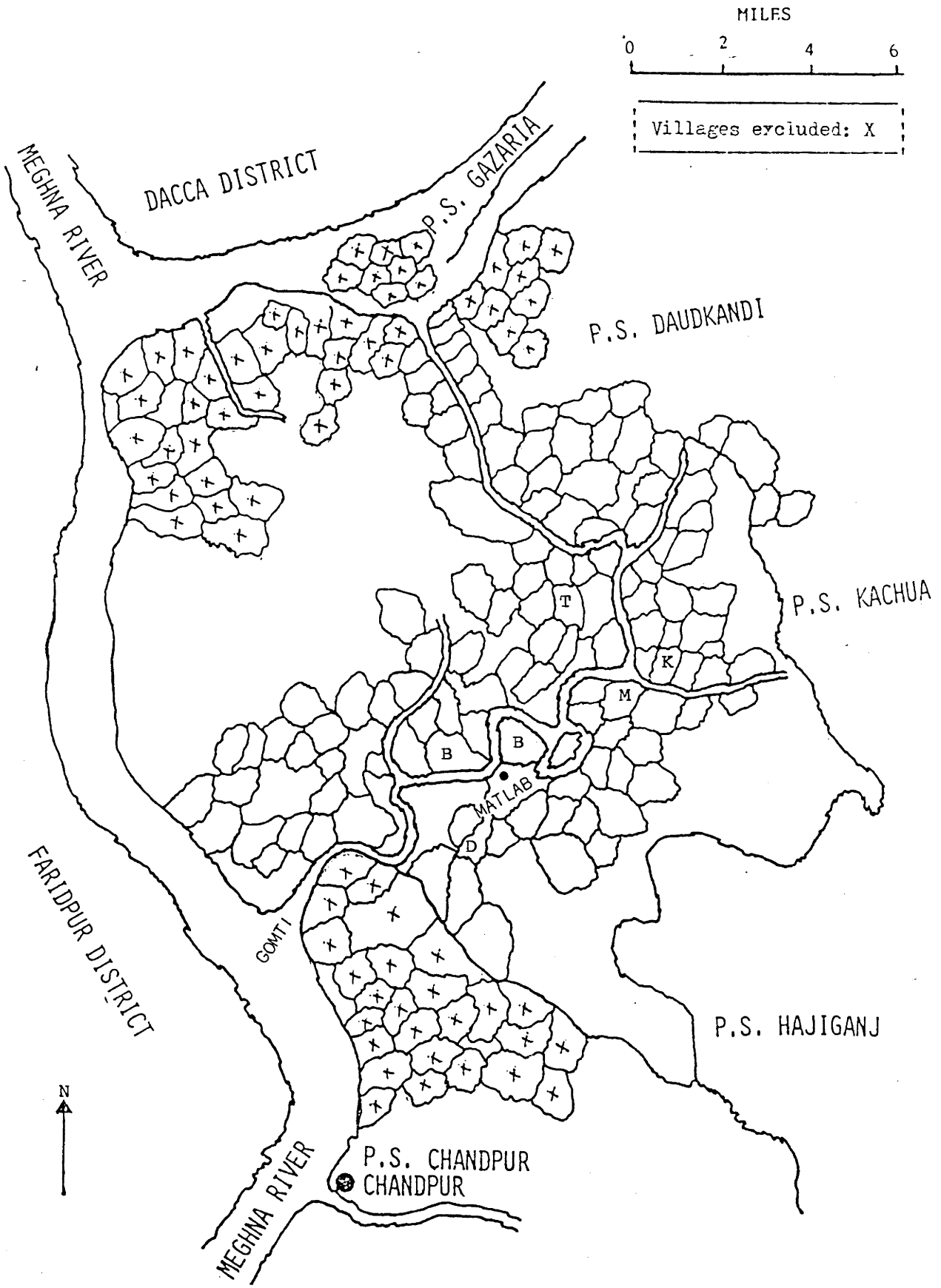


Figure 3
Matlab Area Map Showing Villages of Demographic Surveillance System



Note: T - Tatua, B - Baishpur, D - Dhakirgaon, M - Machuakhal, K - Khidirpur

The study villages are more or less similar to other Matlab villages in terms of socio-economic and cultural backgrounds. Farming is the dominant occupation of the heads of households. The educational level is low, with 55% of the household heads without any formal schooling. Most of the living units are made of sticks and mud with thatched or tin roofs. Sanitation in the villages is very poor. Sewage is usually drained to a nearby surface water source, sometimes the one used for washing purposes. The existing fixed latrines are merely shelters for privacy. The average household size is six persons, and 86% of the total population in the study villages are Muslim.

In rural Bangladesh breast-feeding of children is a matter of tradition and is almost universal and usually continued beyond two years. Supplementary foods, if given are, rarely sufficient to meet the demands of the children. Most of the children receive rice, egg, fish, and vegetables after reaching their first birthday (INFS, 1977 : 173). The present study villages are no exception as regard to this, with 93% of the children aged two years or less being breast-fed.

2.2 The data sources.

The data for this study are generated from two surveys conducted separately in these villages in 1981. Both surveys were done under the auspices of the ICDDR,B, and the author was one of the co-investigators in each case. The first survey (SES Pilot 1981), covering all the households, was a pilot survey on socio-economic differentials in mortality conducted during the months of February to April. Household socio-economic information for the present study was

obtained from that survey. Anthropometric measurement of the nutritional status and morbidity information of all children aged two months to sixty months have been obtained from the second pilot study (SES Nutrition 1981) on socio-economic status and its association with nutrition and morbidity. The study was conducted during the months of June to September, 1981. Analyses have been carried out by matching cases from these two surveys, a task performed by the author working together with computer programmers at the ICDDR,B.

2.3 Collection of data.

The first survey, which collected socio-economic information about the households, was carried out by ten field workers in five groups using a schedule (Appendix A). The field workers were trained for a week and tested in the field. An instruction manual for the field workers was developed and given to each of them for ready reference in the field. During data collection the workers were supervised by a senior field research officer and, on frequent visits, by the investigators (including the author). To ensure complete coverage of the households each team was equipped with an updated listing of the households for a particular village. Normally the household heads were interviewed as the respondent. Only in cases of absence of the head of household was another senior member interviewed.

A questionnaire was also designed for collecting information on anthropometric data and morbidity in the second survey (Appendix B). Five two-member teams (one male and one female) were formed. Although some of them had previous experience in anthropometric data

collection, all workers were extensively trained to use weighing machines, measuring boards, measuring tapes, and skinfold measuring callipers. Before they started field work the extent of variation between the worker's reading and the supervisor's reading was examined. Variations in the reading of height, weight and mid upper-arm circumference were found to be negligible. Due to the wide variation in skinfold measurement and mechanical troubles with one of the instruments, the collecting of skinfold thickness was abandoned in the later stages of the survey.

The body weight of the children was measured to the nearest 50 grams using 25 kilogram Salter scales. Recumbent body length was measured to the nearest 0.1 centimeter for children 100 centimeters or less in length using locally made two-track length boards. Mid upper-arm circumference were also measured to the nearest 0.1 centimeter using oil-cloth tailor's tape. Scales were calibrated daily and standardisation was checked after field work.

A separate fifteen days training was given to the field workers by a medical doctor so that they were able to recognise the major prevalent diseases from the symptoms reported by the mothers. In addition to that a manual describing symptoms and classification of diseases was made available to each worker for ready reference in the field. The identification part of the questionnaire (including sex, date of birth, identification number, and names of the child and its mother) were completed in the office from an updated computer file to ensure complete coverage.

2.4 Data quality and limitations.

The present study uses four categories of data : demographic, socio-economic, nutritional (anthropometric), and morbidity. The demographic variables are the age and sex of the children. In many surveys, especially in developing countries, age data are subject to error. But in this case the age data come from the regular DSS and the recorded dates of birth of the children were matched with the dates of birth stored in the computer master file maintained for the DSS. Detected discrepancies were subsequently corrected. Rigorous training, close supervision of the field workers, and post survey field checks are believed to have resulted in good quality socio-economic data.

Anthropometric data collection involves body measurements, and any survey involving these is prone to measurement error. The errors associated with anthropometric data are of two types : random and systematic. Random errors are those in which no persistent tendency is noted, and therefore they do not affect the mean of a distribution but will increase the variability of measurements about the mean. Systematic errors follow a persistent direction relative to the true value and may be associated with any worker or instrument. Such errors have relatively much more effect on the mean of a distribution than they have on the variance. In the case of the present study, extensive training of the field workers followed by a standardisation of the worker's measurements with those of the supervisor has reduced the chance of between workers variability and systematic error. To ensure accurate measurement, standardisation of the scales was done every day before and after the field work. No indication of

systematic error, both in relation to workers and to instruments, was noted during the survey. Moreover, a field check of a randomly selected five percent sample of the questionnaires was carried out by the supervisor.

In obtaining morbidity information an attempt was made to reduce worker's bias by providing extensive training and a manual describing symptoms of different diseases for ready reference in the field. A field check of a randomly selected five percent sample of the questionnaires was also done by the supervisor.

It should be mentioned that cross-sectional nutrition and morbidity data, including lay reporting of retrospective morbidity data, have inherent limitations. The present study can at best provide some idea about the state of child nutritional status prevailing in the study villages at a particular point of time. Only relatively chronic forms of malnutrition will be easily detected. Moreover, the data will not indicate whether a child is in a stage of recovery or is deteriorating.

The morbidity information about the children is retrospective. The data are reported by the mothers of the children and recorded by non-medical persons. Even with a higher degree of extensive training of the field workers, the chances of misclassification of diseases can never be eliminated. There are at least three factors which influence the reporting of incidences of diseases : memory lapse, perceptions of certain diseases, and social attitudes towards such diseases. Incidences of minor disease can be excluded from reporting due to memory lapse. Misreporting may also result from memory lapse and incidences of disease for one child may be misreported as having

attacked others. Some common ailments may not be considered as incidence of disease and some socially unacceptable diseases, for example tuberculosis, may be deliberately excluded from reporting. Moreover, the degree of under-reporting due to memory lapse or censorship, intentional and unintentional, of diseases may not be uniform among the mothers of different socio-economic groups and as such can pose a serious limitation in studying morbidity differentials.

2.5 Definition of variables.

Nutritional status.

For the purpose of the present study anthropometric measurements on height (length), weight, and arm circumference have been used to assess child nutritional status. Weight for age, height for age, and weight for height are calculated by using the median values of the National Center for Health Statistics (NCHS, 1976), U.S.A., standard growth curves. Arm circumference for age is calculated by using the median value of the standard developed by Wolanski (1961 : cited in Jelliffe, 1966: 228).

Morbidity.

Information on the sickness status of the children for seven days and thirty days preceding the survey was collected from mothers of the children. Symptoms of sickness were recorded for the last seven days and broadly classified at the time of coding. Disease specific information was collected for the thirty-days period preceding the

survey. In both cases no records were kept on the frequency of sickness.

Economic condition of the households.

This category of variables reflects the economic condition of the households. The six variables included in this category are : amount of arable land owned, primary occupation of head, ownership of goods, number of cows, number of boats, and the amount of tax paid to the union council (lowest adminstrative unit) annually. The amount of land owned is assessed on the basis of total land owned by the members of the household. The primary occupation of the household head has been determined on the basis of maximum time allocation to a particular occupation at the time of survey. The ownership of goods, cows, and boats is determined on the basis of ownership by all members in the household. The time reference for the amount of tax paid to the union council is the preceding year. Except for occupation the higher values of the variables may be considered to reflect better economic conditions in the household. For occupation, farmer, businessman, serviceman, millworker and teacher may be considered as favourable occupations in terms of stability of income as opposed to daily labourer, fisherman and boatman.

Education.

Information on the education of household head and highest education among the members of the household have been used as a proxy for the educational status of the households. Both the variables are measured in terms of years of schooling of the person concerned in any

secular institution.

Hygienic environment.

This category of variables includes sources of water used for drinking in the winter season (October - January) of the last year and the extent of use of fixed latrines by the household members aged more than seven years. Both the variables are aimed at reflecting the level of hygienic environment in the household.

Living environment.

This category of variables is to reflect the living environment in the household and includes the floor space of all the dwellings in the household and the structure of the largest dwelling in terms of construction materials. The smallest category of floor space may reflect the poorest living conditions and the households with the largest dwelling in the category of "other than tin" and "tin mixed" may also represent poorer living conditions.

CHAPTER 3

NUTRITIONAL STATUS

3.1 Introduction.

Usually the levels of human nutritional status based on different anthropometric measurements are expressed relative to the local and/or international standard growth curve. The use of a single reference population makes the international comparison meaningful and the situation intelligible. Until recently, of the many standards developed the Harvard standard was the most popular, although it was lacking many of the desirable characteristics, such as lack of bias and adequate sample size (Neumann, 1979 : 307). The new reference standard developed by the National Center for Health Statistics (NCHS), U.S.A., is presently considered the most suitable for use as an international standard (Waterlow et al., 1977 : 489). In the absence of any local standard, the NCHS standard has been used in this study as a reference for presenting the nutritional status of the children. The observed weight, height for age, and weight for height are expressed as percentages of the 50th percentile value of the NCHS standard value of the corresponding measurements, separately for each sex. Arm circumference for age, separately for each sex, is compared with the Western standard of reference developed by Wolanski (cited in Jelliffe 1966 : 228) and expressed as a percentage of the median value. Examination of the level of child nutritional status on the basis of these indices and their relationship with different household characteristics and the sex of the children has been attempted in the following sections.

3.2 Levels of nutritional status.

Weight is one of the most widely used anthropometric measurements. It represents nutritionally labile tissue and fat and reflects acute changes of recent onset (Neumann, 1979 : 228). In developing countries, the prevalence of protein energy malnutrition (PEM) is best indicated by weight deficiency in all age groups (Jelliffe, 1966 : 64). Low body weight for age does not always indicate marasmus but may indicate stunting or nutritional dwarfism where the low body mass is appropriate for the low height (length). Table 3.1 presents the proportion of children at different levels of underweight for age.

TABLE 3.1

AGE SPECIFIC PERCENTAGE OF CHILDREN AT DIFFERENT LEVELS OF UNDERWEIGHT FOR AGE COMPARED WITH THE NCHS 50TH PERCENTILE VALUE

Age (Months)	No.of children	Levels underweight for age			
		1st level (90%-81%)	2nd level (80%-71%)	3rd level (70%-61%)	4th level (<61%)
2-12	309	17	37	29	10
13-24	401	7	29	41	22
25-36	312	9	36	37	17
37-48	334	8	33	44	14
49-60	365	5	33	48	13
Total	1721	9	33	40	16

Source: SES Nutrition 1981

Of all the children in the study, 98% were found to weigh less than 91% of the standard weight for age median and thus can be considered as malnourished. Children of age 2 to 12 months were found to be in better nutritional status than the older children, while the children in the 13-24 months group seem to be most vulnerable. The Bangladesh Nutrition Survey (INFS, 1977 : 112) examined the

nutritional status of children combining second and third degree malnutrition by age according to the Gomez classification. It was observed that the proportion of malnourished children increases as the age of the children increases. Dependence of the children on breast milk and its adequacy for maintenance of health in the first six months of life may have resulted in the children in that age group being relatively well nourished. Another possible explanation may be that a selection process worked in this age group through the death of severely malnourished children.

Height is also considered as an important anthropometric measurement. The extent of height deficit in relation to age may be regarded as a measure of duration of malnutrition. Children below 91% of the standard height for age can be considered as stunted. Table 3.2 presents the proportion of children at different levels of height for age by age of the children.

TABLE 3.2

AGE SPECIFIC PERCENTAGE OF CHILDREN AT DIFFERENT LEVELS BELOW STANDARD HEIGHT FOR AGE COMPARED WITH THE NCHS 50TH PERCENTILE VALUE

Age (Months)	No.of children	Levels below standard height for age		
		1st level (90%-81%)	2nd level (80%-71%)	3rd level (<71%)
2-12	309	29	1	0
13-24	401	57	4	*
25-36	312	55	5	*
37-48	334	68	5	0
49-60	365	72	7	1
Total	1721	57	4	*

Note: * less than 0.5%
Source: SES Nutrition 1981

The data indicate that 61% of all the children in the study are stunted and the extent of stunting is less prominent among the children of age one year or less. As age increases the extent of stunting also increases. The Bangladesh Nutrition Survey (INFS, 1975 : 114) also documented a similar relationship of stunting with age of the children : using the Harvard standard of reference, 74% of the children less than five years of age were found to be stunted. The smaller number of stunted children in the present study may have resulted from the availability of the treatment for diarrhoea in the area. The lowest proportion of stunted children in the first year of life indicates that children are born with a better nutritional status but subsequently become stunted.

Mid upper-arm circumference is also used to measure nutritional status. A lower value of arm circumference may represent a diminution of muscle mass and/or subcutaneous tissue, while a higher value may represent increased fat and/or muscle mass (Neumann, 1979 : 311). Different cutoff points have been suggested for separating normal individuals from those with PEM. Jellife and Jelliffe (1969 : 253) suggested 85% of Wolanski's standard while others (Kondakis, 1969 : 201) have argued that 80% of the standard is much more reasonable and realistic. Table 3.3 presents the age specific percentage of children at different levels below the standard arm circumference for age, and it can be seen that 49% of the children fall below 81% of the standard median value. Here also it is observed that the children of age 2-12 months are in better condition and those of 13-24 months are the worst.

TABLE 3.3

AGE SPECIFIC PERCENTAGE OF CHILDREN AT DIFFERENT LEVELS BELOW STANDARD ARM CIRCUMFERENCE FOR AGE COMPARED WITH THE WESTERN STANDARD*

Age (months)	No.of children	Levels below standard arm circum.for age 1st level (90%-81%)	2nd level (80%-71%)	3rd level (<71%)
2-12	309	44	39	5
13-24	401	35	47	13
25-36	312	49	38	7
37-48	334	48	40	3
49-60	365	48	47	3
Total	1721	45	43	6

Note: * Based on Wolanski, cited in Jelliffe (1966 : 228)
Source: SES Nutrition 1981

Jelliffe (1966 : 195) introduced the use of weight for height (length) to assess nutritional status and the technique was subsequently promoted by others (for example, Waterlow, 1972 : 566). Weight for height is an estimate of body proportions and provides an index of current nutritional status. The major advantage of using weight for height (length) is that it may be considered almost race and age independent (Waterlow, 1972 : 566). Table 3.4 presents the percentage of children in different levels of standard weight for height by age group. Children with a weight for height of less than 81% of the NCHS reference median are considered to be acutely undernourished or wasted and those with a weight for height between 81%-90% of the reference median are moderately undernourished (Graitcer, et al., 1980 : 757).

TABLE 3.4

AGE SPECIFIC PERCENTAGE OF CHILDREN AT DIFFERENT LEVELS BELOW STANDARD WEIGHT FOR HEIGHT COMPARED WITH THE NCHS 50TH PERCENTILE VALUE

Age (Months)	No.of children	Levels below standard weight for height		
		1st level (90%-81%)	2nd level (80%-71%)	3rd level (<71%)
2-12	309	45	13	2
13-24	401	50	34	5
25-36	312	49	28	2
37-48	334	61	16	1
49-60	365	60	13	1
Total	1721	53	21	2

Source: SES Nutrition 1981

The data indicate that 23% of the children in the study area are acutely undernourished or wasted, with the proportion highest (39%) in the 13-24 months age group. The Bangladesh Nutrition Survey (1975 : 113) documented 22% as wasted on the basis of the Harvard standard.

The use of weight for height in combination with height for age was introduced by Waterlow (1972 : 565) and Seone and Latham (1971 : 98). They suggested that by using them in combination one could classify PEM according to severity and also gain some picture of the duration. Waterlow (1972 : 565) suggested four categories of nutritional status that could be identified using weight for height and height for age in combination. These are : (a) normal, with normal weight for height and height for age; (b) wasted, with low weight for height but normal height for age; (c) stunted, with normal weight for height but low height for age; and (d) wasted and stunted, with both low weight for height and low height for age. The cutoff

points defining normal and low are arbitrary and may be defined in a suitable way to fit the community in question. Although the present study uses the NCHS standard, an attempt has been made to identify children in these four categories of nutritional status and for this purpose weight for height greater than 80% and height for age greater than 90% are considered normal. Table 3.5 presents the percentage of children in each of these four categories by age group.

TABLE 3.5

AGE SPECIFIC PERCENTAGE OF CHILDREN AT DIFFERENT LEVELS OF NUTRITIONAL STATUS (WEIGHT FOR HEIGHT AND HEIGHT FOR AGE COMBINED).

Age (months)	No.of children	Levels of Normal	Nutritional Wasted	Status Stunted	Wasted and Stunted
2-12	309	63	11	24	2
13-24	401	30	12	34	24
25-36	312	36	8	37	19
37-48	334	30	2	56	12
49-60	365	23	2	66	9
Total	1721	36	7	44	14

Source: SES Nutrition 1981

The table indicates that 36% of the children are normal, 44% are stunted, 7% are wasted and 14% are concurrently wasted and stunted. The highest proportion of concurrently wasted and stunted children is found in the age group 13-24 months and the proportion decreases as the age increases. Wasting shows a decreasing tendency as age increases, but for stunting the situation is reversed. The Bangladesh Nutrition Survey (1977 : 115) identified 20% as normal, 58% as

stunted, 6% as wasted and 16% as both wasted and stunted. A similar relationship of wasting and stunting with age was also documented, but using the Harvard standard as reference.

3.3 Differentials by household characteristics.

The percentages of children who may be considered as relatively malnourished by different anthropometric indices and household economic characteristics are presented in Table 3.6. All of the variables except occupation of household head show a definite pattern of an inverse relationship with the nutritional status of the children, with the proportion of malnourished children increasing as the household status (in terms of the different variables) decreases.

Land ownership shows a clear inverse relationship with the nutritional status of the children, but ownership of two acres of land or more seemed to make the difference more prominant than ownership of less than two acres of land. The difference in proportions of malnourished children among different land holding groups was found to be highly significant ($P<0.001$) for weight for age and arm circumference for age (tests are based on Chi-square statistics as presented in Appendix C). Height for age though shows a decline in the proportions of malnourished children as land ownership increases, but the differences are not statistically significant. Weight for height and concurrent wasting and stunting also show a declining tendency in the proportions of malnourished children as the household land holding increases. For both measurements differences among the proportions for different landholding groups are highly significant ($P<0.01$) .

TABLE 3.6

PERCENTAGE OF RELATIVELY MALNOURISHED CHILDREN BY HOUSEHOLD ECONOMIC CHARACTERISTICS AND LEVELS OF NUTRITIONAL STATUS

Economic characteristics	No.of children @	Levels of nutritional status Wt./Age (<71%)	Ht./Age (<91%)	Arm/Age (<81%)	Wt./Ht. (<81%)	Wasted + Stunted
Land(acres):						
0.0	439	58***	64	52***	27**	16**
0.1-0.9	766	58	64	51	24	14
1.0-1.9	263	56	59	51	24	12
2.0+	232	43	56	35	14	7
Occupation of head:						
Farmer	535	55	61	48	22	12
Teacher etc.	172	60	60	48	21	11
Business	201	52	59	46	25	15
Fisherman etc.	174	62	62	51	29	16
Daily labourer	323	60	68	53	27	18
Others	294	52	61	48	18	12
Ownership: Articles						
None	295	63***	65*	58***	31***	21***
Quilt,Lamp	740	59	65	50	24	14
Radio etc.	662	49	57	43	19	10
No.of cows:						
0	985	59**	63	52*	25*	15
1-2	394	52	61	45	24	15
3+	312	50	59	44	18	9
No.of boats:						
0	777	57	61	50	24	15
1	801	55	63	49	23	13
2+	112	52	61	44	23	11
Amount of tax(Taka):						
0	316	62***	64*	55**	26*	17***
1-5	658	59	65	51	26	16
6-10	419	53	59	47	22	11
11+	307	47	57	41	17	9

Note:'*' P<0.05; '**' P<0.01; '***' P<0.001 (Based on Chi-square)
Sources: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

Ownership of cows, though a reflection of land holding status, also has the extra feature of indicating the possibility of milk availability in the household, which may have a bearing on the nutritional status of the household members. It has been observed that the proportions of malnourished children are fewer in the households with more cows and the differences among the proportions are statistically significant for weight for age, arm circumference for age, and weight for height.

The proportion of malnourished children by ownership of boats was also examined. It was observed that the proportions show a decreasing tendency as the number of boats owned by the household increases, but for none of the indices were the diferences among the proportions found to be statistically significant. Ownership of boats was considered as an indicator of household economic status as most of the study villages are in a riverine area and inundated by water for several months of the year, and boats are the only effective means of transport. The major limitation of this variable is that fishermen, who are relatively lower in economic status, may have more boats.

The amount of tax paid to the union council is usually determined by the council in consultation with the elected representatives on the basis of household socio-economic status. It may be considered as a comprehensive picture of the household socio-economic status as viewed by the society itself. The poor families are usually exempted from payment and the amount should be higher for the richer families. The distribution of malnourished children by the amount of tax paid has also been examined. It is observed that the proportion decreases as the amount of tax paid by the household increases and for all the

nutritional indices the differences among the proportions are statistically significant.

Ownership of different goods also shows a strong inverse relationship with the nutritional status of the children. The goods included in the list are quilt, hurricane lamps, bicycle, watch, radio, and remittances. Remittances, though not goods in a strict sense, are considered as an equivalent. Quilts and hurricane lamps are improved alternatives to indigeneous articles meant to serve the same purpose. Households are classified into three categories in terms of ownership : households possessing none of the goods may be considered as the poorest; households with either a quilt or hurricane lamp or both are considered as middle economic class; and households with a bicycle, watch, radio, or remittances are considered as the highest category households. An examination of the proportions of malnourished children by these categories clearly indicates that the proportions decrease as the household status in terms of these items increases. For all the nutritional indices the differences among the proportions are highly significant ($P<0.001$) except for height for age ($P<0.01$) . Ownership of a radio and a watch is not only a reflection of the household economic status but also an indication of the modernity of the household. In that respect it is obvious that this variable may have a better relationship with child nutritional status as reflected in the findings.

Occupation of the household head could have a strong relationship with the nutritional status of the children, but in the present study the differences in the proportions were found to be insignificant. But it should be mentioned that the occupational categories, except

farmer and daily labourer, consist of a wide variety of occupations and homogeneity within a category has not been achieved. Farmer and daily labourer are two distinct occupational classes in rural Bangladesh and represent two extremes in economic status : the rich farmers are at the top having control of the land, and daily labourers are at the bottom and subject to serious income instability. A comparison of the proportions of malnourished child between households headed by farmers and daily labourers could be more meaningful. It is clear that in the households with farmers as heads there are fewer malnourished children than in those headed by daily labourers.

Table 3.7 presents the percentages of relatively malnourished children by education of household head and of the member with highest education in the household. Both the variables show an inverse relationship with the proportion of malnourished children : the higher the education the lower the proportion of malnourished children. But for education of head the differences among the proportions are significant only for weight for age and concurrent wasting and stunting. For most cases the differences among the proportions are highly significant. Higher education of the household head may have resulted in better economic conditions in the household which may ensure better food intake and after sickness care for the children, resulting in better nutritional status of the children. On the other hand the highest education in the household, in most cases, is the education of the younger members and may not have any effect on household income. However, it shows a highly significant relationship with all the indices ($P<0.001$) except weight for height ($P<0.05$). In this regard the highest education in the household was found to have more effect on child nutritional status. It may so happen that

schooling among the younger members indicates better care of the children in those households which in turn affects the nutritional status of the children. Bairagi (1980 : 767) also noted in another rural area of Bangladesh that the education of the mother and the household income affect child nutritional status in an interactive way. A higher family income was of relatively greater advantage to the children of literate mothers than to those of illiterate mothers in improving nutritional status.

TABLE 3.7

PERCENTAGE OF RELATIVELY MALNOURISHED CHILDREN BY HOUSEHOLD EDUCATIONAL CHARACTERISTICS AND LEVELS OF NUTRITIONAL STATUS

Educational characteristics	No.of children @	Levels of nutritional status Wt./Age (<71%)	Ht./Age (<91%)	Arm/Age (<81%)	Wt./Ht. (<81%)	Wasted + Stunted
Education of head (years of schooling):						
0	881	59***	63	51	25	15*
1-5	562	54	62	48	22	14
6+	254	48	57	42	21	9
Highest among the members (years of schooling):						
0	473	65***	66***	55***	26*	19***
1-5	721	57	64	50	21	14
6+	502	47	54	41	19	9

Note: '*' P<0.05; '***' P<0.001 (Based on Chi-square)
Sources: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

None of the variables included to reflect a hygienic environment in the household show any significant relationship with child nutritional status. Table 3.8 presents the proportion of malnourished children by sources of drinking water and extent of use of fixed

latrine by household members. Sources of drinking water does not refer to the current use pattern and as such may not be a good proxy for hygienic environment in the household. Use of fixed latrine refers to the current use pattern and the proportion of malnourished children decreases as the extent of latrine use increases. However, the differences among the proportions are not statistically significant.

TABLE 3.8

PERCENTAGE OF RELATIVELY MALNOURISHED CHILDREN BY HYGIENIC ENVIRONMENT IN THE HOUSEHOLD AND LEVELS OF NUTRITIONAL STATUS

Hygienic environment	No.of children @	Levels of nutritional status Wt./Age (<71%)	Ht./Age (<91%)	Arm/Age (<81%)	Wt./Ht. (<81%)	Wasted + Stunted
Sources of drinking water:						
Tubewell	780	54	60	49	23	14
Tank	426	60	66	50	21	12
Others	494	54	61	47	25	15
Extent of latrine use:						
All members	1084	54	60	48	23	13
Some	515	59	65	51	23	14
None	95	59	65	50	23	16

Source: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

Living environment as measured by the structure of the largest dwelling and floor space in the household shows a negative correlation with child nutritional status. In the study villages most of the richer households have relatively larger dwellings made of tin. Cement dwellings are very rare. The dwellings of poorer households are usually made of thatched wall and roof and are of smaller area.

Tin dwellings are considered better than thatched and a smaller area indicates crowding. Table 3.9 presents the percentage of malnourished children by structure of the dwelling and floor space. The proportion of malnourished children was found to be less among children living in tin dwellings. The proportions differ significantly for weight for age, height for age, and arm circumference for age. There is also a decreasing tendency in the proportion of malnourished children with an increase in floor space and the proportions differ significantly for all the nutritional indices.

TABLE 3.9

PERCENTAGE OF RELATIVELY MALNOURISHED CHILDREN BY LIVING ENVIRONMENT AND LEVELS OF NUTRITIONAL STATUS

Living environment	No.of children @	Levels of nutritional status Wt./Age (<71%)	Ht./Age (<91%)	Arm/Age (<81%)	Wt./Ht. (<81%)	Wasted + Stunted
Structure of dwelling:						
No tin used	426	59**	64**	54***	24	15
Tin mixed	1099	56	63	49	24	1.
All tin	166	43	51	35	19	8
Floor space(Sq. feet):						
<170	529	59***	64***	55***	26*	16**
170-242	371	60	63	51	26	15
243-315	351	60	69	49	23	13
316+	449	45	53	40	19	9

Note:'*' P<0.05; '**' P<0.01; '***' P<0.001 (Based on Chi-square)
Source: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

Table 3.10 presents the proportion of malnourished children by household size, family structure and religion. Household size makes a statistically significant difference in the proportions of malnourished children by weight for age, but the pattern appears to be in the inverted 'U' shape. For other indices a decreasing tendency, though not significant, among the proportions of malnourished children is evident as the household size increases. Related to this findings, more children are found to be malnourished in one-couple families, but here the differences in proportions are found to be significant for all the nutritional indices. Religion does not seem to have any affect on child nutritional status.

TABLE 3.10

PERCENTAGE OF RELATIVELY MALNOURISHED CHILDREN BY FAMILY STRUCTURE, RELIGION AND LEVELS OF NUTRITIONAL STATUS

Household characteristics	No.of children @	Levels below standard median Wt./Age (<71%)	Ht./Age (<91%)	Arm/Age (<81%)	Wt./Ht. (<81%)	Wasted + Stunted
Household size:						
1-5	496	56***	59	51	24	13
6-9	956	58	64	48	24	15
10+	248	45	61	45	20	11
Family type:						
One couple	1290	58***	64**	50*	25*	15**
More than one	403	48	56	44	19	9
Religion:						
Muslim	1461	56	62	49	24	14
Hindu	260	56	62	47	24	14

Note: '*' P<0.05; '**' P<0.01; '***' P<0.001 (Based on Chi-square)
Sources: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

3.4 Sex differentials.

Though biologically (in relation to survival) males are weaker than females, Bangladesh is experiencing a higher female mortality, except in the neonatal period and at ages more than forty five (D'Souza and Chen, 1979 : 257). Differentials of this type are very obvious in a community where women are traditionally undervalued compared to men. Table 3.11 presents the proportion of malnourished children by sex and different indices.

TABLE 3.11

PERCENTAGE OF RELATIVELY MALNOURISHED CHILDREN BY SEX AND NUTRITIONAL STATUS

Sex	No.of children	Nutritional status				
		Wt./Age (<71%)	Ht./Age (<91%)	Arm/Age (<81%)	Wt./Ht. (<81%)	Wasted + Stunted
Boy	915	53**	60	48	22	13
Girl	806	59	64	49	25	15

Note: '**' P<0.01 (Based on Chi-square)
Source: SES Nutrition 1981

This study confirms that more female children are malnourished than males and this is reflected in all of the indices. However, the difference among the proportions is found to be statistically significant only for weight for age. Similar observations were also documented in other studies (Chen, 1980: 55; INFS, 1977: 102).

The extent of sex bias in different socio-economic classes may not be the same. The favouring of male children in the subsistence or below subsistence level households may not be as prominent in terms of

nutritional status as in richer households. With very limited resources in the poorer households survival is of prime concern and the male bias may not materialise because of limited resources. It is also suspected that the extent and degree of sex bias among the lower status households is less than among higher status households. In the richer households female children are discriminated against to a greater extent both in food allocation and medical care, and female children in those households have a life no better than their poor counterparts.

Table 3.12 presents the percentage of relatively malnourished (by weight for age) children by some selected household characteristics and sex. The table demonstrates that a greater number of female children are malnourished compared to males irrespective of their household status. An improvement in household status shows a decreasing tendency in the proportion of malnourished female children but the differences for most part are not statistically significant. However, for male children the decreasing tendency in the proportions of malnourished as the status of the household increases is more prominent and the differences among them are significant for most of the household variables. Moreover, when the differences between the percentages of malnourished male and female children for a given household status have been examined, an increasing tendency with the increase in household status is marked. This indicates that the extent of male bias increases as household status increases. Improvement in household status does not necessarily mean the same improvement in nutritional status for male and female children. Richer families may have more, but often it is mainly for the males.

TABLE-3.12

PERCENTAGE OF RELATIVELY MALNOURISHED (WEIGHT FOR AGE < 71%) CHILDREN BY DIFFERENT HOUSEHOLD CHARACTERISTICS AND SEX

Household characteristics	Boys No. @	Boys %	Girls No. @	Girls %	Difference in % Girls - Boys
Land (acres):					
0	241	57**	198	60	3
0.1-0.9	402	55	364	62	7
1.0-1.9	130	52	133	60	8
2.0+	136	39	96	49	10
Ownership of goods:					
None	148	63***	147	63	0
Quilt, Lamp	400	58	340	61	3
Radio, Watch	359	43	303	56	13
Education of head (years of schooling):					
0	467	57**	414	61	4
1-5	308	50	254	60	10
6+	132	42	122	53	11
Highest education (years of schooling):					
0	255	65***	218	65*	0
1-5	377	51	344	62	11
6+	275	44	227	50	6
Structure of dwelling:					
No tin used	223	57**	203	62	5
Tin mixed	590	54	509	60	6
All tin	92	36	74	53	17

Note: '*' P<0.05; '**' P<0.01; '***' P<0.001 (Based on Chi-square)
Sources: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

3.5 Summary.

Malnutrition among the children of the study villages was found to be highly prevalent. Children of age 13-24 months were in worse condition and those of age one year or less were in a relatively better condition. Differentials in child nutritional status for different household characteristics were found to exist. Girls were found to be relatively more malnourished than boys. The differentials

in nutritional status for different household characteristics were found to be more prominent in the case of boys. It is further observed that the extent of sex differentials increases as the household status increases.

CHAPTER 4

MORBIDITY

4.1 Introduction.

So far an inverse relationship between child nutritional status and household characteristics has been observed. The mechanism of the relationship, however, will not be clearly understood unless the role of morbidity is examined. In the following sections an attempt will be made to identify the role of morbidity in determining child nutritional status.

In this study morbidity refers to any incidence of illness in the week and month (including the last week) preceding the survey. Last week's status was asked and indications were noted for at most three illnesses in those cases in which any illness was reported. These were later classified into broad categories. Information was collected about some specific diseases occurring during the preceding month, but multiple incidences were not recorded. All of these were reported by the mothers of the children, and no attempt was made to evaluate the reliability of the mothers' reporting. Another longitudinal study of infectious diseases and physical growth of children in a rural area of Bangladesh compared the mothers' reporting about children's illnesses with that of examinations by physicians (Black et al., 1982 : 305). The history of abnormal stools of the children as reported by the mothers was verified by a subsequent stool test, and in 80% of the cases the mothers' reporting was confirmed by the test.

4.2 Patterns of morbidity.

Out of the 1721 children covered in the survey, 65% were reported to have had at least one illness in the week preceding the survey : 36% reported only one illness, 20% reported two, and 10% reported three. Since no attempt was made to identify underlying causes in cases of multiple reportings, more than one illness may well have been reported for a single cause of illness. For the sake of simplicity only the first mentioned cause will be considered for studying morbidity. The high incidence of diseases was also reflected in the study of nearby villages (Black et al., 1982 : 305). In that study children of age two months to sixty months were observed for one year, and it was observed that the children had at least one and often several concurrent illnesses for 75% of all days of observation.

TABLE 4.1

AGE SPECIFIC INCIDENCE (PER 100 CHILDREN) OF ILLNESS IN THE WEEK PRECEDING THE SURVEY BY THE FIRST MENTIONED DISEASE

Disease	Age in months					Total
	2-12	13-24	25-36	37-48	49-60	
Respiratory	39	28	24	23	25	28
Gastrointestinal	20	24	20	19	17	20
Skin	6	10	11	11	8	9
Ear,Nose and Throat	2	1	2	5	3	2
Rash and Fever	1	*	2	*	1	1
Others	4	6	4	6	6	5
Total	72	69	63	64	60	65
N	309	401	311	334	365	1720

Note: '*' less than 0.5
Source: SES Nutrition 1981

The age specific incidence per 100 children in the week preceding the survey is shown in Table 4.1. Over all age groups respiratory diseases have the highest rate of incidence (28%) and the incidence is

negatively related to age. This category of diseases mainly includes colds and cold fever, whooping cough, asthma, pneumonia and bronchitis. Cold and cold fever have been reported to have the highest incidence rate of 24 per 100 children, whooping cough has 2 per 100 children and the others have very low incidence rates.

The next highest incidence rate of 20 per hundred children was reported for gastrointestinal diseases. This category includes diarrhoea (9%), dysentry (8%), worms (2%) and other gastrointestinal diseases (1%). No incidence of typhoid and cholera were reported for the week preceding the survey. The incidence rate for this group of diseases is found to be highest in the age group 13-24 months and lowest for those 49-60 months.

Skin diseases have the third highest incidence rate of 9 per 100 children. This category includes scabies, eczema, ringworm, and other unspecified skin diseases. Among them scabies is dominant and the highest incidence rates were observed for children aged 13 months and above. The observed incidence rate of ear-nose-and-throat-related diseases was quite small (2%).

Information about sickness in the month (including the last week) preceding the survey was collected for some specific diseases. These diseases include measles, chicken pox, pneumonia, whooping cough, bronchitis, tuberculosis, worms, diarrhoea, dysentry, ear infection, scabies, oedema, night blindness, and jaundice. Only two incidences of tuberculosis were reported. The percentage of children who had at least one incidence in the month preceding the survey by diseases and age group has been presented in Table 4.2. It is observed that the highest proportion of children had diarrhoea in the preceding month,

followed by scabies, dysentry, worms in stool, ear infection and whooping cough. The other diseases were reported for a very small proportion of children.

TABLE 4.2

PERCENTAGE OF CHILDREN HAVING AT LEAST ONE INCIDENCE OF SPECIFIC ILLNESSES IN MONTH PRECEDING THE SURVEY BY DISEASE AND AGE

Disease	Age in months*					Total
	2-12	12-24	25-36	37-48	49-60	
Diarrhoea	43	41	31	31	30	35
Scabies	24	27	27	23	19	24
Dysentry	15	23	24	25	20	22
Worms	11	26	22	21	24	21
Ear infection	9	12	7	10	10	10
Whooping cough	4	4	4	5	4	4
Measles	4	3	4	4	3	3
Pneumonia	2	3	1	2	1	2
Jaundice	0	1	1	2	3	1
Dropsy	0	2	1	1	2	1
Bronchitis	2	1	0	1	1	1
Night blindness	0	0	0	0	2	1
Chicken pox	0	1	0	0	0	0

Note: * Number of children in the age groups are same as in Table 4.1.
Source: SES Nutrition 1981

4.3 Differentials in morbidity.

The percentage of children who had any sickness in the week preceding the survey are crosstabulated with different household economic variables in Table 4.3. The differences among the proportions of children ill in the preceding week are statistically significant for land ownership, occupation of household head, and ownership of different goods, but no regular trend can be discerned. Land ownership shows a curvilinear (inverted 'U') relationship whereas ownership of goods shows a different pattern ('U' shaped). For occupation of household head the differences among the proportions are statistically significant, but for farmer and daily labourer the

proportions are apparently equal.

TABLE 4.3

PERCENTAGE DISTRIBUTION OF CHILDREN SICK IN THE WEEK PRECEDING THE SURVEY BY HOUSEHOLD ECONOMIC VARIABLES

Economic variables	No. of children @	% sick in the week	Remarks (Based on Chi-square)
Land(acres):			
0.0	439	61	
0.1-0.9	766	67	P<0.01
1.0-1.9	263	71	
2.0+	231	58	
Occupation of head:			
Farmer	535	67	
Teacher etc.	172	65	
Business	201	60	P<0.05
Fisherman etc.	174	56	
Daily labourer	323	67	
Others	293	65	
Ownership: Articles			
None	295	68	
Quilt and lamp	740	62	P<0.05
Radio etc.	661	68	
No.of cows:			
0	985	64	
1-2	394	70	NS
3+	312	62	
No.of boats:			
0	777	66	
1	800	65	NS
2+	112	57	
Amount of tax(Taka):			
0	316	66	
1-5	658	63	NS
6-10	419	67	
11+	306	65	

Note: 'NS' Not significant
Sources: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

Table 4.4 presents the proportion of children who were sick in the week preceding the survey by education of head of household and highest education among the members of the household. For none of the variables were the proportions among the different categories of variables found to be statistically significant, and no pattern of relationship between education and illness status of the children in the preceding week has been observed. However, with this type of morbidity data the scope of valid conclusions is always hindered, because of the greater extent of under-reporting of diseases among the lower educational category of households. This under-reporting is mainly due to normative differences in perception of diseases among different educational groups.

TABLE 4.4

PERCENTAGE DISTRIBUTION OF CHILDREN SICK IN THE WEEK PRECEDING THE SURVEY BY EDUCATIONAL STATUS OF HOUSEHOLD

Educational characteristics	No. of children @	% sick in the week	Remarks (Based on Chi-square)
Head of household (years of schooling):			
0	881	66	
1-5	562	63	NS
6+	253	66	
Highest among the members (years of schooling):			
0	473	63	
1-5	721	66	NS
6+	501	65	

Note: 'NS' Not significant
Sources: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

The percentage of children who had some sickness in the preceding week according to sources of drinking water and the extent of latrine use is presented in Table 4.5. Though for sources of drinking water the proportions differ significantly a higher incidence rate among the children of households using tube well water is not clear. However, it should be mentioned that this water-use information refers to the winter season of the previous year. The preceding week's incidences may be affected by more recent water-use patterns, thus the use of the previous year's water sources as a proxy to overall present hygienic environment may not be an appropriate one. Nonetheless, the extent of latrine use among the household members, which may reflect the current hygienic environment in the household, does not show any significant relationship with the incidence of disease in the preceding week.

TABLE 4.5

PERCENTAGE DISTRIBUTION OF CHILDREN SICK IN THE WEEK PRECEDING THE SURVEY BY HYGIENIC ENVIRONMENT IN THE HOUSEHOLD

Hygienic environment	No. of children @	% sick in the week	Remarks (Based on Chi-square)
Sources of drinking water:			
Tubewell	779	69	
Tank	426	59	P<0.01
Others	494	63	
Extent of latrine use:			
All members	1083	66	
Some	515	63	NS
None	95	67	

Note: 'NS' Not significant
Sources: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

However, it should be mentioned that most of these latrines are just

to maintain privacy and may not meet the hygienic standard and therefore, may not have benificial impact on sickness status of the children.

Table 4.6 presents the percentages of children who were sick in the week preceding the survey by structure of dwelling and floor space in the household. For neither of these variables are the differences among the proportions found to be statistically significant.

TABLE 4.6

PERCENTAGE DISTRIBUTION OF CHILDREN SICK IN THE WEEK PRECEDING THE SURVEY BY LIVING ENVIRONMENT IN THE HOUSEHOLD

Living environment	No. of children @	% sick in the week	Remarks (Based on Chi-square)
Structure of dwelling:			
No tin used	426	63	
Tin mixed	1099	65	NS
All tin	165	72	
Floor space(sq.ft.):			
<170	529	66	
170-242	371	65	
243-315	351	66	NS
316+	448	63	

Note: 'NS' Not significant
Source: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

The percentages of children who had an illness in the preceding week by household size, family type, and religion are presented in Table 4.7. The differences in proportions are found to be statistically significant only for religion, with a greater proportion of Muslim children having an illness in the preceding week in

comparison with Hindus (assuming the same degree of under-reporting for both groups). However, the factors responsible for this differential could not be identified from these data. In relation to sex differentials no significant difference was observed in the proportions of children who had illness in the preceding week.

TABLE 4.7

PERCENTAGE DISTRIBUTION OF CHILDREN SICK IN THE WEEK PRECEDING THE SURVEY BY FAMILY STRUCTURE AND RELIGION

Household characteristics	No. of children @	% sick in the week	Remarks (Based on Chi-square)
Family structure:			
Household size:			
1-5	496	68	
6-9	955	64	NS
10+	248	65	
Family type:			
One couple	1289	65	
More than one	403	64	NS
Religion:			
Muslim	1460	67	
Hindu	260	56	P<0.001

Note: 'NS' Not significant
Sources: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

Differentials in preceding month's sickness status of the children for some specific diseases by household characteristics and sex of the children have also been examined. The pattern of differentials is almost the same as that observed for the proportions having illness in the preceding week.

It has been observed that for almost all of the household variables the differences among the proportions of children who were ill in the preceding week are not statistically significant. This trend is also observed for different diseases. It was thought that the better the household status in terms of those variables, the lower would be the morbidity rate among the children. No such pattern of relationship has been observed, however, and in some cases the situation is found to be the opposite. This may have happened because of under-reporting of diseases for the children of lower status households. An anthropological investigation in three villages of Tangail, Bangladesh (Ashraf et al., 1982 : 2041) documented that the tendency to under report illness episodes is higher among the poorer households.

4.4 Morbidity and nutritional status.

The relationship between morbidity, especially from infectious diseases, and nutritional status is well established. The most obvious relationship is the adverse effect of illness on nutritional status. The higher susceptibility of a malnourished host to infection is the other aspect of the nutrition-morbidity relationship. The present study examines the effect of illness on nutritional status.

Table 4.8 presents the percentages of relatively malnourished children as measured by different anthropometric indices and illness status in the preceding week. It can be seen that the current nutritional status of the children is dependent on current illness status or that of the near past, and this phenomemon is demonstrated for all the nutritional indices except height for age. Arm

circumference for age is found to be most affected by recent illness. The relationship between height for age and recent illness, which was found to be not significant, can be explained by the fact that a deficit in height for age indicates the duration of malnutrition, and thus is less likely to be affected by more recent illness episodes.

TABLE 4.8

PERCENTAGE OF RELATIVELY MALNOURISHED CHILDREN BY ILLNESS STATUS IN THE PRECEDING WEEK AND NUTRITIONAL INDICES

Illness status	No. of children @	Nutritional indices Wt./Age (<71%)	Ht./Age (<91%)	Arm/Age (<81%)	Wt./Ht. (<81%)	Wasted+ Stunted
Ill	1119	58**	62	53***	25*	15*
Not ill	601	51	60	42	21	11

Note: '*' P<0.05; '**' P<0.01; '***' P<0.001 (Based on Chi-square)
Source: SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

Among the diseases the children had in the preceding week, gastrointestinal diseases are found to have a significant relationship with child nutritional status. Table 4.9 presents the percentages of relatively malnourished children (according to various measures) and presence or absence of gastrointestinal diseases in the last week. It can be seen that the larger proportion of the children who had a gastrointestinal disease in the preceding week was relatively malnourished in comparison to their counterparts who had no incidence of the disease in the preceding week, and a significant relationship is observed for all the indices of nutritional status, again excepting only height for age.

TABLE 4.9

PERCENTAGE OF RELATIVELY MALNOURISHED CHILDREN WHO HAD AN INCIDENCE OF GASTROINTESTINAL DISEASE IN THE PRECEDING WEEK BY NUTRITIONAL INDICES

Gastro-intestinal disease	No. of children	Nutritional indices Wt./Age (<71%)	Ht./Age (<91%)	Arm/Age (<81%)	Wt./Ht. (<81%)	Wasted+ Stunted
Present	344	62**	63	58***	32***	20***
Not present	1377	54	61	46	21	12

Note: '*' P<0.05; '**' P<0.01; '***' P<0.001 (Based on Chi-square)
Source: SES Nutrition 1981

4.5 Findings and the conceptual framework : a review.

So far in Chapters 3 and 4 an attempt has been made to examine the relationship between household characteristics, morbidity and child nutritional status. The hypothesised direction of the relationship among the variables was systematically presented as a conceptual framework in section 1.4, and an examination of the validity of the hypothesis will now be made.

Chapter 3 documented the relationship between household characteristics and child nutritional status. It was found that the higher the household status the better the child nutritional status. Chapter 4 examined the differentials in morbidity by household characteristics and the morbidity-nutritional status relationship. In the conceptual framework morbidity is assumed to be an intermediate variable between household characteristics and nutritional status. The data used in this study indicate that household status does not have a strong association with morbidity but morbidity does affect child nutritional status. Hence the first part of the hypothesis, higher household status-lower morbidity-better nutritional status, is

not supported by the present study. On the other hand, household status shows a relationship with child nutritional status. Conceptually, only economic variables may have a direct effect on child nutritional status, mainly through food intake, explaining part of the relationship.

The other important factor influencing child nutritional status is morbidity, which does not show any relationship to household status. Now the question arises, does morbidity affect the nutritional status equally among the children with different household statuses? It is possible that consciousness of and the consequences of sickness among the household members is determined by the educational status of the household. Effective medical treatment is heavily dependent on economic status, and poor living and hygienic environments delay recovery. This in effect aggravates the influence of morbidity on nutritional status among the children of lower status households. Table 4.10 presents the proportion of malnourished children by three selective household characteristics (one from each of the economic, educational, and living-environment categories) and sickness status in the preceding week. The higher proportion of malnourished children among those suffering sickness in the preceding week indicates the adverse effect of sickness on nutritional status. The difference between the proportion of sick and non-sick children for different levels of the household variables reveals that the magnitude of the difference is higher in the lower status households. This indicates that morbidity affects the nutritional status of children in lower status households more adversely than those from higher status households. Poor nutritional status, which generally exists among the children of lower status households, may interact

synergistically with infection to aggravate the situation further.

Thus it is found that differentials in child nutritional status for different household characteristics exist. Sickness occurs almost independent of household status. But the household status will determine (among many other factors) how far a child will be affected by sickness.

TABLE 4.10

PERCENTAGE OF CHILDREN BY DIFFERENT HOUSEHOLD CHARACTERISTICS AND WEIGHT FOR AGE CONTROLLING FOR ILLNESS STATUS IN THE WEEK PRECEDING THE SURVEY

Household characteristics	Ill in the week Number @	Weight/Age (<71%)	Not ill in the week Number @	Weight/Age (<71%)	Difference in percents (ill - not ill)
Goods owned:					
None	200	66***	95	57*	9
Quilt and lamp	455	62	285	54	8
Radio,watch, Bicycle	446	51	215	44	7
Highest education:					
0	298	69***	175	57*	12
1-5	479	58	242	53	5
6+	324	49	177	42	7
Structure of dwellings:					
No tin used	267	61**	159	55	6
Tin mixed	715	60	384	50	10
Tin	118	44	47	43	1

Note: '*' P<0.05; '**' P<0.01; '***' P<0.001 (Based on Chi-square)
Sources: SES Pilot 1981, SES Nutrition 1981
@ - Total numbers of children may differ due to missing data

4.6 Summary.

The analysis of the child morbidity data shows a high rate of disease incidence in the week preceding the survey. The respiratory and gastrointestinal diseases are found to be the major causes of illness during the period. No definite pattern of relationships in illness episodes and household characteristics are found to exist. An adverse effect of illnesses on nutritional status is also observed. Among the many reported diseases, gastrointestinal diseases show significant negative influence on child nutritional status. The effect of illnesses on nutritional status is found to be relatively greater in the children coming from lower status households than those from higher status households.

CHAPTER 5

SUMMARY AND CONCLUSIONS

The importance of the nutrition factor in the life of an individual vis-a-vis the national development of any country is beyond controversy. In the developing countries children are most vulnerable to malnutrition and as a result the future prospects of the individual and the country are bleak.

The foregoing chapters have examined the level of child nutritional status and pattern of morbidity in the study villages, along with the relationships of these to different household characteristics and the sex of the children. The analyses were mainly guided by the conceptual framework presented in section 1.4.

Malnutrition was found to be highly prevalent among the children of study villages. The extent of acute malnutrition (measured by different anthropometric indices) was highest among children aged 13-24 months and lowest among children of one year or less. The lesser extent of malnutrition among the children aged one year or less may have resulted from their dependence on breast milk, which provides adequate nutrition during the first six months of life. The higher proportion of malnourished among children aged 13-24 months indicates the weaknesses of the supplementation process practised in rural areas.

The incidence of disease in the week preceding the survey was also found to be very high among the children. The major causes of illnesses during that period were reported to be respiratory and gastrointestinal diseases. The incidence of gastrointestinal diseases was found to be highest among children aged 13-24 months. At this age supplementation is introduced in most cases, and contamination of food and feeding utensils may be responsible for the high rate of gastrointestinal diaeases.

An analysis of the differentials in child nutritional status by household economic status, educational status, and living environment in the household showed a significant inverse relationship with all the indicators of child nutritional status excepting height for age. More girls were found to be malnourished than boys.

With regard to the differentials in morbidity by those household variables, no consistent pattern of relationship could be discerned. Among the many diseases the incidence of gastrointestinal diseases in the week preceding the survey was found to have a significant adverse effect on child nutritional status. The effect of sickness in the preceding week on nutritional status, controlling for different levels of household variables, was also examined. It was determined that the differences between the proportions of relatively malnourished children with and without any illness episodes in the preceding week was higher in the lower status households. This indicates that the adverse effect of illness on nutritional status was higher among the children of lower status households.

The economic condition and educational levels of the household members may affect child nutritional status not only through the quality and quantity of food intake, but may also have an influence on post-sickness behaviour in terms of medical care and intake of compensatory diet. On the other hand, ignorance due to illiteracy along with poor living and hygienic conditions may delay recovery from illnesses and could further aggravate the situation.

If the above findings are related to the conceptual framework presented in section 1.4, a modification to the hypothesised framework may be suggested. The direct negative relationship of household economic conditions with child nutritional status was demonstrated by smaller proportions of relatively malnourished children in the higher status households. The hypothesis of poor nutrition among the children of lower status households due to higher disease incidence is not tenable on the basis of the evidence obtained in the present study. Rather, most children were found to become ill almost independently of household status, but household status starts playing its role after a child becomes ill which, in consequence, makes the children of lower status households relatively more malnourished than those of higher status households.

In studying the sex differentials in nutritional status and morbidity some interesting points have emerged with bearings on the conceptual framework. Differentials in nutritional status were observed between sexes but for morbidity no such differences were noted. More girls were found to be malnourished than boys irrespective of their household status, but interestingly the differentials in girls nutritional status for different household

chararacteristics were not statistically significant. In the case of boys on the other hand, these differentials are significant, implying that the conceptual framework is suitable only to explain the mechanisms of the relationships of nutrition-morbidity-household characteristics for boys. It could further be said that an improvement in household status may not help improve the nutritional status of girls.

Malnutrition in childhood is an outcome of a complex interaction of a wide variety of factors. Some have direct bearings on nutritional status. Basically the nutritional status of children is determined directly by their food intake and health status. These two factors are functions of economic and socio-cultural characteristics of the household. To understand the state of nutritional affairs in a community, a study of both the direct and indirect factors associated with the problem should be made. An idea of the mechanisms, through which these factors are operating, such as identification of the factors causing socio-economic differentials in child nutritional status, is also essential for the development of a rational policy to overcome the malnutrition problem in the community.

The higher degree of vulnerability to malnutrition of the children aged 13-24 months warrants special attention for this group. An in-depth study should be carried out for identifying the factors responsible for causing widespread malnutrition at this age. A community-based simple growth monitoring programme may help in identifying the children needing attention and the parents could be advised of the best possible actions to improve the situation.

In view of the importance of nutrition in human life and to the development of the country as a whole, the problem of malnutrition should be recognised as a problem of development rather than only a humanitarian problem. It is beyond doubt that without the economic well-being of the community members no development programme can give any lasting solution to the problems faced by the people in settings such as the one described here. Short term interventions, such as feeding programmes for the children, may, however, be needed to save the most vulnerable groups from severe consequences.

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APPENDIX-A

QUESTIONNAIRE FOR COLLECTING SOCIO-ECONOMIC STATUS INFORMATION

1. Study No.: 233 , 2. Village: ....., 3. Code: ....., 4. Family No.: .....

5. 1974 Family No.: ....., 6. Bari: ....., 7. Religion: ....., 8. Type of Ration Card:.....

9. Tax paid to U.C./Year: ....,10. Date of Interview: .....,

11. Dwelling No. 1: Length: .....(feet), Breadth: .....(feet),
    Dwelling No. 2: Length: .....(feet), Breadth: .....(feet),
    Dwelling No. 3: Length: .....(feet), Breadth: .....(feet),
    Dwelling No. 4: Length: .....(feet), Breadth: .....(feet),

12. Main Sources of water during Winter Season, Ashin 16 - Magh 15 (October - Janu)
    Drinking: ....., Cooking: .....
    Bathe : ....., Washing: .....

13. Structure of Largest Dwelling:
    Wall: ....., Roof: .....,
    Floor: .....,

14. Use of Fixed Latrine:
    Male: Yes / No, Female: Yes / No,
    Within 15 yards from used water source: Yes / No,

15. Tick the items owned:
    Lep (Quilt), Hurricane Lamp, Bi-cycle,
    Any Watch, Radio, Remittance,

16. Total Land Owned in Acres: .....
    If own land: Self cultivated,
    Renting out,
    Share cropping
    If no land: Takes rent,
    Shares crops,
    Others (specify): .....

17. Highest Education in the Household:
    Type of Education: .....
    Years of Schooling: .....

18. Family Type: .....

20. Number of Cows owned: ....., 21. Number of Boats owned: .....,

Appendix-A continued.....

19. Individual Information:

Village Code: ....., Family No.: .....,

Indiv. No.	Mother's No.	Dwelling No.	Name	Age	Sex	Marital status	Relation to Head	Date of birth	Education Type	Education Yrs.	Occupation Pry.	Occupation Sec.
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

APPENDIX-B

QUESTIONNAIRE FOR COLLECTING CHILDREN'S NUTRITION AND MORBIDITY INFORMATION

To be completed in Dacca:

Village Name :.....

Bari Name :.....

Mother's Name:.....

Child's Name:.....

Study No.:...., Case No.:...., Case Type:...., Religion:...., Sex:....

Village code:...., Family No.:...., Indiv. No.:...., Date of birth:...

Mother's VTS:

Village:...., Family No.:...., Indiv. No.:...., Mother's Case No.:....

Date of Interview:.....

1. Is .....(Name of child) being breast fed? Yes / No.
2. Since last .....(day of week) has .....(Name of child) had any illness? Yes / No.

   If yes what?

Appendix-B continued.....

3. Other than this, did .....(Name of child) ever had any of the following illnesses? If so, when? (check appropriate space).

Illnesses	Since last 7 days	Since last month	Since last Ramzan	Before last Ramzan	Never
Fever with rash(Measles)	.....	.....	.....	.....	....
Chicken Pox	.....	.....	.....	.....	....
Pneumonia	.....	.....	.....	.....	....
Whooping Cough	.....	.....	.....	.....	....
Bronchitis	.....	.....	.....	.....	....
Tuberculosis	.....	.....	.....	.....	....
Worms in stool	.....	.....	.....	.....	....
Diarrhoea	.....	.....	.....	.....	....
Dysentry	.....	.....	.....	.....	....
Ear problems	.....	.....	.....	.....	....
Scabies	.....	.....	.....	.....	....
Dropsy	.....	.....	.....	.....	....
Night blindness	.....	.....	.....	.....	....
Jaundice	.....	.....	.....	.....	....

Appendix-B continued.....

4. Has your child ever had any other health problems or serious accidents? Yes / No

   If yes what?

   ----

5. Height (cms.) .....(lying if less than 100 cms.)

   .....(standing for 100 cms. +)

6. Weight (kg.) .....

7. Arm circumference (cms.) .....

8. Skinfold (mms.) ..... (three readings)

   .....

   .....

9. Interviewer No. .....

10. Interview status:

    Interviewed

    Absent

    Moved away

    Refused

    Died

APPENDIX - C

Example of Statistical Tests Used

For testing the association between variables Chi-square tests were used. An example from Table 3.6 is presented below:

DISTRIBUTION OF CHILDREN BY HOUSEHOLD LANDHOLDING AND AND NUTRITIONAL STATUS (ARM CIRCUMFERENCE FOR AGE)

Land (acres)	Nutritional status <71%	>70%	Total
0.0	226	213	439
	(52)	(48)	(100)
0.1-0.9	388	378	766
	(51)	(49)	(100)
1.0-1.9	133	130	263
	(51)	(49)	(100)
2.0+	82	150	232
	(35)	(65)	(100)
Total	829	871	1700

Note: Figures in brackets indicate row percentages

The value of Chi-square =19.46 with 3 degrees of freedom, which has a 'P' value = 0.0002.

This can be interpreted to mean that the amount of landholding and child nutritional status are not statistically independent, which also implies that the proportion of malnourished children in different landholding groups differ significantly in a statistical sense.