A STUDY ON FOOD SECURITY AND NUTRITIONAL STATUS OF MARGINAL FARM HOUSEHOLDS IN SOME SELECTED AREAS OF BANGLADESH

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A STUDY ON FOOD SECURITY AND NUTRITIONAL STATUS OF MARGINAL FARM HOUSEHOLDS IN SOME SELECTED AREAS OF BANGLADESH

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Dedicated

To

Marginal Farmers of Bangladesh

DECLARATION

I hereby declare that this thesis entitled "A Study on Food Security and Nutritional Status of Marginal Farm Households in Some Selected Areas of Bangladesh" is based on the research work carried out by me. No part of it had been presented previously for any higher degree. The research work was carried out in the department of Institute of Nutrition and Food Science (INFS), University of Dhaka, under the guidance of Dr. Shah Md. Keramat Ali, Professor of Clinical Nutrition, and Dr. Mohammad Rezaul Karim, Professor of Social Nutrition, Institute of Nutrition and Food Science (INFS), University of Dhaka.

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ABSTRACT

The present descriptive prospective study was carried out to find out the extent of food availability and food insecurity in the marginal farm households and to assess their health and nutritional status. The study was carried out in 216 marginal farm households of randomly selected four villages, from original four divisions of Bangladesh, for one year in four rounds covering all seasons. Information about household food production and utilization, land holding, income, expenditure etc. were collected by using a standard structured questionnaire. Household and intra-household food consumption was collected through 24 hours recall and partly weighing method. Height, weight, mid arm circumference of all the study population was measured using appropriate and frequently standardized instruments.

Among the study population 52.3% male and 47.7% female; 54.3% illiterate; 25.9 farmers, 20.7% students and 24.1% housewives; and family size was about 5. About 57% members of the study households were dependent on about 43% adult working population. About 51% households had 16 to 80 decimal of land, while about 25% and 24% had 81 to 100 and 5 to 15 decimal of land respectively. Due to single earning member in 64.4% households and due to low wage rate mean monthly household income was low. Monthly income, total expenditure and expenditure on food were Tk. 3513.4 ± 3025.5, Tk. 3048.3 ±1575.3 and Tk. 1583.1± 739.4 respectively, while per capita monthly income was Tk. 754.1±733.6. About 45 and 52 per cent of total income and total household expenditure was spent for household expenditure on food.

Food security status reveals that out of 1193.8 kg of annual household food production 971.1kg (including 843.2kg staples) was produced from farm land and per capita annual household food production was 105.4 kg and per capita per day food availability for consumption was 290gm. About 50% of produced foods were sold to meet other household needs, while about 44% were used for consumption. From household food production 35.7% marginal farmers could have food security round the year if produced food not at all sold, whereas 4.2% could have food security if partly sold indicating there existed household food insecurity. On an average < 20% households cultivated leafy vegetables and about one third cultivated non-leafy vegetables; about one fourth planted fruit trees; and 45% & 85% respectively were rearing cattle and poultry in their homestead indicating future food insecurity.

Per capita food intake in the marginal farm households was 678.3 gm per day, which was about 52gm less than the rural population. About 91% and 5% of the consumed foods were provided by plant and animal sources respectively. About 451, 52, 6, 23, 119, 7 gm of cereal, roots & tubers, pulses, fish, vegetables and fruits were consumed per capita respectively. Adult marginal farmers aged 20-59 years consumed about 202gm less food amounting to about 464 kcal & 13gm less protein than the rural adult population. Highest food intake (774.3 gm) was found during January – February after amon paddy harvest, while lowest intake (588.3 gm) was observed during October - November before amon harvest indicating drastic seasonal influence on food intake. Mean calorie and protein intakes were 1786.3 kcal and 42.2 gm respectively, which were also lower than the rural population. Nutrient intakes were significantly higher in post- harvest period compared to pre-harvest period ($p<.001$) and also higher in males compared to females ($p<.001$). Except vitamin A, thiamine and niacin none of the nutrients could meet the requirement. Adult males or household heads were the first eater (42.7%) and given preference in eating good quality foods in more amounts (96.2%) compared to female members.

Nutritional status showed that among adults 58.1% had chronic energy deficiency; among adolescent 65.4% and 63% were stunted and underweight and prevalence was higher in males compared to females and 55% were found to have chronic energy deficiency. Among 6 - 9 years age group, 59.3%, 12% and 62% children were stunted, wasted and underweight, where stunting was more prevalent among girls, while wasting and underweight were more prevalent among boys; and among 6-71 months old children 69.4%, 12.9% and 64.8% were stunted, wasted and underweight respectively, while 94.5% were malnourished in respect of weight for age median and more female children were malnourished than males. Stunting and underweight rates increased during lean period before amon paddy harvest but wasting though decreased, did not show any regular trend.

Nutritional deficiency disorders such as dental caries, enlarged thyroid gland, angular stomatitis and nightblindness were found to be existed among 20.8%, 13.0%, 12.0% and 1.5% study population respectively. Morbidity pattern showed that prevalence of fever, dysentery and gastric ulcer were 62, 21.7 and 3.7 per cent respectively.

There was no close relationship between household monthly income, total expenditure & expenditure on food and intakes of different nutrients except fat intake, where there was a highly significant negative correlation with household monthly expenditure on food. Calorie, protein, fat, carbohydrate, thiamine, niacin, vitamin C and zinc intakes were negatively correlated with family size; while calorie, carbohydrate and niacin intakes were significantly positively correlated with the number of earning members. Family size, number of earning members and household monthly expenditure was found significantly related to per capita calorie intake.

About 64% farmers advocated integrated approach of various measures to be adopted in order to ensure round the year food security and 34.3% and 7.9% specifically mentioned arrangement of easy loan without interest for adopting IGA and augmenting easy employment opportunity to increase income and purchasing power capacity respectively.

Inadequate food and nutrients intake resulted poor nutritional status of the marginal farm household members, which were due to lower food availability because of low food production and low household income indicating existing food insecurity and inability to lead a healthy, socially useful and economically productive life. Even their food and nutrient intakes were less than the average national (rural) intake which resulted more prevalence of malnutrition and morbidity.

To improve their food security and nutritional status specific measures, like-- maximum utilization of crop land and homestead; use of HYV seeds, irrigation, fertilizer for augmenting employment opportunities and arrangement of easy loan for undertaking IGA to increase income and purchasing power are needed to be introduced. Besides, counselling to discourage sale of produced foods to increase food availability for consumption along with encouragement to adopt IGA in the household are also recommended.

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LIST OF ABBREVIATION

ACC/SCN	: Administrative Committee on Coordination /Sub-Committee on Nutrition
AGFAS	: Accelerating Growth in the Food and Agriculture Sector
AHFS	: Assessment of Household Food Security
ARI	: Acute Respiratory Infection
ASPS	: Agricultural Sector Programme Support
BARC	: Bangladesh Agricultural Research Council
BDHS	: Bangladesh Demographic and Health Survey
BINP	: Bangladesh Integrated Nutrition Programme
BBS	: Bangladesh Bureau of Statistics
BTEB	: Bangladesh Technical Education Board
BNNS	: Bangladesh National Nutritional Survey
BMI	: Body Mass Index
BCG	: Bacillus Calmat Guarine
CCDB	: Christian Commission for Development in Bangladesh
CED	: Chronic Energy Deficiency
CFCM	: Conceptual Framework of the Causes of Malnutrition
CNU	: Child Nutrition Unit
DIGS	: Directoraate Generaal Internationale Samenwerking
DHSS	: Department of Health and Social Security
DPT	: Diphtheria Pertusis Titenus
DAE	: Department of Agriculture Extension
FA	: Food Aid
FAO	: Food and Agricultural Organization
FAO WFS	: FAO Committee on World Food Security
FFAC	: First Food Aid Convention
FGD	: Focal Group Discussion
GCPH	: Giving Credit to Poor Household
GDP	: Gross Domestic Product
GIEWS	: Global Information and Early Warning System

GNP	: Gross National Product
gm	: Gram
HDR	: Human Development Report
HES	: Household Expenditure Survey
HFA	: Height for Age
HKI	: Halen Keller International
IFPRI	: International Food Policy Research Institute
INFS	: Institute of Nutrition and Food Science
ICDDRB	: International Center for Diarrhoeal Diseases Research Bangladesh
ICESCR	: International Convenant of Economic, Social and Cultural Rights
ICMR	: Indian Council of Medical Research
IDD	: Iodine Deficiency Disorders
IEO	: Increasing Employment Opportunities
IEPP	: Improving Emergency Preparedness Planning
ITS	: Income Transfer Schemes
IU	: International Unit
Kcal	: Kilo calorie
LBW	: Low-Birth-Weight
MAC	: Mid Arm Circumference
MCH	: Maternal Child Health
MOA	: Ministry of Agriculture
mg	: Mili gram
µg	: Micro gram
NCHS	: National Center for Health Statistics
NGO	: Non-Government Organization
NSO	: National Statistical Office
NSP	: Nutrition Surveillance Project
NPNL	: Non Pregnant Non Lactating
ODS	: Overall Development Strategy
ONG	: Organizational Support Group

OSG	: Organizational Non-Support Group
PEM	: Protein Energy Malnutrition
PPRDP	: People's Participatory Rural Development Programme
RDA	: Recommended Dietary Allowance
RNI	: Recommended Nutrition Intakes
SA	: South Asia
SD	: Standard Division
SFS	: Stabilization of Food Supplies
SSA	: Sub-Saharan Africa
TALC	: Teaching Aids at Low Cost
UDHR	: Universal Declaration of Human Rights
UNDP	: United Nations Development Programme
UNICEF	: United Nations Child Emergency Fund
USAID	: US Agency for International Development
WB	: World Bank
WFA	: Weight for Age
WFC	: World Food Council
WFH	: Weight for Height
WFP	: World Food Programme
WFS	: World Food Security
WFCUDEHM	: World Food Conference: Universal Declaration on the Eradication of Hunger and Malnutrition
WHO	: World Health Organization
WSSD	: World Summit on Social Development

CHAPTER – ONE

INTRODUCTION

INTRODUCTION

1.1. BACKGROUND:

Food is a basic human need. World Food Summit in 1996 emphasised the right of everyone to have access to safe and nutritious food as the basic human right and declared the other fundamental right to be free from hunger[1]. Because, adequate amount of food is needed by individual human being for his/her sound health, which is obviously essential to achieve and maintain an active and prosperous life.

Since nutrition is the science of food and its relation to optimal health and performance, good nutritional status of human being principally depends on adequate food intake and its utilization[2, 3]. Nutrition is a process by which living organisms utilizes food for maintaneance of life and growth[4-6] and is concerned with social, economic, cultural and phychological implecations of food and eating[7].

Different food items function in the body in different ways. Some food items provide energy to the body for performing physical and physiologial activities, some foods provide protein for physical growth and maintenance of body tissue and some other foods regulate the body processes. When different kinds of food items are consumed adequately according to the requirement, the body become well nourished and healthy and thus become fit for maintaining active and prosperous life. Hence, it implies that foods of all kinds are needed to be consumed by every body to satisfy his/her daily nutrient requirement at all times. To achieve this goal accessibility to food by every body is a must. Accessibility to food depends on household food availability either from household production or from purchase from the market or from both. This emphasizes the attention on the concept of ensuring household food security. Food security is an access at all times to enough foods to lead an active and healthy life[8, 9]. Household food security depends primarily on the ability of the household to secure enough food to ensure an adequate intake for all the members at all times[10]. But unfortunately, vast majority of the population of the developing world do not have such access to adequate food to satisfy their hunger and nutritional need. An estimate showed that 800 million people do not have access to sufficient food to lead healthy and productive lives[11] and as such they become vulnerable to malnutrition due to inadequate food intake.

Since the major occupation of the majority of the population of developing world is agriculture, lack of engough food to eat is one of the main causes of poor family living conditions. Poor agricultural practics lead to low production of crops, specially food crops, livestock and other farm products. Low farm production leads to decreased income levels for farmers.The poverty and the smaller amount of available food for household consumption resulting from low food production generally lead to undernutrition. Usually landless farmers as well as marginal farmers in developing countries suffer the most from low farm production, because they do not possess enough land and can not do modern agricultural practices to grow their own food. This is one reason why they and thier families are often malnourished than other farm families.

Undernutrition results in an insufficient energy intake to allow people to do work hard. The work capacity of farmers and their families is reduced while they are malnourished- which leads to still lower farm production, poorer living conditions and even greater poverty. Thus a dangerous and spirralling cycle is intrduced, whose effect continues to worsen as it grows [12].

According to Bogert[3] malnutrition is a term widely used to mean faulty or poor nutrition in all of its affects whether from inadequate intake of nutrients or over consumption of foods. Malnutrition is one of the serious problems of national concern affecting millions and millions of lives of the developing world. Malnutrition is the most widespread and serious problem to day affecting young children; combined with infection it is a major cause of death of millions and it is responsible for the retarded growth and development of even greater magnitude[13]. There is overwhelming epidemiological evidence that malnutrition is a major determinant of health in the developing and developed countries[14,15]. About 160 million pre-school children in the world are currently malnourished[16] which is only a little less than in 1990 level of 177 millions[17]. In developing countries 20-25% of the children die within the first 5 years of life and more than 50% of their deaths are related directly or indirectly to malnutrition[18] and 83% of these deaths are attributable to mild to moderate malnutrition. Developing countries are, therefore, the worst hit of malnutrition which results from convergence of poverty, household food insecurity, ignorance, population over burden, lack of appropriate health care facilities compounded with misconceptions, taboos and superistitions, and natural and man made disasters. Analysis of relevant socio- economic and demographic variables revealed that poverty is the central point of all direct and indirect causes of malnutrition and women and children are the victims of malnutrition [19]. Other studies have shown that health and malnutrition is essentially the end result of a complex set of overlapping and interrelated biological, social, economical and environmental phenomena[20-24]. Malnutrition has many advers consequences. In young growing children chronic or prolonged malnutrition retards growth, increases illness and delays learning. A malnourished child is physically less active such as in playing and inattentive in class room and performs less compared to his wellnourished counterpart. The child is also frequently attacked by illness leading to higher absenteeism which is considered as another cause of poor cognitive performance [25].

Bangladesh is one of the least developed countries of the world with a population of 140 million living in an area of 1 44,000 square killometers. Population density in Bangladesh is the highest in the world, which is about 821 persons per square kilometer. More than 80 per cent of its people live in the rural areas and majority of them are dependent on agriculture. About 50 per cent of the rural people are landless and 80 per cent of the people live under poverty level[26]. So a great majority of the rural poor farm households in Bangladesh are in short of required food supply almost round the year, as has been highlighted in the findings of different national nutrition surveys. Nutrition survey in 1962-64 showed that the average intake of calorie, protein and a few other nutrients in the rural areas were adequate while calcium and some nutrients fall short of the requirements[27]. The nutrition surveys conducted in rural Bangladesh in 1975-76 [28] and 1981-82 [29] showed that the average level of intake of calorie and some other nutrients were declined over time and as the consequence extent of malnutrition in the country further aggravated. Nutrition survey of 1981-82 showed that more than 80 percent of rural poor households were deficient in calorie, while 77% in protein, 88% in vitamin A, 97% in vitamin B_2 and 87% households were deficient in vitamin C intake[29]. Ninety three per cent households had intake below the requirement of calcium and fat intake was only 10gm per person per day.

National nutrition survey of Bangladesh 1995-96[30] also showed that per capita food intake of rural people was only 731gm per day, which was 765gm in 1981-82 and 807gm in 1975-76. Average cereal food intake continuously decreased from 537gm in 1962-64 through 523gm in 1975-76 and 488gm in 1981-82 to 452gm in 1995-96. Average per capita calorie intake in rural population was 1892 kcal which was 15.9, 9.6 and 2.6 per cent less than that of 1962-64, 1975-76 and 1981-82 figures respectively. Per capita calorie intake was also more than 7 per cent less than the estimated national average calorie requirement. Poor farmers with per capita monthly earned income of Tk.<400/- and monthly household earned income Tk.<2000/- were consuming 1827 and 1846 kcal per capita respectively [30].

All these findings indicate that short supply of energy dense food supply in the farm households lead them towards chronic and acute malnutrition specially among the children of growing ages and pregnant and lactating mothers.Bangladeshi diet is largely cereal based. The 1995-96 nutrition survey showed that among 6-71 months old children the prevalence of stunting, wasting and underweight were 63.0, 17.5 and 66.0 per cent respectively. Night blindness (1.65% in 2 to<10yrs children and 1.0% among pregnant women), Ariboflavinosis and Goitre are highly prevalent in Bangladeshi children, adolescent and adult population as well. Besides, more than eighty five per cent rural women and 70.8 per cent rural adult males were found to have been suffering from anaemia[30] which rsulted into low productive capacity and thereby reduced gross national production (GNP).

Growth faltering is common among infants and children in poor areas throughout the world. The process of growth faltering started during infancy is thought to be due to poor dietary intake and morbidity[31]. Infant feeding practices have serious implications for infant survival and growth[32, 33]. Increased morbidity and mortality among children living in poor countries like Bangladesh is strongly linked to malnutrition and dietary insufficiency[34, 35]. Under nutrition is associated with 50% of childhood death[36] and around 3.5 million vhildren in different parts of the world die every year due to diseases related to malnutrition[37]. Besides, chronic malnutrition leads to stunted growth and decreases the survival chances and with this adult lifestarted[38-40] and thereby there is lack of initiative and drive along with physical incapacity or weakness.

All these consequences are attributed to household food insecurity throughout the year, more so during period of food scarcity, food shortages and natural disaster as well. However, the malnutritional situation of Bangladesh is a indication of poor dietary intake pattern, which in turn revaled a perpetual food insecurity at household level. In recent years Bangladesh showed a steady growth in annual food (staple) production and is being said that the country will be self-sufficient in food grain production in near future[41- 43]. However, national food security does not clearly resolve the problem of household food insecurity and consequently nutritional status of the household members. Moreover, seasonality in food availability during lean (pre-harvest) and abundant (post-harvest) periods have great influences on household food consumption. Different vulnerable population groups for example marginal farmers, landless, day labourers etc are more prone to these situations and often experience hunger[44].The path from food to nutrition of vulnerable groups is complex and the mechanism must be understood not only in relation to the dynamics of socio- economic aspects but also in the contexts of ecological changes[45]. Therefore, it is necessary to identify the causative factors leading towards low food availability & food insecurity and thereby low intake.

The cited nutritional situation represents the scenario of rural population of Bangladesh who constitute farm, non-farm and land less families, majority of whom belong to marginal farm households. In Bangladesh 59.1 per cent of the households are farm households[46] of whom 49.1 per cent are marginal farm households[46], constituting about 29% of the total population[41- 43, 46]. The marginal farmers have only 50 – 100 decimal of land including homestead[47].These marginal farmers are the key people mainly responsible for production of food for themselves as well as for the whole nation.

The above mentioned situation about food and nutrient intake and nutritional status obviously does not represent or indicate the situation of the members of the marginal farm households. As these people are the cultivators of essential food and other crops, their health and nutritional status is unknown which is essential in order to improve their conditions aiming at the sustainable increased food production throughout the year. To achive this goal it is necessary to gather some information from the marginal farmers such as-

- sources of food supply in the household;
- food production in the marginal farm households from both cultivated land and homestead;
- food crops they usually grow, use of produced foods, food availability from production for household consumption and measures they usually adopt to obtain remaining food supply;
- status of household food budget;
- the types and amount of foods consumed per capita per day and nutrients obtained from usual diets by age & sex groups of the household members with seasonal variation, and percentages of nutrients requirement achieved from usual diets;
- nutritional situation of the marginal farm household members by age & sex with seasonal variation;
- sources of household income and household expenditure especially on food.

These information are needed to plan any effort for achieving household food security in the marginal farm households in a sustainable way.

Food availability throughout the year in the marginal farm households may ensure adequate intake of diverse kind of foods and as a result healthy, nutritionally sound, energetic and productive manpower will be available towards progressive increase in the agricultural production which, in turn, will increase the national productivity over time. To achieve this goal the present study was planned and carried out.

1.2. JUSTIFICATION

Bangladesh is a agricultural based developing country. Out of total 1,99,79,932 households of the country about 59 per cent constitute farm households[41- 43]. And 49.1 per cent are marginal farm households [46,47]. So, about 59 per cent population of the country belonging to farm households, while about 29 per cent of the total population belong to marginal farm households[41-43,46,47]. The marginal farmers are the key people responsible for production of food for themselves as well as for the whole nation. In other words, more than 70 per cent population are some how or other dependent on the marginal farmers for their food supply. Since these farmers have limited small land holding and practicing traditional farming that yields low production and they often face natural calamities like- flood, drought and cyclone, and as such the marginal farmers become vulnerable to malnutrition. The prevailing nutritional situation represents the scenario of rural population that constitute farm, non-farm and land less families, majority of whom belong to marginal farm households. And if these key people are malnourished, principally due to inadequate food supply, specially energy giving staple food supply and imbalanced intake, they become unable to work hard, leading to reduced food production and thus national policy of adequate food supply for the whole nation and attaining national food security will be at stake.

Food security in the marginal farm households and accessibility to food is yet not known. So, to understand the actual situation of food security and food & nutrient intake along with nutritional status of marginal farmers is essential. As these people are the cultivators of food, their health and nutritional status is needed to be studied for finding out laps and gaps in order to improve their conditions. Therefore, in order to formulate any national strategy for addressing the problem associated with food insecurity and low food intake by the marginal farmers, it is necessary to know some of the information related to their food availability & food security status, food intake pattern as well as nutritional status of the members of the marginal farm households.

Nutritionally sound and healthy manpower, however, is very vital to gear up national production in all sectors, especially in agricultural sector because our cultivation is largely labour intensive. Not only food crops but the production of other cash crops are also needed to be increased and that is possible if the cultivators are healthy and hard working throughout the year. This is very much true in the case of marginal farmers. Food availability in the marginal farm households throughout the year may ensure their food security and thereby adequate intake of diverse kind of foods. As a result healthy, nutritionally sound, energetic and productive manpower will be available towards progressive increase in the agricultural production which will, in turn, increase the national productivity over time. It is, therefore, expected that this goal will be achieved in the present study on food security and nutritional status of the marginal farm households of Bangladesh and will facilitate to draw a sustainable plan for food security of the marginal farmers.

1.3. REVIEW OF LITERATURE

1.3.1. Food Security Concept:

In various national, regional and international fora, the objective of banishing the sufferings of hunger from the face of earth has been repeatedly articulated. The world food conference in 1974 declared that "every man, woman and child has the inalienable right to be free from hunger and malnutrition"[48]. Presently, the relation between sustainable development, poverty alleviation and nutrition security gets much attention internationally and nationally[1, 49]. The 1996 world food summit[1] sought, and received, commitment from the FAO member nations to banish hunger in its starkest from among half of today's hungry population by the year 2005. This is already a step-down from the world food conference (1974), where the resolution on objectives and strategies of food production, declared that all governments "should accept the goal that within a decade no child will go to bed hungry, that no family will fear for its next day's bread, and that no human being's future and capacities will be stunted by malnutrition" [48].

But facts remain that millions of hungry people in the world go to bed hungry and thus suffering from malnutrition because of short supply of essential food commodities. Globally 700 million people go to bed hungry every day, 800 million do not have access to sufficient food to lead healthy and productive lives in less developed countries and 200 million under five years old children suffer from malnutrition in Asia[11,50]. Every individual human being is in need of eating adequate amount of food in a balanced way for normal growth, physical & mental development. The need of food is combined with the condition of food security, where accessibility to food by every body is a must. Accessibility to food depends on household food availability either from household production or purchase from market or from both. So, food availability in individual household throughout the year is of great concern which emphasizes the concept of household food security. But access at all times to a sufficient supply of safe, nutritious and acceptable foods must be in a socially accepted way[51]. Food security has long been used as an important macro - level indicator of agricultural stability and progress for both agricultural and economic researchers. However, little work has been done to operationalize the concept at the household level.

A series of initiatives had been undertaken and established since 1943 till 1990 by the scientists and economists of the World Community towards the achievement of food security as follows:

Table 1.3.1: Initiatives Related to Food Security, 1943-1990.

Year	**Initiatives**
1943	- Hot springs conference on Food and Agriculture
1945	- FAO established
1946	- UNICEF established
1948	- Universal Declaration of Human Rights
1963	- World Food Programme established
1966	- International Convenant of Economic, Social and Cultural Rights
1967	- First Food Aid Convention
1974	- World Food Conference: Universal Declaration on the Eradication of Hunger and Malnutrition
	- World Food Council established
	- FAO Committee on World Food Security established
1975	- FAO Global Information and Early Warning System (GIEWS) established
1978	- FAO Regional Food Plan for Africa
1981	- European Community "Plan of Action to combat hunger in the world" and initiation of food strategies in four countries
	- IMF Compensatory Financing Facility extended to cereals
1983	- Broadened concept of food security adopted by FAO
1984	- Rome III convention gives central place to food security
1985	- USAID Famine Early Warning System (FEWS) established World Food Security Compact (FAO)
1987	- Mandate of FAO Food Security Assistance Service broadened to focus more on national policy
1988	- World Bank task force report "The Challenge of Hunger in Africa: a call to action and initiation of World Bank food security studies in Africa"

1989 - Convention on the Rights of the Child adopted by the General Assembly of the United Nations.
- Initiation of FAO food security planning in four African countries

The concept of food security was first introduced during the World Food Conference[48] of 1974 and it has evolved over a period of time. Subsequently, its use in the development practice was further promoted in a joint effort by the World Food Council and FAO to move away from one sided emphasis on raising food production as the main solution of the world food problem. Until the early 1970s adequate availability of food grains at the national level was considered a good measure of food security. Emphasis was placed on food self sufficiency at the national level principally through domestic production. In the 1970s food security was mostly considered in terms of national and global food supplies. The 1974 world food conference added another dimension of food security when it emphasized, apart from the overall availability, stability of food supplies within and over the years[48]. Later the question of "access" and "entitlement" gained prominence which is mainly due to writings of Amartya Sen[52]. However, an agreed definition of food security suggests that all households should be able to avail at all times of adequate food for a healthy living. This interpretation of food security, apart from emphasizing the elements of availability, stability and access, also includes - while giving due attention to "healthy" living - the nutritional dimension[53].

In the course of time food security has been defined in many different ways. The definition evolved to encompass a growing range of aspects. Initially, three elements were considered crucial: 1) availability of food;
2) stability of supply; and
3) access to food (or in terms of subsistence production, possibilities of barter, or purchasing power).

This interpretation of food security resulted in the term being applied above all to macro-level (international, national or regional) food security. For a long time the most common expression of food security was the creation of large reserves of staple food at the national and / or regional level. Micro- level aspects such as household food security, quality of available food, nutrition received relatively little attention in the early years of the food security debate. These shortcomings, however, did not go unnoticed for long.

The DGIS (Netherlands Ministry for Development Corporation) defined food security, based on the World Bank definition on food security cited elsewhere, which goes on to specify : the critical factors essential in achieving food security are[54-56]:

a) production / availability of food;
b) stability of production and supply of available food throughout the year;
c) access to food (through subsistence production, purchasing power or transfers of food, including food aids), and the individual consumption of food ;
d) quality of the available food; and
e) equity

Availability of food refers to the amount of food available at household level. Food can be produced by the household members, purchased and /or obtained through exchange with other people. Food availability at this level is closely linked with availability at the local market or at higher levels. Here, sufficient food may be available, but it does not automatically mean that it reaches the various households at lower levels. It will depend on distribution mechanism and also on climatic (drought/flooding) and economic fluctuations. Often, locally produced foods are only seasonally obtainable. Market and government induced force prices of agricultural inputs and out puts may fluctuate, affecting food availability. These types of fluctuations have an impact on the stability of the available food supply as well. Stability also depends on the effectiveness of storage facilities at household and community level. People need money (from sale of produce and/or employment) and/or productive resources (land, credit, technology, infrastructure etc.) in order to acquire food from elsewhere or to produce sufficient food by themselves. This refers to the aspect "access to food". Generally speaking, households in urban areas depend more on the purchasing power than rural households to obtain food. To what extent income will be spent on food items is strongly related to decision making processes within the families governed by socio-cultural factors.

The relation between food availability (food production) and food accessibility (income generation) is complex. Food insecurity is often seen as a problem of inadequate access resulting from insufficient purchasing power. At the same time it is recognized that many areas have little or no income earning capacities out side agriculture. Access to and control over productive resources, therefore, is stressed to improve the availability of food. However, environmental constraints may strongly affect food production and thus food availability [57-62].

Individual access from household access to food is also an important issue. The questions arises do all members of the household have access to and consume enough food? Differences exist between men, women, and children and age groups about individual consumption of food, where socio-cultural factors play an important role in the way food is distributed among the members. Food can be consumed, but critical is its quality aspect which relates to its caloric /nutritive value and the way food is stored, preserved, processed and prepared, and food safety i.e. the absence of harmful toxicological and microbiological substances.

It should be emphasized that food security does not automatically mean improvement of the nutrition situation. Nutrition situation depends on some factors which influence food consumption. Three important factors[56]are-

1) the basic and environmental health situation,
2) caring capacity specially for children, and
3) consumer's preferences- often related to culture, social situation and basic education.

The level of education of the mother, for instance, is strongly related to the nutritional status of the children. A number of factors influence the nutritional situation and food security at household and community levels both in rural and urban settings. Complex relations exist between different factors. A distinction can be made between factors which influence the food and nutrition situation at individual, household, community and national levels [63-65]. Food security is achieved if adequate food in respect of quality, quantity, safety, socio-cultural acceptability is available and accessible to and satisfactory utilization by all individuals at all times to achieve good nutrition for a healthy and happy life[66]. Food security as already stated emphasizes the 'stability', 'availability', 'accessibility' and 'utilization' of food. The inclusion of utilization or in other words consumption, absorption and metabolism of food underlines that 'nutrition security' is the ultimate goal. Since, food intake and nutritional status are inextricably linked, household food insecurity is one of the fundamental underlying causes of inadequate dietary intake, malnutrition, disease and death.

Achieving a dependable food security system implies the need to achieve food security at four levels. National level food security is implicit in food self-sufficiency. Regional food security implies special efforts to address the problems of areas of chronic food insecurity and of vulnerability to national disaster. Household level food security implies that each household has assured access to the means to either produce or procure sufficient food of an adequate quality for nutritional well being. Intra-household food security implies the absence of discrimination in the distribution of food within the household [67].

The food security concept has proved to be a valuable analytical instrument exercising strong influence on policy making, but its drawback is that it is hard to operationalize at the household level. Because, in fact, access factor as a concept is quite similar to Amartya Sen's "entitlement" and refers to the extent to which people can actually claim or command available food resources and it holds a wide range of different aspects : income, subsistence productions, barter, collection of wild foods, distribution of productive assets, functioning of markets, political factors, international economic relations[68].

Only a decade and a half ago it would have seemed navie to analyze food security as purely a distribution problem, while in the late 1980s it had become reasonable to focus on food insecurity as the inability of poor countries, poor families and poor individuals to purchase sufficient quantities of food from existing supplies [69].

In the developed countries, supply is growing far more rapidly than demand; but in many developing countries the situation is the reverse. In most of Asia and Africa, and even much of Latin America, for improving food security requires both increasing the purchasing power of the poor and boosting overall food production. Increased food supplies and purchasing power must be inextricably linked elements of any long - term food security effort. And in the short run, redistributing food supplies from the developed to the developing world is likely to be the best way to meet the more immediate food security needs of the poor and as such net export of cereals from developed to developing countries were 80% larger in the mid - 1980s compared to the mid- 1970s[70, 71]. Based on the FAO's estimates of adequate calorie standards for people, it is estimated that some-where between 340 million and 370 million people have inadequate diets[72]. Reutlinger and Selowsky (1976) have estimated that as many as 1.I billion people suffer from calorie deficient diets. These estimates seem to be useful primarily in emphasizing that malnutrition continues to be a huge and persive problem in developing countries [73]. But Sukhatme and others suggested that human body has the capacity to adjust to calorie intakes lower than the FAO standards, leading to a reduced estimate of people with inadequate calorie intake[74,75].Whatever the estimate , it is clear that levels of food intake below the FAO standards are closely associated with abject poverty.

In countries with very low average incomes and massive poverty, such as India, special programmes for ensuring food supplies to the poor might well have reduced the number of people in abject poverty[76,77]. In India, where about one third of the malnourished people of the world live, there was no measurable trend in the proportion of rural people living below poverty line. From 1956 - 67 to 1977-78, the proportion of rural people in India below the poverty line has fluctuated between 40 and 60 per cent[78]. However, during these years the absolute number of people living in poverty increased.

The high marginal propensity of the poor to spend on food requires more food to back up more employment[79]. Kumar (1988) demonstrates that additional supplies of food are necessary for improved labor productivity and increased demand for labor by small farmers. The study also indicates that inadequate supplies of food indirectly influence the decisions of small farmers to adopt modern technology[80]. Thus, not just food security as a welfare objective, but food supplies on a productive input call attention to the present food imbalances between the developed and developing countries. It follows that for developing countries, optimal growth will be associated with high rates of growth of employment; and, therefore, requires greater supplies of food. The capacity of developed country surpluses to insure those food supplies acts as a very positive force for economic growth, equity and food security in the third world.

1.3.2. Agricultural Growth and Access to Food:

The current understanding of food security is based on the interrelated concept of stable agricultural production and adequate access to food[81]. Agricultural growth implies increased level of productivity and there are three ways of achieving the productivity are-

1) increasing yields,

2) increasing cropping intensity and
3) switching to higher valued crops[67].

Since many people in the third world are engaged in agriculture, growth in agriculture through increasing production increases their incomes which enable them to spend more money on food for acquiring food security.

Since increasing food production by incentives, there is a special need for technological change which provides incentives to farmers - incentives which are both potentially greater than those provide by higher prices and which have no negative impact on the poor[82]. Von Braun analyses the specific mechanisms through which cost-reducing technological change can be Pro-poor, Pro- food security[83].

Secondly, an agriculture based-development strategy that enhances food security for the rural poor requires massive investment in rural infrastructure. In Bangladesh, Ahmed and Hossain showed that good infrastructure compared to poor infrastructure was associated with 92% more fertilizers use per hectare, 4% more labour per hectare in farming , 30% more non-farm employment, and a 20% higher wage rate[84]. Typically, one-third or more of the agricultural area of developing countries is so ill-served with infrastructure as to be left out of these processes[85].

The size of the requisite investment in rural infrastructure is quite large if agriculture is to become the centerpiece for any development strategy. But in many developing countries such as Latin America, India, China and the Philippines this investment strategy is neglected in country side rather concentrate the bulk of resources in a few major urban centers and in highly capital intensive industries[69].

Export-led growth typical of South Korea, if fed by massive capital flow, can bring the mass of people to income level that provides food security. But the countries like Taiwan, Thailand, Malaysia, Kenya, and the Ivory Coast, which have done well from the beginning in providing food security depending on broad–based agricultural strategies[86]. In Bangladesh agriculture growth i.e. cereals yields have been growing at an average annual rate of 2.2 percent, which is only marginally above the 2.1 percent rate of land productivity increase required to offset the combined effects of land loss and population growth[67]. In the 1980s, Kenya's agricultural sector grew at an average annual rate of nearly 3% and was the primary force behind a slightly more rapid growth in GDP.

Tanzania, on the other hand, was unable to sustain a rate of growth above 1% for either its agriculture sector or in GDP. Growth in the incomes of Kenya's poor was so rapid as to require large imports of food to sustain per capita consumption. Food imports grew at 6.5% per year in Kenya compared to only 3.0% in Tanzania from 1970 to 1985. Kenya has been able to provide better food security to its people by promoting more rapid and more equitable growth through an emphasis on its agricultural sector[87-89].

It therefore, becomes important to emphasize agriculture for its broad – based employment and income-generating potentials. The current global structural imbalances have the potential to reduce the risk of a high employment growth, rural-based agricultural growth strategy[69].

The greatest part of the poor and food insecure population depends greatly on local agriculture for a living in majority of the countries with severe food security problems. In such cases, development failures are often tantamount to failures of agricultural development. Development of agriculture is seen as a crucial step towards reduction of poverty and food insecurity, but, as in the past, world agricultural production is likely to keep up with, and perhaps may exceed the effective demand for food, the problem will continue to be one of persistence of poverty, leading to growth of the effective demand for food of the poor that would fall short of that required by them to attain levels of consumption compatible with freedom from under nutrition[90].

The poor lose if the physical supply of food is not increased, either by lower incomes from reduced employment or from higher prices. The major damage to the poor occurs, if both the purchasing power of the poor and the supply of food are reduced. The direct transfer of food to the poor represents a feasible and potentially efficient means of achieving food security by redistribution of foods across international boundaries[52,91-95]. But it is important that such food transfers actually reach the poor or else prices will be depressed. Price decreases, of course, benefit the poor, but there is always the danger that such decreases will retard the process of technological change in agricultural[96,97].

The two principal means of targeting food aid to the poor are food- for- work and food subsidies. Food- for- work is usually highly effective at reaching the most poor, because the work is onerous and the pay is low. In Africa food comprises some 15 to 40% of the cost of public works[98]. Food subsidies are another means of targeting food towards the poor. Food subsidies have the effect of distorting consumption patterns towards food—more food is consumed at a given income level when income comes from food subsidies than when it comes in other forms[99,100]. Broad subsidy schemes have immense costs and an immense impact on food security. In recent years, Egypt has spent up to 9% of its national income and 17% of its national budget on food subsidies. These subsidies have accounted for about 16% of the total incomes of the poorest quartile of the population. The level of caloric intake of Egypt's poor is high in relation to international norms of that level of income[101-109]. Food subsidies may be targeted to the poor by very general measures, such as choosing lower quality foods, or by giving the poor food stamps or inviting them to field kitchens or feeding centers.

Bangladesh is using food aid to back both food-for-work and food subsides. In the mid - 1980s, the average value of food aid in Bangladesh equaled 26% of annual development expenditure. That provided a substantial quantity of food and the financial means for the government to transfer purchasing power to the poor. An econometric analysis of public development expenditure in Bangladesh indicates that during the period 1976 to 1985, every dollar reduction in the supply of food aid was followed by a reduction in public expenditures on development of as much as 18 cents [84,110]. Food aid provides an importantly link in the needed partnership between developed and developing countries. Food aid in support of rural public works can do much to build an efficient and reliable rural infrastructure. The construction of all weather roads and new irrigation systems helps sets the stage for long-term agricultural growth. Such rural public works also provides much- needed short- term employment and income for the poor. The poor will then use their increased purchasing power to buy the food sent into the system by food aid [69,111].

1.3.3. Food Security: - An Economic Perspective

Lack of purchasing power due to low income is generally seen as one of the main problems for the majority of food insecure people. Thus increasing the income of marginalized groups of people should be a major focus for any policy regarding food security. Since for certain increasing income is not the only focus, by itself, this does not automatically result in improvement of food security / nutrition situation or to increases in consumption. But the central importance of income does imply that food security policies have the general objective of fighting against poverty as their main goal, encompassing other objectives and activities involved in poverty alleviation[55].

Raising incomes of the people engaged in agriculture generates a demand for labor-intensive goods and services which are typically produced in the country side[112,113]. For example, smallholder farmers in Bangladesh and Malaysia respectively spend 35 and 40 % of their increments to income on locally produced non-agricultural goods and services[84,114]. Small farmers in Nigeria spend as much as 20% of their increments to income on locally produced agricultural goods, such as vegetables and live-stock, creating additional employment opportunities in the agricultural sectors[114]. Reardon et al. (1988), emphasizes the importance of non- agricultural employment in improving food security in the rural areas of Burkina Faso[115].

Throughout the Third World, the poor spend between 50 and 80 % of their increments to income on food[116]. Thus, any increment in food prices has a deleterious impact upon their incomes. The vulnerability of Asian poor to rising of food prices is well known. The poor in Africa are also generally the net purchasers of food and hence are also vulnerable to rising food prices[87,117].

Economic approaches to food security have traditionally focused on assessing aggregate levels of food supply, agricultural production and the balance of agricultural trade[72,118-121]. In the 1970s food security was defined at the macro- level as the ability to avoid short-term deficits in aggregate food supply[122] and it was directly linked to grain stocks at the global and national level[123]. At the micro level, food security was conceptualized primarily as the ability to tackle successfully weather transitory shocks to food supply, such as drought, floods, market failure, or civil strife[44]. The focus was on food grains (staples), national stores of grain, and agricultural policy that ensured staple supplies and stores of grains. Most importantly food security was conceptualized as the out come measure of agricultural policies. The traditional economic focus on staple supply as the indicator of national food security has translated into a focus on total calorie intake and anthropometric status as primary indicators of household food security[124].

Although world food supplies stabilized at more than adequate levels, yet hunger and malnutrition continued to be prevalent. Hence, it becomes clear that aggregate food supply was not a useful proxy for food security as well as food consumption at the household or individual level. From an economic perspective, malnutrition was increasingly recognized as the individual level manifestation of a complex combination of household, community, regional, national, and international factors[64, 125, 126].

Seminal work by Sen[68] brought attention to the issue that access to food by households and by individuals, could be constrained by economic, social, and cultural factors and was most often a chronic, not transitory, condition at the household level. Since households have limited access to resources and strive to fulfill a variety of basic needs, procurement of food competes with acquisition of health service and other goods and services. Food needs are, therefore, not necessarily the most dominant basic needs for a given household's subsistence or survival[44]. The neoclassical economic theory of household production added further to the concept of food security by emphasizing the decision - making processes within the household that determine how scarce resources are allocated.

Household food security was focused as a measure that would link national-, regional-, and community - level measures of food security to household food consumption and individual nutritional status. It is seen as a concept that will relate agricultural policy to issues of nutrition[64].Once household food security was identified as an important variable in food security – a variety of definitions and conceptual frameworks of household food security were proposed from the agricultural economic perspective. Whereas previous definition of macro-level food security focused on food availability (supply), most of the recent household food security frameworks are concerned primarily with household access to food, although recognize that access is just one component of household food security. The issue of food distribution at the community level is also addressed by some of the frameworks, in that all groups in a society are viewed as requiring equal access to sufficient food.

The international fund for agricultural development concisely defines household food security as the capacity of a household to procure a stable and sustainable basket of adequate food[127]. Some of the terminology used in this definition is difficult to operationalise. Adequacy may be obtained in terms of quality and quantity of food, which contribute to a diet that meets the nutritional needs of all members of the household, while stability refers to the ability of the household to procure food across seasons and transitory shortages, which is the more traditional definition of food security. Sustainability is the most complex of the terms, which encompasses the issues of resource use and management, human dignity, and self-reliance, among others[127].

Increased income does not translate directly into increased food consumption at either the household or individual (child) level. Shifts in control of income from women to men are important[128]. Economic, food and agricultural policies and programmes that advantage the most vulnerable population groups are the most likely to provide positive benefits in terms of food security and nutritional status[128].

Economic growth in developing countries is changing consumption patterns, with slower growth (and in many countries actual declines) in per capita food consumption of grains and rapidly growing per capita and total meat consumption, combined with induced growth in cereal feed consumption. Some researchers hypothized that high- meat diets in developed countries limit improvement in food security in developing countries. They argue that reduced meat consumption in developed countries would release cereals from live-stock feed to food for poorer populations, thus improving food security in developing countries. Rosegrant M W et al[129] analyzed this hypothesis on the implications for future global cereal and meat supply and demand resulting from changes in global income, population growth and other structural changes and examined the effect of large reductions in meat consumption in developed countries on food consumption and food security in developed countries. They showed that while the long-term prospects for food supply, demand and trade indicate a strengthening of world cereal and livestock markets, the improvement in food security in the developing world will be slow, and changes in the dietary patterns in developed countries are not an effective route to improvement of food security in developing countries.

To examine the effects of an income-generating policy on the consumption of macro and micronutrients by households and preschoolers of southwestern Kenya, a study with 1677 under six pre-schoolers of 617 households indicate that although increases in household income do result in improved household level vitamin A intake, increases in household income are not significantly associated with intake of dietary vitamin A by preschoolers. The analysis suggests that although increases in household income have some very positive effects on household food security and household micronutrient consumption, other community- based health, sanitation and nutrition interventions are needed to address the dietary needs of individuals within the households[130]. The experience towards development of one of food security indicators includes the development of a food basket, defined as the group of food that meet the characteristics such as is now consumed by important population segments of the community. The concept implies a dynamic food basket, the quantities of which are calculated in a way that simulates the behavior of the consumer and the best nutritional knowledge. The measure of the risk of being unable to buy the foods needed for a family is used as a proxy for food security risk[131].

The world has been making progress in improving food security in respect of per person availability of food for direct human consumption, but this progress has been very uneven. Many developing countries have failed to achieve such progress, even in some developing countries, the food security situation is now worse than 20 years ago. Although the world has already produces sufficient food, the persistence of food insecurity does not reflect so much a lack of capacity of the world as a whole to increase food production to whatever level would be required for every one to have consumption levels assuring satisfactory nutrition. The under nourished and the food insecure persons are the victims of these conditions because they are poor in terms of income with which to purchase food or in terms of access to agricultural resources, education, technology, infrastructure, credit, etc., to produce their own food. Economic development failures account for the persistence of poverty and food insecurity[90].

Economists see household income as the Key potential "Shock" to household food security, along with market food prices. At a more micro-level it is important to acknowledge other types of coping strategies and social mechanisms that function to buffer the effects of income and prices fluctuations. Food gifts, loans and other machanisms often alleviate short – term stresses on household food supply[132].

Analysis of some of the reasons why the well laid plans of the 1970's failed to be an effective bulwark against hunger show that causes of hunger current in the 1970's can be summarized some what brutally as follows: either there is not enough food to eat or what is available is poor in nutritional quality. Poor nutrition is synergistic with disease. Together they result in increasing debility and finally death. Famine is an unusual event, precipitated by this some triad of factors, on a catastrophic scale. The strategies can be placed similarly under three broad headings:

- The first is that food production must be increased so that there is more food available for everyone,
- The second is that national food security strategies should be developed and implemented, and
- The third is that nutritional quality of people's diet should be improved.

These are three major goals which have dominated international thinking for a decade. The strategies based upon these have failed to make a marked impact on the risk. Vulnerable households face to famine. It suggests that irrespective of the quantity and quality of food generally available in the household, poorer communities and poorer countries are able to lay claim in to a share of what is available. These claims are mediated by a heirachy of relationship – households within communities, communities within countries and countries in the world at large --- and the nature of the relationship constitutes the political economy within which famines arise and must be analyzed[133].

1.3.4. House hold food security: An Advanced Concept:

Household food security has been defined as "Access to food, adequate in quantity and quality to fulfil all nutritional requirements of all household members throughout the year"[134]. From the view point of individual member in a household, food security may be defined as physical and economic access to balanced diet, including the needed micronutrients, safe drinking water, primary education and shelter[135].

Household food security depends primarily on the ability of the household to secure enough safe food to ensure an adequate intake for all the family members at all times[10]. This implies that food of all kinds should be available throughout the year for ensuring balanced diet in order to sustain household energy need and to meet other nutritional requirements.

Household food security integrates environmental, economic and cultural factors in a manner that can provide a useful tool for predicting dietary patterns within the household. These factors affect the manner in which households manage their food resources, either by affecting initial food selection and acquisition or by affecting the use of food once it has been selected. Household food security is an out come of these decisions.

As world food supplies stabilized at more than adequate level and hunger and malnutrition continued to be prevalent, it becomes clear that aggregate food supply was not a proxy for food consumption at the household or individual level. Therefore, in the mid-1980s, it became clear that adequate food availability at the national level did not automatically translate into food security at the individual and household levels. Researchers and development practitioners realized that food insecurity occurred in situations where foods were available but not accessible because of erosion to people's entitlement to food[136]. Entitlement refers to the set of income and resource bundles (for example, assets, commodities etc.) over which households can establish control and secure their livelihood. Households derive food entitlement from their own production, income, gathering of wild foods, community support (Claims), assets, migration, etc. Thus a number of socio- economic variables have an influence on a household's access to food.

As a result the household food security approach that evolved in the late 1980s emphasized both availability of food and stable access to it, food availability at the national and regional levels and stable and sustainable access at the local level were both considered essential to household food security. Interest centered on understanding food system, production system and other factors that influence the composition of the food supply and household's access to that food supply over time[137].

Regional foods supplies are affected by governmental inter–regional trade policies, seasonality and climate. The state of regional food supplies determines what foods are available in the community–level markets where households go to sell, trade and purchase foods for consumption. Community food market are affected by seasonality and climate, but also by a host cultural factors that determine food selection by households and patterns of intra – household food sharing. Individual dietary intake is the outcome of the intra – household distribution of the food available in the family.

At the household level, food security is determined by a household's current food supplies, past stable food supply, and potential future supply which is a function of the available household resources such as, land, labor and time. Between household food security and individual nutritional status are patterns of food distribution within the household and individual food consumption, including differences in dietary quality and quantity. Gittelsohn[138,139] has looked at the complexity of factors affecting intra-household food allocation and has found that in rural Nepal culturally specific food-serving behaviours result in nutritional penalties against women. Morbidity, a variable that is affected by community-level factors and also by household-level factors such as food preparation and hygienic practices, also affect an individual's nutritional status[140].

Household food security can be viewed in three different dimensions: the past (stable) food supply, the current stores, and the anticipated future supply of food adequate to meet the nutritional needs of all household members. Past food supply is reflected by the stable flow of food into the household, its storage and consumption within the household and its flow out of the household. Current food security is the presence of sufficient household food stores to meet the immediate nutritional needs of the household members. Future food security is viewed as that portion of existing food stores which is invested in planting and in feed to animals to ensure adequate food supplies in future[141].

The various means by which foods enter and leave the household represent a pattern of interactions. Households differ in their use of one or more pathways for obtaining and recollecting food. Information about food flow through the household during the course of the preceeding year can be used to give a picture of past household food security. By using a food-flow model for household access to food, issues of both adequacy and stability of food supply can be addressed. This approach is similar to those used in other studies to estimate, household-level food security[140]. Household food-flow model, however, has the potential to incorporate food adequacy, stability and sustainability into measurement of food security. The flow of foods into a household via different modes (self production, purchase, receipt as gift etc.) should theoretically meet or exceed the out follow of foods from the household (food consumed, sold, paid as rent, given to others, animal feed, etc).

Food flow in the marginal farm households emphasizing their food security is shown in the following food flow chart:

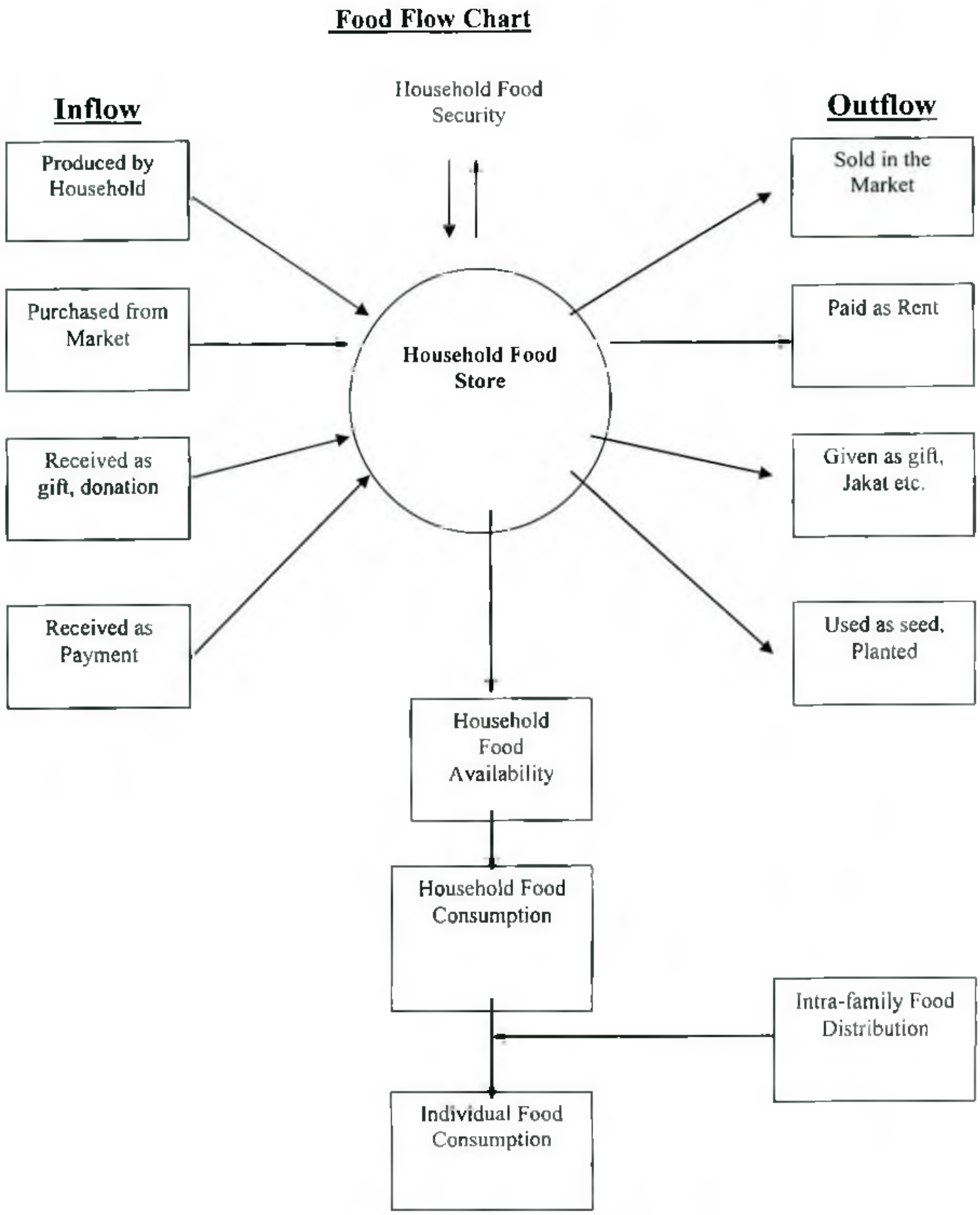


Figure 1.3.1: Food Flow through the Marginal Farm Households

1.3.5. Household food security: An Anthropological Perspective:

Anthropology has a great deal to contribute to the conceptualization of household food security. Anthropologists have traditionally collected information on food provisioning, preparation and consumption practices as part of their ethnographic description of cultural settings.[142-146].

Anthropological perspectives on food have focused on eliciting indigenous belief systems surrounding food, such as food classification, food proscriptions and prescriptions and so on. Ecological and medical anthropologists have investigated household responses to food shortages, with a particular emphasis on understanding and indentifying adaptive strategies for subsistance.[147-149].

Although "household food security" has not been a common component of anthropological studies, in recent years anthropologists have turned their attention to examining food security at the community level[150, 151].

Anthropologists have a number of tools at their disposal for investigating household food security. The primary focus of anthropology is on human belief, perception and behaviour at the community, household and individual levels. Through intensive study of small groups, anthropologists are in a good position to uncover the subtle dynamics that mark household – level decision making and activity and to understand this behaviour to a certain degree from the point of view of the people themselves. The ecological approach in nutritional anthropology typically considers the physical and social environments, social organization, available technology for food production, and cultural and ideological systems when assessing the determinants of food choices and diets [152].

1.3.6. Poverty (Food Insecurity), Nutrition – Infection Nexus:

A recent study examined the relationship between per capita income growth and infant mortality in developing countries during the period from 1960 to 1990 and shows that according to its estimates, a 10% increase in per capita income leads, on an average, to about a 2% reduction in infant mortality over a five-year period and a 4% reduction over a 30-year period, which ended with the conclusion that 'Wealthier is Healthier'[153].

Poor households typically spend a huge proportion of their budget on food, and as their income rises, they tend to spend a correspondingly larger part of the additional income on food. It may, therefore, be expected that their calorie intake will rise strongly with rising income. Pitt and Strauss indicate that an increase in income brings forth an almost proportionate increase in calorie intake[154, 155]. At very low levels of consumption, calorie intake rises rapidly with income, but beyond a point it becomes virtually constant.

The findings of a number of studies suggest that as poor households get less poor they spend the additional income on more expensive foods, such as finer cereals or meat and dairy products, which may be more tasty but do not necessarily yield more calorie. That explains why the elasticity of food expenditure is high and yet the elasticity of calorie intake is so low [156-160].

The impact of income on calorie intake is unlikely to be negligible. The notion of a negligible impact of income on calorie intake of the poor is inconsistent with much evidence linking calorie intake with productivity. Most of this evidence shows that higher calorie intake raises productivity, and thereby the income-earning capacity, of the poor[158, 161-163].

While the income – calorie relationship may be a matter of dispute, there is no disputing fact that higher income leads to higher intake of other nutrients such as protein, iron and other micronutrients which are essential for healthy life[164, 165].

However, even if higher income leads to higher intake of all nutrients, that by itself need not ensure higher nutritional status, because the intake of nutrients may not be the binding constraint at all. This brings the issue of the nutrition-infection nexus. Frequent attacks of infectious diseases may hamper the utilization of nutrient at the cellular level by various ways. Furthermore, infections may reduce the level of intake itself by reducing appetite. In such cases the intake of more nutrients as afforded by higher income will not by itself improve the situation[166-170].

To some extent, higher income in the hands of the poor will help matters here by enabling them to live in a more hygienic environment and to purchase the necessary medical care. But the purchasing power of the poor may not be strong enough to justify the fixed costs of setting up medical facilities on private initiative. In this situation, higher private income in the hands of the poor will not lead to higher nutritional attainment, in the absence of state or community level actions. Anand and Ravallion (1993)[171] noted that higher per capita income may improve the health of a population through two channels- by reducing poverty and thereby giving more income to the poor , and by enabling the state to invest more on health. From a cross –country analysis they found that the second channel was twice as effective as the first in improving life expectancy. They also found that in Sri Lanka over a period from 1952 to 1981 an increase in public health spending reduced infant mortality 22 times more than what was achieved by an equivalent increase in per capita income. They do not consider the existence of two-way causation between diet and disease; just as disease may reduce the usefulness of diet, so a poor diet may magnify the effect of disease. Thus a poor diet may cause malnutrition indirectly by raising the susceptibility to infection or by intensifying the adverse effect of infection. But one may wrongly conclude that diet has no effect. A recent study by Haddad et al. in 1995 found that not only do diet and disease have independent effect on child anthropometry, they also interact strongly with each other. Thus low calorie intake does affect nutritional status adversely, partly on its own and partly by accentuating the effect of morbidity[172]. In an authoritative review Martorell and Ho (1984) concluded that, while food support given to malnourished children may not make them any less susceptible to infection, the severity of any given infection clearly reduced, thereby reducing child mortality[173].

1.3.7. Food Insecurity:

The phenomenon loosely labeled hunger in the 1980s is now being discussed as food security or insecurity. Food security at a minimum includes the followings: a) The ready availability of nutritionally adequate and safe foods, and b) the assured ability to acquire personally acceptable foods in a socially acceptable way. Food insecurity, on the other hand, exists whenever food security is limited or uncertain[9]. There are different forms of food insecurity[10]:

a) Chronic food insecurity refers to households that are perpetually short of food,
b) Seasonal food insecurity results from food shortage and higher price during lean period before harvest or from seasonal unemployment, and
c) Transitory food insecurity arises from failure of crop production, loss of employment, man made or natural disaster/calamities and other adverse circumstances.

Food supply is often disrupted in different ways resulting into household food insecurity. Food insecurity may occur at the household level, and is occurring in the absence of regional and national food insecurity[68]. Food crisis in Africa during the early 1970s stimulated to focus on the lack of food supplies as the major cause of food insecurity[174].

The root of household food insecurity is poverty. Mal distribution of land, backward agricultural practices and thereby low food production, lack of employment specially during lean seasons, low wage rate and low household income resulting into low purchasing power, frequent natural calamities such as flood, draught, social and political unrest, chronic national food shortage, seasonal differences in food production and supply etc also contribute to a great extent in household food unavailability and thus food insecurity. Inadequate food, due to food shortage, or to inappropriate consumer behaviour or intra-household distribution is termed as food insecurity. Food insecurity at the household or individual level may be transitory, or short-term because of a particular event of short duration, results from a temporarily limited access to food. Chronic food insecurity results from a long-term food shortage. Food insecurity occurs in mild, moderate and severe forms, just as PEM does. The level of food insecurity may be related to the relative availability of food.

A "shock" often precipitates household food insecurity, which can aggravate poverty or adversely influence food production. There are many different kinds of shock, for example, serious illness, sudden loss of job, farm production crises, such as crop failure due to drought or flood and some other agricultural catastrophe. More over any crisis that has an adverse impact on the livelihood of the family may also result in household food insecurity. Another important determinant of food insecurity is gender discrimination[175]. The presence of civil conflict increases vulnerability to food insecurity, and vice versa[176]. Recent information from FAO vividly demonstrates that the incidence of food insecurity or undernourishment is highest in countries with a high incidence of civil conflict[16]. For example, 56% of the countries where more than half of the population was undernourished were experiencing conflict, while only 8% of the countries with the lowest incidence of undernourishment were mired in conflict. Similarly, child mortality rate decline as the prevalence of food insecurity declines[16].

Population groups generally affected by household food insecurity include marginal farmers, landless agricultural/day labors, temporary workers, small traders, fisherman, forestry worker, pastoralists, urban poor and urban slum dwellers. However, the potential consequences of food insecurity among these vulnerable groups include hunger, malnutrition and either directly or indirectly effect health and quality of their lives[10].

The measurement of food insecurity at the household or individual level involves the measurement of those quantitative, qualitative, psychological and social or normative constructs that are centered to the experience of food insecurity, qualified by their involuntariness and periodicity. Risk factors for food insecurity include any factor that affects household resources and the proportion of those resources available for food acquisition[9].

The precise relationships between food security and its risk factors and potential consequences need much more research now that there is an emerging consensus on the definition and measurement of food insecurity. Indicators of food insecurity are proposed as a necessary component of the core measures of the nutritional status of individuals, communities or nations[9].

1.3.8. The Seasonal Food Insecurity and Houschold Food Consumption:

In many developing countries, specially in Asia and Africa, crops production is dependent on seasonal climate. As a consequcnce, food insecurity is not constant throughout the year, and rural poor households often experience a food-insecure period just before the new harvest. Seasonal fluctuations in food insecurity and household responses to this insecurity can influence family and individual consumption patterns. Generally, in periods of food insecurity a shift from highly preferred foods to less preferred foods is expected to occur[10].

1.3.9. Household food insecurity and its consequences

In many households undernutrition amongst women and children may be the physical expression of lack of household food security i.e. food insecurity[134]. As the consequence of household food insecurity household members, particularly the mothers and children suffer from various degrees of malnutrition and thus cause malnutrition among the entire population. Poor nutrition often starts in utero and extends well in to adolescent and adult life[177]. Mothers who are undernourished before or during pregnancy are more likely to give birth to underweight infants. Low-birth-weight infants are a far higher risk of dying in the neonatal period or later infancy and are more likely to experience a variety of developmental deficits. These infants, if survive, may grow poorly during childhood, do less well at school and have less productive working capacity during adulthood. A low-birth weight infant is thus more likely to be under weight or stunted in early life[177].

Besides, infants if girl with low birth weight are more likely to become undernourished mothers themselves at adulthood, thereby perpetuating the cycle of undernutrition from one generation to the next.

The causes and consequences of early childhood deficiencies arising from low food intake have implications for later life and may be present as risk factors for future generations. Severe iron deficiency anaemia during pregnancy may even place a women's life at risk during child birth. Iodine deficiency disorders starting with foetus may cause brain damage or stillbirth. Folate deficiency in pregnancy may result in neural tube defects during foetal development. Vitamin A deficiency may increase morbidity and mortality risk and affect vision, while anaemia and iodine deficiency disorders may lead to cognitive deficits[178]. These consequences are obviously due to household food insecurity coupled with food discrimination among male and female members of the household. Different studies highlighted the consequences of household food insecurity)

A study of food insecurity and nutritional adequacy was conducted with a sample of 153 women in families receiving emergency food assistance in Toronto, Canada. Contemporaneous data on dietary intake and household food security over the past 30 days were available for 145 of the women. Analyses of these data revealed that women who reported hunger in their household during the past 30 days also reported systematically lower intakes of energy and a number of nutrients. The effect of household level hunger on intake persisted even when other economic, socio-cultural and behavioral influences on reported dietary intakes were considered. Estimated prevalence of inadequacy in excess of 15% were noted for Vitamin A, folate, iron and magnesium in this sample, suggested that the low level of intakes associated with severe household food insecurity are in a range that could put women at risk of nutrient deficiencies[179].

A conceptual frame work showing the household and social implications of food insecurity was elicited from a quantitative and qualitative study of 98 households from a heterogeneous low income population of Quebee city and rural surroundings; the study was designed to increase understanding of the experience of food insecurity in order to contribute to its prevention. According to the respondent's description, the experience of food insecurity is characterized by two categories of manifestations, i.e. the core characteristics of the phenomenon and a related set for actions and reactions by the households. This second category of manifestations is considered here as a first level of consequence of food insecurity. These consequences at the household level often interact with the larger environment to which the household belongs. On a chronic basis, the resulting interactions have certain implications that are tentatively labeled social implications. Their examination suggests that important aspects of human development depend on food security. Findings underline the relevance and urgency of working towards the realization of the right to food[180].

1.3.10. Target Vulnerable Households to Food Insecurity:

In a community who supper the most from food insecurity? Conventionally it is thought that the population groups in a rural community usually experience food insecurity are the people of landless households, landless farm households, marginal farm households, small farm households, agricultural or other labour households, who are principally engaged in agricultural activities for food production. But majority of these people belong to marginal farm households, who are the main work force for cultivating essential food crops, staple in particular, for themselves and for the whole nation as well. In order to identify the most vulnerable population groups in respect of food insecurity, it is necessary to consider the fact that who are those belong to the first section of the farm population mainly responsible for food production and supply for the whole nation? How is their condition regarding food intake, health and nutritional status along with economic situation? And on whom the other sections of the population depend for their food supply? Considering these facts it is necessary to target the appropriate population group most vulnerable to food insecurity for analyzing factors affecting it. For this purpose, vulnerability mapping can be a useful and important tool which considers a variety of factors in targeting vulnerability households among the population groups.

1.3.11. Vulnerability Mapping (Risk Mapping):

To identify the target group households vulnerability mapping / risk mapping is very much useful[136]. Vulnerability maps are maps which identify the areas and sector of the population which are most vulnerable to food insecurity. This map highlights the regions that need to be monitored more closely, help governments and NGOs to target food aid and other necessary intervention more effectively and to identify factors to take into consideration in designing interventions for vulnerable areas (Table1.3.2)[136]. An earlier version of vulnerability mapping used in the 1770s was 'functional classification' of under-nourished population as the basis for food and nutrition planning[44].

Table 1.3.2: Household Vulnerability Assessment Matrix

Risk of an Event	**Ability to Cope**			
Shocks/Trends	**H/H Characteristics**	**Areas to Resources**	**Production/income Opportunities**	**Support Structure**
Baseline Vulnerability Crop Production and Livestock Risks Drought episodes Soil conditions Pest infestations **Market Risks** Market infrastructure price fluctuations (asset, food, cash crops, livestock) Food shortages Access to employment **Political Risks** Conflict / war	Composition (age dependency ratio) Education Health status Out migration	Access to land Access to labour Liquid assets Productive assets Credit Common property resources (for wild foods and other products) Food stores	Crop/livestock Production Other income sources Seasonal migration	Community support mechanisms (claims) NGOs Government policies Access to social services
Current Vulnerability Crop Production and Livestock Risks Current Drought Pest attack **Market Risks** Market infrastructure price fluctuations (asset, food, cash crops, livestock) Food shortages Access to employment **Political Risks** Conflict / war	Composition (age dependency ratio) Education Health status Out migration	Access to land Access to labour Liquid assets Productive assets Credit Common property resources (for wild foods and other products) Food stores	Crop/livestock Production Other income sources Seasonal migration	Community support mechanisms (claims) NGOs Government policies Access to social services
Future Vulnerability (trends) Environmental Degradation Land Pressure Out Migration	Demographic changes	Land tenure changes	Employment trends	Support structure changes

Jaspars et al[181] in a review paper showed that in reaching vulnerable groups strategies to target vulnerable households are common in the protected phase of emergency. It is not always justified by an improvement in nutritional status or food security of the beneficiary population. Common target groups are the poor and malnourished, but in complex emergencies these are not always the most vulnerable. Methods to target the poor rely on community-based relief committees and local authority, which is being followed in many countries. The author suggested on citing examples of such targeted assistance programmes in Kenya, South Sudan and Tanzania, that if targeting has to be done because of scarce resources, this should be done on a geographical basis and on the basis of nutritional status.

1.3.12. Marginal Farm Households:

The majority of the people of a developing country largely belong to rural population. The farm household members, on the other hand, mainly constitute rural population. The proportion of farm households in a rural community is much higher in any agriculture-based country, because the occupation of majority of rural people is agriculture or farming. But major portion of farm households are marginal farm households having only 5 to 50 decimal of lands. The people of marginal farm households are mainly farm labour engaged in farming in their own land or lased land or land cultivating on share cropping basis as well as they sell their labour to other's farm land, even about three fourth of their farm labour is being sold. So, these farm people are the main work force for agricultural production and as such food production of a developing country is largely dependent on these marginal farmers.

1.3.13. Marginal Farm Households in Bangladesh:

Being a developing country, the economy of Bangladesh is principally dependent on agriculture. Since the rural people are mainly engaged in agricultural activities, a significant higher proportion of them constitute the farm households. Total number of households of Bangladesh was 19979932 in 1997 of which 59.1% were farm households[41]. But the number of total households increased to 25307000 in 2001 of which more than 70% were reported to have agriculture holding[43] and 66.18% of whom were farm households and 33.82% were non-farm households[43]. Out of total 11798242 farm households 49.1% are marginal farm households of which 57.9% have 5 - 49 decimal of land and 42.1% have 52 - 99 decimal of land. Some 30.8%, 17.6% and 2.5% are small (1 - 2.49 acre), medium (2.5 - 7.5 acres) and large (7.5+ acres) farm households respectively[46]. But in a book for Agriculture Diploma Course[47] in Bangladesh it was shown that the proportion of marginal farmers having 0.01 to 1 acre of land were 50.6% of the population and marginal farm households having 5 to 99 decimal of land were 43.33% of all farm households of which about 71% have 5 - 49 decimal and 29% have 50 - 99 decimal of land.

In Bangladesh households having land less than 5 decimal are considered as non-farm landless households and households having 5 to 249 decimal of cultivated land are recognized as small farm households[41]. But in Agriculture Economics it has been stated that farm households having 1 to 100 decimal of land holding are categorized as marginal farm households[47]. It has been stated that households with less than 5 decimal of land are not qualified as farm households. So, for practical consideration and convenience land holding and / or operated between 05 and 100 decimal of land are taken as cut-off point for distinguishing marginal farm households. However, farm households having 05 to 100 decimal of operated land including homestead are considered as marginal farm households.

1.3.14. Food Security Situations: Food Security in South Asia:

Apart from China, South Asia happens to be the most densely populated region in the world[182]. A vast majority of the poor and food-insecure people of the world live in the South Asian countries such as Bangladesh, India, Nepal, Pakistan and Sri Lanka[183]. Using the international comparable poverty line of 'one dollar per day in 1985 purchasing power', just under a half of world's population lived in South Asia in 1993. Thus in 1993, some 43% of the South Asian population was poor compared to 26% in East Asia and the Pacific including China and 24% in Latin America; and even 39% in Sub-Saharan Africa[182]. All these countries are classified by the World Bank as 'poor' based on the GNP and GNP per capita annual growth rates[184 - 186] as shown in the Table 1.3.3:

Table 1.3.3: Growth in GNP and Per Capita GNP in South Asian countries

Item	Bangladesh	India	Nepal	Pakistan	Sri Lanka
Annual growth rate of GNP (1980-93)	4.5	5.0	4.6	6.1	4.6
Annual growth in agricultural production (1980-91)	2.7	3.2	4.9	4.2	2.3
Annual growth in population (1980-91)	2.2	2.1	2.6	3.1	1.4
GNP per capita annual growth rate:					
1965-80	- 0.3	1.5	-	1.8	2.8
1980-93	2.1	3.0	2.0	3.1	2.7
GNP per capita in 1998 (US Dollar)	350	430	210	480	810

Sources: FAO Year Book, Production, 1994; Human Development Report, 1996; WHO (1999).

This region is also backward in terms of other social development indicators[185]. According to UNDP Human Development Report[185], the Human Development Index of South Asian countries ranked as follows: Bangladesh 143, India 135, Nepal 151, Pakistan 134 and Sri Lanka 89. Infant mortality rate, maternal mortality rate, illiteracy or life expectancy at birth are more disaggregated human development indicators as found in these countries. And as such the incidence of malnutrition is very serious in this region[187]. Because, 'Poverty breeds malnutrition and, in turn, malnutrition increases poverty, a vicious cycle'- as has been stated by Abraham Horwitz[188] who has encapsulated a whole set of complex interactions that shape nutritional well being of the people. This view, however, fairly corresponds to the situation of South Asia and in most of these countries poverty line is defined in terms of expenditure on food plus other essential expenditure; the former can be translated in terms of calorie intake at the household level.

Agriculture plays a vital role in the economies of these countries, although its share is declining, and has come down to nearly 25% of GNP in Pakistan and Sri Lanka[184, 185]. It is a dominant sector in all the countries in terms of rural employment and also claims a high share in the total trade as shown in the following Table 1.3.4.

Table 1.3.4: Role of agriculture in national economies in South Asian Countries, 1991

Item	Bangla-desh	India	Nepal	Pakis-tan	Sri Lanka
Agriculture's share in GDP in 1993	30	31	43	25	25
Percentage of labour force in agriculture,1991	60	65	94	52	48
Agriculture trade as share of total trade,1991	10	17	21	16	32

Sources: FAO Year Book, Production, 1994; Human Development Report, 1996.

Agrarian structure in these countries is dominated by small and marginal farmers (i.e. holding les than one ha) which account for a large proportion of farm households. The share of these holdings in total cultivated land is nearly at 20% in Sri Lanka and Bangladesh, and 15% & 17% respectively in India and Nepal and only 2% in Pakistan. In addition there are a large number of landless households accounting for 20% of all rural households in Bangladesh, 30, 18, 30 and 22 per cent in India, Nepal Pakistan and Sri Lanka respectively[189]. These two categories i. e. marginal farmers and landless labourers and a large number of traditional craftsmen constitute the bulk of food insecure households in the rural areas of these countries. Per capita holdings are small and agriculture is characterized intensive cultivation and the scope for extensive agriculture is more or less exhausted in the countries of this region.

An impressive achievement has obtained by most of the South Asian countries in respect of availability of food grains at the macro level. There has been a significant improvement in the per capita availability of food, in terms of calories, over two decades (1969-71 to 1990-92) in India, Pakistan and Nepal, and a marginal decline in Sri Lanka. Only in Bangladesh there was a significant decline in the overall food availability[190].Of course such availability of food grains by itself is not a sufficient condition for food security for the poorer households. The following Table 1.3.5 shows the changes in the availability of food grains in terms of calories:

Table 1.3.5: Changes in Food grains availability in South Asian Countries (calorie per capita per day)

Country	1968-71 (i)	1990-92 (ii)	ii and % of i
Bangladesh	2118	1995	94.2%
India	2037	2331	114.4%
Nepal	1910	2144	112.3%
Pakistan	2177	2339	107.4%
Sri Lanka	2267	2233	98.5%

Sources: FAO Food Security Situation (mimeo, 1996)

There has also been a change in diet composition of various population groups, indicating a rise in the intake of non-cereal (fruits, vegetables) consumption in general and animal product in particular, which suggests an increase in the availability of calories at a faster rate than the availability of food grains, particularly cereals. At the same time, changes in the diet composition to superior cereals and animal products suggest that the cost of calories has increased which is due to rise in the per capita income. Although the records of different countries are not uniform, but improved availability of food grains and quality of food is a common feature of most of the countries in this region. However, per capita availability of low cost nutritious foods, specially pulses, has declined in a number of countries, e.g. India and Pakistan.

National food availability as the move towards national food self-sufficiency depends on domestic production or on trade for food. Agricultural policies of South Asian Countries were directed to augment food supply from domestic sources on priority basis. One indicator of this tendency is the decline in the share of imports in food grains availability in these countries[191, 192] as shown in the Table 1.3.6 below:

Table 1.3.6: Production, import, export of cereals and pulses in the triennium ending 1993 (in 1000 mt)

Country	Production (1)	Imports (2)	Exports (3)	Net Availability (4)	1 as % of 4
Bangladesh	293037	1484	-	30788	95.2
India	211227	1139	938	211428	99.5
Nepal	5430	53	28	5455	99.5
Pakistan	23003	2145	753	24395	94.3
Sri Lanka	2472	1086	1	3558	69.5

Sources: FAO Production Yearbook, 1993; FAO Trade Yearbooks, 1993

However, South Asian Countries improved the level of food availability through domestic production and from imports at the macro level over the past two decades. Another achievement in this regard is the strengthened capacity of these countries to cope with the yearly fluctuations, and thus periodic shortfalls, in food grains production. During the last two decades, there were few instances of death from starvation even though some countries faced severe droughts, floods and cyclones which resulted in large shortfalls in agricultural production. A steady supply at the national level was possible in a number of countries by better management of available food stocks integration of domestic food markets and judicious use of buffer food stocks as well as trade channels.

Partly because of food grains availability in domestic and international markets as well as judicious price policies, the real prices of food grains did not rise to any significant extent from the mid 70s to the early 90s. Food grains prices did not exacerbate incapability of even other sections of population who did not have domestic production, to obtain foods. This factor further assisted the poor and food insecure households. Seasonal fluctuations in food grains prices were more severe compared to intra-year fluctuations in the general index of prices. These fluctuations hit those households which were not in a position to stock food grains. The incidence of such fluctuations was particularly serious in the marginal and small farmers, wage labourers and other workers in the informal sectors whose employment varied over the seasons[53].

The countries of this region did reasonably well in maintaining an adequate supply of food grains at the national level. There were fluctuations in food grains production but public policies muted these fluctuations by proper supply management and as such that shortfalls in domestic food grains production did not severely reduce the supplies. Seasonal instability in the supplies as well as seasonal fluctuations in food grains prices could not be corrected to the desired extent. The South Asian countries, however, could provide access to food to progressively larger number of households, yet severe pockets of hunger remained. As Protein energy Malnutrition (PEM) is much worse in South Asia, per capita crop production does not correlate with the prevalence of child PEM in this region[19] (Table 1.3.7).

Table 1.3.7: Crop Production and PEM in South Asia

Countries	Crop production per capita (metric tons)	Prevalence of underweight%
Bangladesh	.24	68
Bhutan	.18	38
India	.22	59
Maldives	-	43
Nepal	.27	54
Pakistan	.18	42
Sri Lanka	.14	34

Source: UNICEF (1996)

Average annual growth rate of different characteristics during the period from 1990-92 to 1997-99 in the South Asian countries classified by change in number of undernourished shows that total population, per capita dietary energy supply, per capita food production and per capita agriculture production in total population increased at a rate of >0.5% per year in Bangladesh, India and Nepal, while those decreased in Pakistan and Sri Lanka at a rate of <-0.5% per year[194-196] (Table 1.3.8).

Table 1.3.8: Growth of population, per capita dietary energy supply, and food and agricultural production for South Asian countries in the 1990s, classified by change in number of undernourished.

Countries	Average annual growth rate 1990 – 92 to 1997 – 99 (percentage)			
	Total Population	Per capita dietary energy supply	Per capita food production	Per capita agricultural production in total population
Increased:				
Bangladesh	2.2	0.3	0.5	0.6
India	1.8	0.4	1.1	1.0
Nepal	2.4	-0.5	0.2	0.2
Decreased:				
Pakistan	2.5	0.9	1.8	1.9
Sri-Lanka	1.1	0.9	0.5	0.9

Source: Total population: UN World Population Prospects, 2000 revision.
Dietary energy supply, agricultural and food production: FAO estimates.

It was mentioned before that even though South Asia has a slightly higher proportion of poor compared to Sub-Saharan Africa, the South Asian poor have on an average a higher level of income than their African counterparts. And per capita availability of calorie is also higher in South Asia[197] as shown in Table 1.3.9. At the same time, the available evidence does not suggest that South Asia lags behind Sub-Saharan Africa in public provision of health and hygiene[198]. Yet all the evidences point to a more massive incidence of under nutrition in South Asia[177]. The state of food insecurity in the world 2001 also shows that intake and changes in per capita dietary energy supply during the period from 1990-92 to 1997-99 is much lower in South Asian countries compared to other developing countries except Sub-Saharan Africa. On the other hand proportion of undernourished people of these countries is much higher, while rate of change is lower compared to other developing countries except Sub-Saharan African countries where undernourishment in total population is about 10% higher than South Asian countries (Table 1.3.10)[194 - 196].

Table 1.3.9: Per Capita Calorie Availability in Different Countries: 1969-71, 1979-81, 1990-92

Region	Per capita daily calorie supply			Annual rate of growth (%)		
	1969-71	1979-81	1990-92	69-71 to 79-81	97-81 to 90-92	69-71 to 90-92
Developing Countries	2140	2330	2520	0.9	0.7	0.8
South Asia	2060	2070	2290	0.0	0.9	0.5
East & South-East Asia	2060	2370	2680	1.4	1.1	1.3
Sub-Saharan Africa	2140	2080	2040	-0.3	-0.2	-0.2
Middle East/ North Africa	2380	2850	2960	1.8	0.3	1.0
Latin America/ Caribbean	2510	2720	2740	0.8	0.0	0.4
Developed Countries	3190	3280	3350	0.3	0.2	0.2
Industrialized Countries	3120	3220	3410	0.3	0.5	0.4
Transition economics	3330	3400	3230	0.2	-0.5	-0.1
World	2440	2580	2720	0.5	0.5	0.5

Source: FAO (1996).

Table 1.3.10: Change in per capita dietary energy supply, and prevalence of undernourishment in developing countries between1990-92 and 1997-99

Region / Country	Per Capita Dietary Energy Supply (kcal / day)		Proportion of Undernourished (percentage)	
	1990 – 92	1997 – 99	1990 – 92	1997 – 99
Developing World	2540	2680	20	17
Asia and the Pacific	2530	2710	20	16
East Asia	2720	3020	16	10
South East Asia	2480	2660	17	13
South Asia	2330	2400	26	24
Latin America and Caribbean	2710	2830	17	19
Near East and North Africa	3010	3010	8	9
Sub-Saharan Africa	2120	2190	35	34

Source: Total population: UN World Population Prospects, 2000 revision.
Dietary energy supply, agricultural and food production: FAO estimates.

Indeed, South Asia suffers from by far the worst incidence of child undernutrition among all the regions in the developing world including Sub-Saharan Africa as seen in Table1.3.11. Some 17% of South Asian under five children was found to be wasted during the period 1985-95 as compared to an average of only 9% in the developing world as a whole and 7% in Sub–Saharan Africa. Like wise as many as 60% of South Asian children were stunted as compared to 41% in the developing world and 39% in Sub-Saharan Africa[187, 197, 199].

Table 1.3.11: Regional Variation in Childhood Malnutrition: c. 1990

Region	Low weight for height(%) (wasted)	Low height for age (%) ((stunted)	Low weight for age (%) (underweight)	Low birthweight babies (%) (LBW)
South Asia:	17.1	59.5	58.3	33
Bangladesh	15.5	64.6	65.8	50
Bhutan	4.1	56.1	37.9	--
India	19.2	62.1	63.9	33
Maldives	6.3	--	--	20
Nepal	14.0	69.0	70.0	26
Pakistan	9.2	50.0	40.4	25
Sri Lanka	12.9	27.5	38.1	25
East and South-East Asia	5.2	33.3	23.6	11
Sub-Saharan Africa	7.0	38.8	30.2	16
Middle East/ North Africa	8.8	32.4	25.3	10
Latin America /Caribbean	2.6	22.7	12.0	11
Developing Countries	9.1	40.7	33.9	19

Source: UNDP (1994), UNICEF (1996), FAO (1996).

It should be noted that the prevalence of child undernutrition has actually been declining in South Asian countries[200], as in other countries of South-East-Asia, even as in most other parts of the world (Table1.3.12). So, it would appear that higher income, lower poverty and better provision of public health have all had their beneficial impact. But the initial levels of undernutrition were so high that, even after this decline, the absolute levels remain higher than any other part of the world.

Table 1.3.12: Change in the Prevalence of Underweight Children in Developing Asia

Region/Country	First period	Second period	Third period
South Asia			
Bangladesh	84.4 (1975)	65.8 (1990)	56.3 (1996-97)
India	78.0 (1977)	61.0 (1992)	53.4 (1992-93)
Pakistan	54.7 (1977)	40.4 (1991)	-
Sri Lanka	58.3 (1976)	38.1 (1987)	37.7 (1993)
South-East-Asia			
China	21.3 (1987)	17.4 (1992)	-
Laos	36.5 (1984)	40.0 (1994)	-
Malaysia	25.6 (1983)	23.3 (1993)	20.1 (1995)
Myanmar	42.0 (1982)	36.7 (1991)	42.9 (1994)
Philippines	33.2 (1982)	29.6 (1993)	-
Thailand	36.0 (1982)	13.0 (1990)	13.0 (1990)
Viet Nam	51.5 (1986)	44.9 (1994)	39.8 (1998)

Source: WHO Global Database on Child Growth and Malnutrition (As reported in FAO, 1996)

The extent of child undernutrition has been measured by the prevalence of moderate-to-severe stunting as recorded in WHO's database. After experimenting with various combinations of explanatory variables, it has been finally chosen one which contains per capita income, population per doctor, the extent of urbanization, and female literacy rate-all referring to the early 1990s [198]. Female literacy is now widely recognized to be an important determinant of the health of a nation. Some evidence from India, Pakistan and Sri Lanka based on country wide household surveys shows the incidence of child under nutrition for four categories of mother's education[201]. It can be seen that in each country, for all three categories of undernutrition, the incidence of undernutrition falls monotonically with the level of maternal education- the illiterate mothers being associated with the highest incidence in every case (Table 1.3.13). In fact, the level of education does not have to be particularly high before it begins to have its effect. Even those women who have not gone beyond the primary school can have as much as 20% less undernutrition among their children as compared with illiterate mothers.

Table 1.3.13: Differentials in Nutritional Status of Children

Characteristics	Low WFA	**India** Low HFA	Low WFH	Low WFA	**Pakistan** Low HFA	Low WFH	Low WFA	**Sri Lanka** Low HFA	Low WFH
Sex:									
Male	53.3	52.3	18.8	40.9	51.0	10.2	37.6	26.4	12.4
Female	53.4	29.4	16.1	40.0	48.9	8.2	38.6	28.8	13.5
Residence:									
Rural	55.9	54.1	18.0	44.6	54.9	9.8	38.7	26.2	13.6
Urban	45.2	44.8	15.8	32.5	40.7	8.1	27.0	18.8	11.3
Mother's education:									
Illiterate	59.2	58.5	18.8	44.9	55.5	10.3	52.8	50.5	15.2
Literate level 1	50.4	46.4	16.8	37.1	43.8	7.5	44.5	34.3	13.8
Literate level 2	43.5	39.3	14.7	25.8	33.2	5.3	36.1	25.0	12.5
Literate level 3	30.3	30.0	12.3	13.o	18.2	3.6	28.2	15.4	11.8

Source: DHS reports; India 1992-93; Pakistan 1990-91; Sri Lanka 1987; Thailand 1987

Note: India and Pakistan data refers to under-five children; Sri Lanka refers to 3 – 36 months-old children. Literacy levels are defined as follows: Level -1: up to middle school in India, and up to primary level in Pakistan and Sri Lanka.

South Asia happens to suffer from the highest incidence of low-birth-weight babies (LBW) in the whole world. One in three new born of this region is an LBW baby, as compared to the average of 1 in 5 in the developing world and 1 in 6 in Sub-Saharan Africa[202]. The occurrence of low birth weight is mainly a reflection of poor malnutrition; the women who experience greater nutritional stress during pregnancy tend to bear more LBW babies. These LBW babies born with initial handicap from inadequate foetal nutrition, hampers the development of their immunological competence leading more neonatal deaths as compared with normal babies. Those who survive with a defective immune system fall prey to frequent infections and get trapped into the vicious cycle of the nutrition-infection nexus following retarded physical and mental development. The average age at first marriage of the South Asian women is low which also causes LBW, since it is well known that pregnancy at a tender young age raise the likelihood of low birth weight babies.

It is also known that the proportion of pregnant women suffering from anaemia is exceptionally high in South Asia and according to a recent estimate it is as high as 78% which is higher than anything as observed in the rest of the world. Hence, there is no doubt about the woeful condition of the maternal nutrition in South Asia. The fact that South Asian women receive a raw deal in the allocation of food and health care facilities has been much discussed and convincingly documented from numerous micro-studies[203-209]. The consequences of such discrimination are manifested in higher morbidity, and eventually higher mortality, of women relative to men.

The origin of female disadvantage lies in the discriminating treatment offered to women in the allocation of life-saving resources such as food and health care. Almost every where in the developing world women suffer more than the men in the reproductive age, but the differential is much higher in India than in other parts of the world[202].

As expected, per capita income, health facilities, urbanization and female literacy are all found to be significant in determining cross-country variation in child undernutrition. Of course there may be something beyond the four variables that could not be ascertained. This region may be poor, and it may have low female literacy and poor medical facilities, with the exception in Sri Lanka, but these alone can not explain its exceptionally high rate of child undernutrition. It should be noted that the prevalence of child under nutrition has actually been declining in South Asia, as in most other parts of the world. So, it would appear that higher income, lower poverty and better provision of public health have all had their beneficial impact. But the initial levels of under nutrition were so high that, even after this decline, the absolute levels remain higher than any other part of the world[202].

All these factors are indicative of the specially poor condition of maternal nutrition in South Asia which lies behind the excessive child undernutrition in this region. Although these factors are important in shaping the nutritional status of a population, they can not be fully account for the exceptionally high level of undernutrition observed in South Asia. Perhaps, there may be something underlying in south Asian culture- associated in precipitating undernutrition, which is yet to be investigated thoroughly.

1.3.15. Household Food security Status in Bangladesh:

Food security at the household level in Bangladesh is serious and is the most difficult level of food security to achieve, because it is both an outcome of, and a powerful contributor to chronic and pervasive poverty. Child malnutrition, widely regarded as single most important indicator of persistent poverty and, in turn, food insecurity, showed considerable improvement in Bangladesh throughout the 1990s, with declining levels of all three main anthropometric measures[67]. Income poverty has also declined and it fell faster in the urban areas, but rural income poverty has also been falling at between 0.8 and 1.0 percent per annum during the 1990s[210].

Fifty six million people (44% of the total) live below the absolute poverty line (defined in terms of the head count index of 2122 kcal /capita /day), of whom 46 percent are 'hard core' poor, living on 1805 kcal or less[211]. In rural areas 51% compared to 26% in urban areas live below the absolute poverty line[210]. While the proportion of undernourished people in total population has been falling, the rate of reduction has been less than the rate of population increase, so that the number of undernourished people has been rising[194]. Empirical studies both in Bangladesh and elsewhere in the developing world indicate that poverty alleviation is strongly linked to agricultural growth. In the Bangladeshi context, several studies echo the finding that the rate of rural poverty reduction is strongly influenced by the rate of agricultural growth[212]

In Bangladesh, it has been estimated that marginal farm households which is about half of rural population, purchase on average about 62 to 80 percent of the rice they consume[213]. Rice provides rural households with >70% of their energy intake and accounts for almost 50% of their food expenditure[214]. The poor are also the most seriously affected by inflation, particularly rise in food prices, since they spend a high proportion of their incomes on food:

Nutritional studies show considerable mal-distribution of food within household along age and gender line resulting among females. Lower aged children, particularly female children, and pregnant and lactating women are mostly deprived which plays an important role in lowering female life expectancy, and it is significant that Bangladeshi women have shorter life expectancy than men, despite the fact that women have a natural biological propensity to live longer[210]. Age and gender bias combine the food insecurity position of girls the worst of all. The 1999-2000 Bangladesh Demographic and Health Survey indicates that according to all three major anthropometric indicators female under five children have significantly poorer nutritional status than their male counter parts[215]. Intra-household discrimination is a function of many variables, including ignorance of special nutritional needs and deep seated cultural values and taboos that dictate that men eat more and first, which is primarily a function of food shortage / scarcity at the household level.

Agriculture dominates the economy of Bangladesh as it produces 96% of the food consumed by its population and it employs more than 65% of population and 17% of its export earning comes from agricultural[216]. Though the annual growth rate of food production in Bangladesh is 1.5 percent (0.24 metric tons of crop production per capita)[41,193] national level food availability seems not translated into household food consumption. Even though the country is thought to be self-sufficient in rice production, the diet of rural people, which predominantly rice, is very low in energy and micronutrients because households do not have access to the resource they need to grow or purchase enough food. They can not afford other nutritious foods like pulses, vegetables, fruits and animal foods. Girls and women often eat last and least in the household due to the persistence of cultural practices that favour boys and men[216]. The third Report on World Nutritional Situation[217] indicated that more than 60% of the total household expenditure in Bangladesh is allocated to foods which clearly indicates a phenomenal food insecurity at household level

An evaluation study on food security, health and nutrition of People's Participatory Rural Development Program (PPRDP) undertaken by Christian Commission for Development in Bangladesh (CCDB) in four upazilas of greater Rajshahi district was conducted in 1996 among 3716 population of all age and sex groups in 828 beneficiary households including 34.9% landless and 41.8% marginal farmers. The study findings showed that food insecurity existed in 79.8% households before entry into the program in1992-93, while in 16.7% households there was no food insecurity. Among the multiple responses regarding food insecurity in their households, about 75% respondents stated that foods were not available throughout the year, 33.5% stated that foods were not available during lean period as against 33.4% stated that foods were not available even during post harvest period due to very low income, while 78.9% mentioned that they did not have enough money to purchase food as needed. After the PPRD Program implementation the proportion of food insecure households came down to 44% as they mentioned that produced foods were not sufficient for round the year food supply in their households[218].

A loan for food procurement is a good indicator of household food insecurity in Bangladesh, because it is a traditional coping strategy used when a household is fall short of food supply and unable to produce or purchase sufficient food for consumption. Almost one third (30%) of households in the Chittagong Hill Tracts, hilly region of Bangladesh, were found to have taken a loan for food in the preceeding / previous month, that was more than double the percentage in rural Bangladesh, which suggest that household food insecurity was more common in the hilly region of Bangladesh[219]. Comprehensive understanding of the food and nutrition insecurity mechanism in rural Bangladesh is difficult partly due to complex nature of the problem and partly due to scattered and inadequate research findings.

Nutritional surveys conducted during the past decades all confirm that mothers in Bangladesh have a low quality diet. Nutrition surveillance project (NSP), conducted by Helen Keller International (HKI), data from 2000 revealed that less than 15% of mothers ate 'dal'(pulse), green leafy vegetables, eggs or yellow/orange fruits and vegetables on at least four days in the week prior to the surveys[220] which is reflected in the high prevalence of micronutrient deficiencies.

Body mass index (BMI) less than 18.5, indicating under nutrition in adults, is also considered as an indicator of food insecurity in adults[221] which is mostly due to a diet that is inadequate both in quality and quality. According to the criteria proposed by WHO, the prevalence of undernourished mothers in rural Bangladesh indicates a critical food insecurity situation (Prevalence of under nutrition >40%), and the prevalence in urban slums indicates a serious food insecurity situation (Prevalence of under nutrition 20%-39%) [221].

Data from the 1997 National Vitamin A and Anaemia Survey conducted by NSP showed that 2.7% of the pregnant mothers had night blindness and 45% of non-pregnant mothers were anaemic[222, 223]. The data collected by six Nutrition surveillance Project (NSP) surveys in 2000 on over 57,000 women reveals that almost one half 45% or rural mothers and one third (34%) of mothers in urban slums had a BMI <18.5 and were undernourished, a prevalence that is amongst the highest in recent survey in Asia and indicates 'critical food insecurity'[224]. An estimated 9 million women of child bearing age (15-44 years) are undernourished in rural Bangladesh compared to only 0.8 million women in a developed country of similar size[224]. The following Table 1.3.14 shows that the prevalence of undernutrition in rural Bangladeshi mothers is much higher than in other Asian countries [177, 225 - 227].

Table 1.3.14: The percentage of undernourished (BMI<18.5) non-pregnant mothers in rural areas and urban slums in Bangladesh in 2000 and in other countries

Countries	Percentage of undernourished
Bangladesh, rural	45.0
Bangladesh, urban slum	34.0
Nepal	27.0
Vietnam	25.0
Indonesia	12.5
Tanzania	9.0
United States of America	4.0

Mothers in households with less than 50 decimals of land an amount which is insufficient to economically support the household are about 20% more likely to be undernourished (prevalence 45% undernourished) than mothers in households (32% undernourished) with large amount of land i.e.: >500 decimals[227].

HKI also collected date through NSP from Char (some midstream islands created from river sediment and are in a constant state of formation and erosion) communities in Kazipur, Nageswari and Rajibpur sub- districts during the Monsoon months of August and September when the incidence of floods and erosion usually peaks. Collected data show that Char households are about 13 times more likely to have been affected by these disasters than households in rural Bangladesh. Flood and erosion disrupt the lives of Char dwellers by damaging crops, homes, water & sanitation facilities and other assets and hinder access to food, schools and work. Loss of employment and a house were also much more common in the chars. These disasters and crises have substantial economic costs which mean that households often face difficulties in paying for basic essentials including food and health care .Households are sometimes forced to take a loan to purchase food, a clear sign that they are food insecure. This loan strategy was used in the previous two months by 17% of Char households, compared with only 11% of households in rural Bangladesh[228].

Char dwellers are considered poorer than the mainland population and are increasingly becoming the targets of efforts to reduce poverty[229]. Poor households tend to spend most of their meager food budget on rice. Young children consumed animal foods less frequently in the Char than in rural Bangladesh which suggest that the quality of their diet was lower. Households in the Chars are, therefore, more food insecure, the quality of diet is worse and more children and women are malnourished than elsewhere in the country[230]. Depending on the experiences from couple of years HKI suggests that there is great potential to improve household food security, nutritional status and livelihoods in the Chars through household food production.

Food security in Saotal community, one of the major tribal population groups, living in northern districts of Bangladesh showed that annual mean food production and mean food purchased by Saotal families was 1232 ± 2333.8 kg and 411 ± 304.8 kg per family respectively. Total food received was 1643.0kg of which 1064.0 kg was left available for household consumption per family per year, while per capita per day food available for consumption was amounted to 0.631 ± 468.3 kg. In 46% Saotal families per capita food availability was more than 0.500 kg and above. Of course, food availability or in other words food security of Saotal families was found better in comparison to other segments of the Bangladeshi population[230]. Per capita per day total food intake in Soatal families was 1211.8 gm which was much higher than the rural population of Bangladesh[28-30]. Mean calorie, protein and fat intake per capita in Saotal families were 3051.6 kcal, 73.9gm and 24.5gm respectively, which were also found to be much higher than the intakes of rural population[28-30]. Micronutrients intake were also higher than the rural Bangladeshi population.

Although, there were limitations, households food security as well as food and nutrients intake pattern of Soatal tribe is comparatively much better than that of rural population of Bangladesh. Tribal Nutrition survey of Bangladesh in 1981-82 showed that per capita per day food intake of Khashia tribe of Sylhet was 614 gm indicating more food insecure than the Saotal tribe[29].

From the foregoing, it is evident that the analysis of food and nutrition insecurity of a vulnerable group like marginal farmers, would be more complicated if the households' livelihood system is viewed as a whole. More investigations are, therefore, needed to further refinement of food security and nutrition nexus of these households.

1.3.16. Food security Status in various Nations and Communities:

Despite the impressive gain in global and national food production and supply, a large proportion of the population is still food insecure in parts of Sub-Saharan Africa and South Asia[177].

As nearly as 40% of Indian population live below poverty line with more or less same number without health cover, safe drinking water and shelter[135]. Cereals and pulses constitute the main sources of food supply in India. Production of rice has gone up by over four times, wheat 10 times, oil seed 4 times, potato 12 times and sugarcane by nearly 6 times and in case of coarse cereals and pulses, the production got only doubled since 1951 to 2000. Milk, fish, egg, meat, vegetables and fruits production has also gone up significantly over the years[231]. Per capita availability of food grains increased from 395 gm in 1951 to 531 gm in 2000 in spite of tremendous population growth during the same period[232].

A cross-sectional study among 1895 people of 363 families in a tribal community in West Bengal showed that 48% of the families were food insecure with average per capita daily calorie intake was 2236 kcal, while 23% families could get less than 1600 kcal per day per capita, and in 52% families calorie intake was more than 2400 Kcal[233].

The effect of seasonal changes in household food availability on the dietary intakes and the nutritional status of 24 lactating women from small holder rural households in a rural area of Kenya, were investigated on monthly basis over a 15 month period in 1992-93 agricultural cycle. Significant seasonal difference were found in intakes of calcium, Vitamin A, Vitamin C, riboflavin, and niacin respectively ($p<0.01$) as well as in the intakes of protein, iron and thiamine ($p<0.05$), but not with energy and fat intakes. Large inter seasonal weight losses of 5.6 kg (about 9%) at the rate of 1.1 kg/month, were observed between baseline measurements and the peak of the lean month when the energy intake was 36.7 kcal/ kg/day and protein at 1.1g/kg/day. About 50% of the lost weight (2.8 kg) was recovered during the harvest months of January and February, when energy intakes improved to 41.0 kcal/kg/day, and protein to 1.2 g/kg/day. However, further weight losses of 1.6 kg or 0.5 kg/month between March and June. While much of the weight loss may have been due to reduced energy intakes during periods of food scarcity, part of lost weight may have been due to increased energy requirement as a result of lactation and to increased physical activities. Further investigations are recommended[234].

Nutritional status and household food security were longitudinally monitored in three besieged cities of Bosnia-Hercegovina, namely – Sarjevo, Zenica and Tuzla, during the winter and spring of 1993 to 1994. The objectives were to provide early warning of a deterioration in the food and nutrition situation and identify particularly vulnerable groups so that action could be taken to prevent potential undernutrition and target resources to the most needy. Before the cease fire at the end of February, 1994, trends in various indicators such weight loss, decline of household food stocks, rising food prices, reduction in food aid distribution, suggested that the situation was deteriorating. The elderly were found to be more nutritionally vulnerable than children or adults, household with the least access to resource were the most food insecure, while the city of Zenica appeared to be particularly hard hit. Access to food improved as a result of the cease- fire, which was reflected in the improvement in indicators of security and weight gain. The finding show the effects of an uncertain and reduced food supply on a previously well-fed healthy population in an industrialized country[235].

To monitor nutritional status and food security in order to identify nutritionally vulnerable groups, a monitoring study was carried out in three besieged cities namely-Sarajevo, Tuzla and Zenica, of Bosnia – Hercegovina with 1739 individual from five different household groups and all residents of two old peoples homes of 20 local communities and mine collective centres. Information on household food security was collected through structural questionnaire in every month from December 1993 to May 1994. All subjects were weighed and their heights measured. Weight for age Z scores and body mass index were calculated for children and for adults and elderly people respectively. It was found that before a temporary cease fire from December 1993 to February 1994, access to food was reduced. In February 1994 no significant signs of undernutrition were detected among children or adults, but elderly people had higher than expected levels of undernutrition (15.5%) with BMI <18.5, a higher rate of weight loss than adults (1.2kg over two months), and a higher prevalence of self reported illness. Elderly people in Bosnia Hercegovina are at greater risk of undernutrition than other age groups. Undernutrition may be precipitated in elderly people by sickness, cold, stress and problems related to food preparations[236].

A study was carried out in a peri-urban barrio in Caracas, Venezuela with 238 women in poor and very poor households that provided data on food availability and their perception of food resource constraints and hunger experience with the home. Socio-economic data and food related behaviour that may predict HFS levels were gathered. It was found that on average, the top 12 food contributors of energy provided 81% and predicted more than 90% of the variation in households total energy availability using stepwise regression analysis[237].

1.3.17. Household Food Security and Dietary Intake:A path from Food to Nutrition:

Research carried out in the late 1980s and early 1990s demonstrated that food is only one of the factors of malnutrition equation, and that in addition to dietary intake and diversity, health and disease and maternal and child care are also important determinants[238] Researchers identified the main processes that have a bearing on nutritional security. First - the process that involves the household's access to resources for food. This is the path from production or income to food. Second - the process that involves translating the food obtained into satisfactory nutritional levels. A number of determinants affect the nutritional benefits of the food consumed, such as the quality and composition of dietary intake, intra-household food distribution, food safety and hygiene, health and disease.

Nutrition security depends not only on sufficient food at household level, but also on factors such as adequacy of various nutrients, health and child care, access to water and sanitation. It is now recognized that increased calorie consumption by an individual or household may not necessarily ensure an adequate intake of other nutrients and the bio-availability of specific nutrients[135].

Household food intake or in other words food consumption is influenced by many factors, and the choices of kinds and amounts of food eaten often vary from community to community and country to country. However, those factors most likely to affect food intakes everywhere in the world are:

- Amounts and varieties of food produced and available;
- Income levels; and
- Nutritional knowledge.

Household food consumption principally depends on food availability in the household, which, in turn, is dependent on food production for home use and per cent of household income to household expenditure on food. Nutritional knowledge, on the other hand, influences nutritious food production as well as household expenditure on food of good quality and quantity. Therefore, daily food consumption is a function of an interaction among food production, income, food availability and nutritional knowledge, all of which are, in turn, dependent on several specific factors[239] as shown in figure 1.3.2:

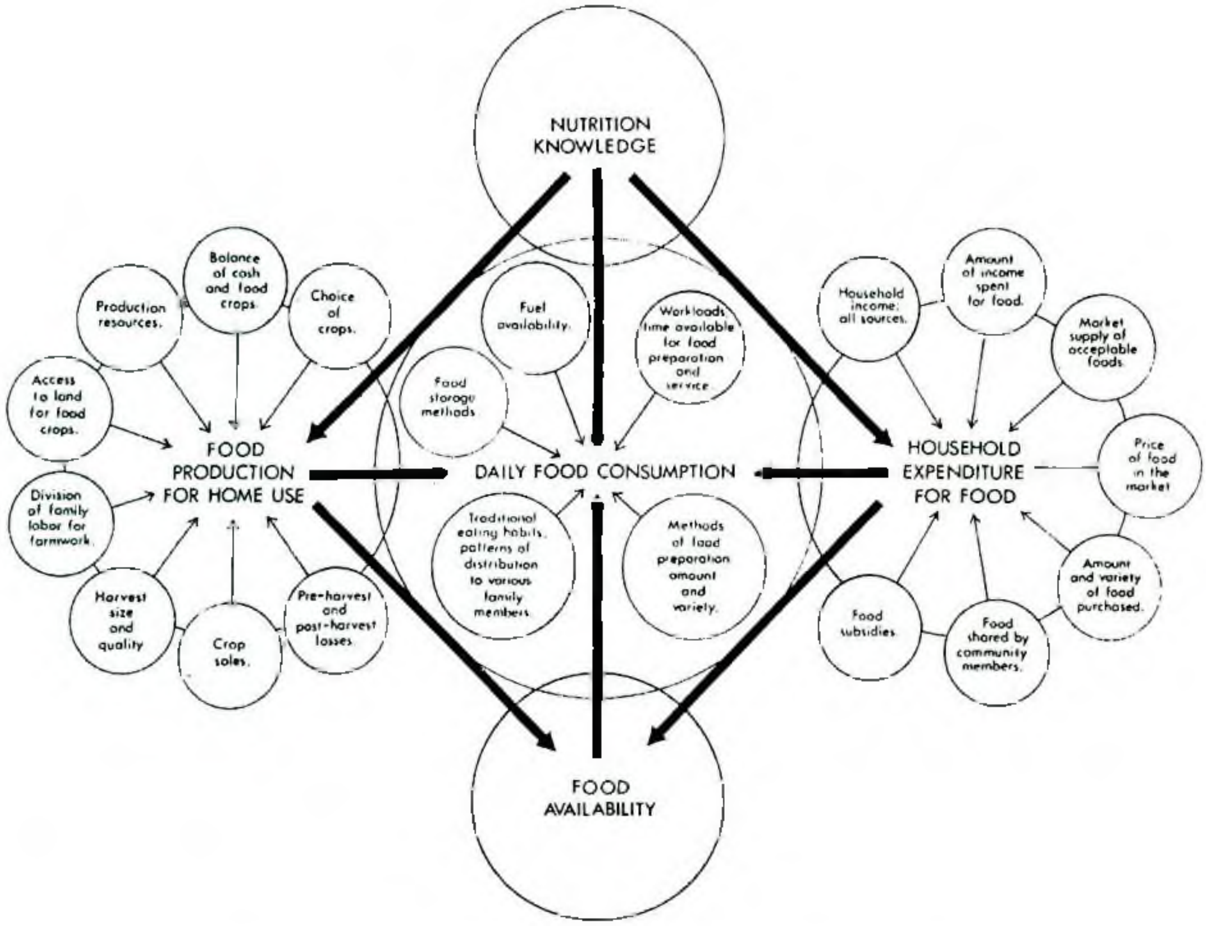


Figure 1.3.2: Factors affecting household food consumption

(Source : Food, Nutrition and Agriculture, FAO, 1986)

1.3.18. Factors Affecting Nutritional Status:

Nutritional status is an outcome of food consumption by the people coupled with several variables. A number factors influence on the nutritional status of the people such as –food availability, agricultural methods, land quality and amount, land tenure patterns, cropping patterns, food storage, incentives to produce, social roles, income-levels, socio-cultural patterns, meal pattern, food distribution in the family, family size, acceptability, nutritional knowledge, food preferences and state of health etc (Figure 1.3.3). Of these, most important factors are being discussed as follows[239]:

Food Availability: Food availability is a primary consideration, since the basic nutrition problem in at least two-thirds of the world is lack of sufficient food for normal growth, health and activity. Food availability in large measure depends on such things as:

- Quality of the farm land ;
- Enough land on which to grow food;
- Water and Climate;
- Agricultural methods,
- Cropping patterns,
- Available farm labour;
- Money or farm capital; and
- Professional expertise to help increase both farm production and equitable food distribution

Meal Patterns: The number of meals eaten and the quantity and kinds of foods included in the meal pattern in a particular country or region have usually developed around native foods or from those that have been grown there over long period of time. Food scarcity, family work habits and food preparation method also affect meal pattern. If only one main meal is eaten each day, food intake, specially for children, is very likely to be inadequate regardless of the method of preparation used. Pregnant and lactating women may also have difficulty in meeting food requirements when fewer than three meals a day are consumed[239].

Food distribution in the family: Traditionally, fathers or male heads of the family may have priority for amounts and certain kinds of food within the family and after the male head of the family has been served, sons in birth-order beginning with the eldest usually have preference. Women, daughters and young children may eat with male members of the family, but in some cultural environments they eat separately in another place or even after male members have finished eating. In some cases, women and young children only have access to foods that are left after male members have eaten. Thus nutritional well-being of the family members is likely to be impaired. In that case, both health and life of infants, young children and pregnant women become disastrous, due to the added effect of inequitable food distribution within the family unit[239].

Family size: Family food resources, specially for those who are very poor or marginally poor, are more apt to meet dietary needs when there are fewer to eat. The food available to a large family might be enough for a family half of that size but inadequate to prevent malnutrition in a large family. Since children are the most vulnerable of all family members to malnutrition, the youngest child is usually the most severely affected by inadequate food intake. In part, this is so because as family size grows, there is less food for each child according to their proportion to size. Thus, young children of one to six years old, may not be adequately fed leading them most vulnerable to malnutrition. Severe protein-energy malnutrition would likely be less prevalent if families are smaller. Next to children pregnant and lactating women are most vulnerable to malnutrition. Fewer children in a family would lessen the vulnerability of mothers to malnutrition. So, all families, regardless of income, need to recognize the upper limits of available food supplies in relation to population growth, particularly in poor land less and marginal farm families.

Acceptability: Each society has developed traditional ways to seek, choose, handle, prepare, serve and eat food. Customs and traditions are the basis for this behaviour, which usually varies in different ways from one social group to another. Food acceptability depends on culturally determined values, attitudes, and beliefs. Developing food habits, learning manners related to food consumption and accepting or rejecting certain forms or kinds of foods begin early in life and become deep-rooted parts of behaviour within the group. Along with the food offered and accepted, directly or indirectly, children also receive information from which their feedings, attitudes, behaviour and habits related to food are developed. From this frame work of learning, individuals desire particular kinds of foods prepared according to culturally approved guidelines and served in the socially accepted manner [239].

In relation to the foods appropriate for people to eat, many food avoidance pattern as well as some superstitions and taboos exist in different cultures and regions of the world. Some food avoidance patterns are practiced by entire communities or even larger segments of the population. Others apply only to sub-groups within a given population at a particular time in life, who if already vulnerable to malnutrition, then much more nutritional deficiencies are likely to develop in them.

Food customs and practices are associated in some ways with almost all religions, although they may vary from one religion to another. Most religious groups also have certain dietary restrictions. Thus, whatever the reason certain foods may be unacceptable to members of a specific religious group. However, the alternative foods they have chosen to eat are apt to be appropriate substitutes. A food is considered to be acceptable or not also depends on physical characteristics of food such as, Flavour- which involves smell, texture and temperature, Appearance- which includes colour and shape. These characteristics also affect attitudes towards food[239].

State of Health: Nutritional status is an important component of one's state of health. Not only does nutritional status affect health, but state of health also influences nutritional status. Infections and fever may cause loss of appetite or create difficulty in chewing, swelling and digesting food. Worm infestation such as round or hook worms compete with body for nourishment and thus prevent needed nutrient absorption into the blood stream. Such conditions contribute to malnutrition. The sick, the convalescent and the elderly all have special food needs due to their poor state of health[239].

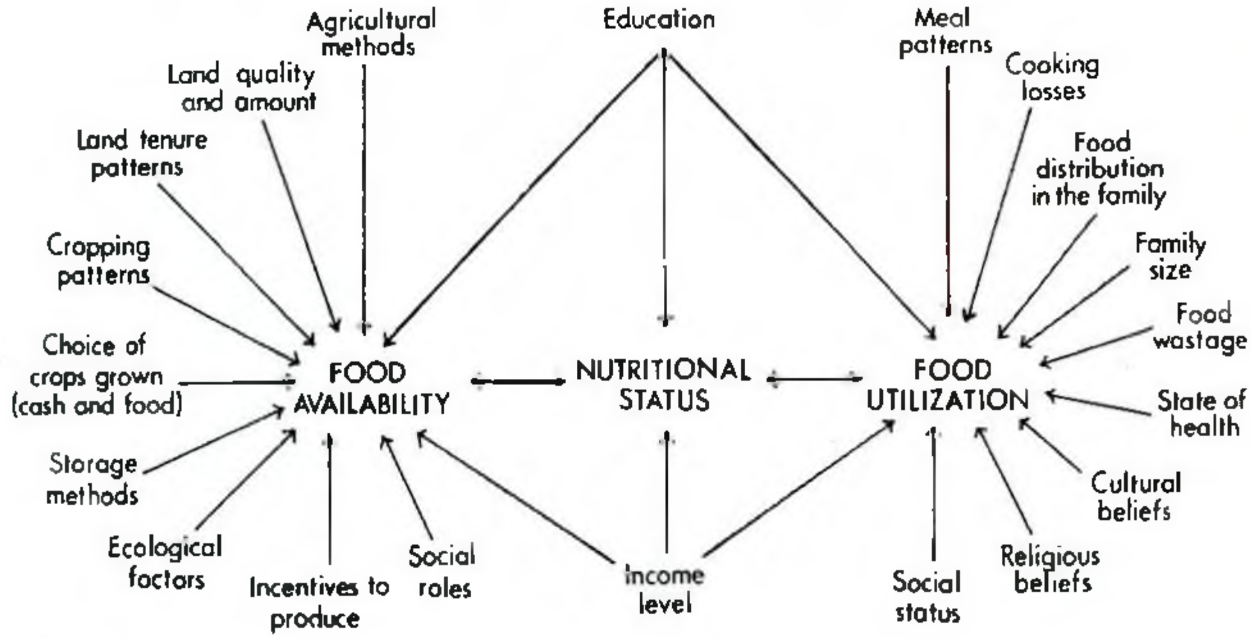


Figure 1.3.3: Factors affecting Nutritional status.

(Source: Food, Nutrition and Agriculture, FAO, 1984)

Sources of Foods: Foods have been grouped together in several different ways. One way to group them is by what is usually called a food commodity grouping[239], they are:

- Cereals & cereal products;
- Starchy roots & tubers;
- Legumes (dried beans), nuts and seeds (oil seeds);
- Vegetables;
- Fruits;
- Food of animal origin;
- Fats & oils; and
- Sugars and syrups.

Many people use to eat food from some of the groups, but not from all the groups and thus hampering balanced food intake. Balanced food intake is a prerequisite to have all the nutrients required by the body for adequate nourishment. Hence, based on this grouping, the different types of foods are needed to be included in the diet to have a balanced diet for every member of the family.

1.3.19. Causes of Malnutrition:

The causes of malnutrition are complex. Based on the wisely used food-health-care conceptual framework causal factors and their interactions are considered at three main levels—immediate, underlying and basic (Figure 1.3.4). The synergistic interaction between the two immediate causes—inadequate dietary intake and disease – accounts for much of the child malnutrition and mortality in developing countries. Three groups of underlying factors contribute to inadequate dietary intake and infectious diseases: household food insecurity, inadequate care, and poor health services and an unhealthy environment. These underlying causes are, in turn, underpinned by basic causes that relate to the amount, control, and use of the resources[177, 240].

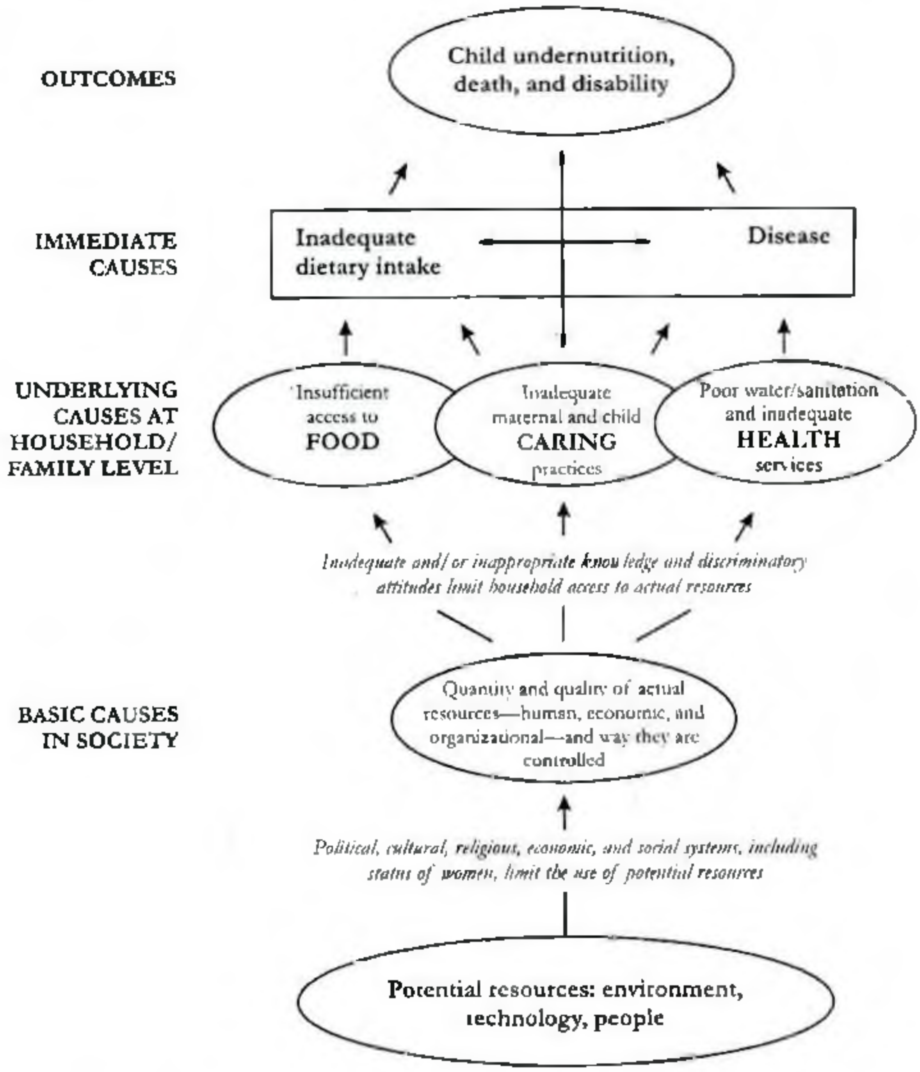


Figure 1.3.4: Conceptual Framework of the Causes of Malnutrition
(Source: UNICEF (1998) The State of the World's Children 1998. Oxford: Oxford University Press).

1.3.20. Consequences of Malnutrition:

Undernutrition in early childhood causes serious consequences. Underweight children tend to have more severe illness, including diarrhea and pneumonia. There is strong association between the severity of underweight and mortality[221]. It has been estimated that out of 11.6 million deaths in 1995 among under five children in developing countries, 6.3 million (54%) were associated with low weight for age. The majority of these deaths can be attributed to the potentiating effect of mild to moderate under nutrition[241].

Malnutrition constraints people's ability to fulfill their potential needs. Undernourished people have less energy to undertake work, are less able to attend school, and once in school are less able to concentrate in learning. Diet-related chronic diseases take individuals out of the work force and take resources away from primary health care services. In respect of importance of malnutrition to economic growth researchers have derived conservative estimates of the forgone GDP as a result of iron deficiency alone in childhood and iron, iodine, and protein-energy malnutrition in adults[242]. For Pakistan the losses are over 5% of GDP. For Bangladesh, the cost of iron deficiency in children alone is nearly 2% of GDP. A recent analysis of economic consequences of iron deficiency has estimated the median value of productivity losses due to iron deficiency to be about 4 US dollar per capita, or 0.9% of GDP, for a range of developing countries[243]. According to World Bank estimates, the elimination of child malnutrition in India would increase its national incomes by 28 billion U S dollar, which is more than Indian's current combined expenditure for nutrition, health, and education[244]. A more conservative estimate made in 1990 shows an economic loss to the world as a whole of 8.7 billion US dollar[245].

1.3.21. Food and Nutrient intake pattern in Bangladesh and other countries:

Food and nutrient intake pattern of Bangladeshi population was investigated by four national nutrition surveys and other small scale nutritional studies. In 1962-64 national nutrition survey[27] for the first time was conducted in Bangladesh, the then East Pakistan, which showed that per capita per day food consumption was 886gm of which 62, 32 and 6 per cent were contributed by cereals, vegetables & other plant foods and foods of animal origin. Cereals, pulses, animal food and vegetables & fruits intakes were 546 gm, 27.6 gm 56.5gm and 157gm respectively. Calorie, protein and fat intakes were 2301 kcal, 57.9 gm and 15.8gm per capita per day respectively. Calcium and iron intakes were 273 and 10.3 gm respectively, while vitamin A and vitamin C intakes were 1870 I.U. and 14.4 gm respectively[27].

The findings of second Bangladesh rural Nutrition survey in 1975-76 showed that per capita per day food intake was 807 gm contributed by cereals-65%, vegetables & other plant foods-30% and animal foods-5%. Per capita intakes of cereals, pulses, animal foods, vegetables and fruits were 523, 23.8, 44, 126, and 20.6 gm respectively. Per capita per day calorie, protein and fat intakes were 2094 kcal, 58.5 gm and 12.2 gm respectively[28]. About 59, 60, 81, 89 and 93 per cent households were found to have deficient in calorie, protein, Calcium, vitamin A and vitamin C intakes respectively in 1975-76.

Per capita per day food intake of the Bangladeshi population was 765 gm as found in the third Bangladesh rural nutrition survey[29] in 1981-82. Cereals contributed 64%, vegetables & plant foods contributed 30% and animal foods contributed 6 per cent of the total food intake. Per capita per day cereals, pulses, animal foods, vegetables and fruits intakes were 488, 8.0, 44.5, 120, 17.4 gm respectively. Per capita per day calorie, protein and fat intakes were 1943 kcal, 48.4 gm and 9.8 gm respectively. Only 24% and 23% of the households had adequate calorie and protein intakes. About 93, 88 and 87 percent households were deficient in calcium, vitamin A and vitamin C intakes. Food intake in the small farm households (marginal) was 745 gm including 470, 117 and 35 gm of cereals, vegetables and animal foods respectively. Calorie, Protein, fat, calcium, iron, vitamin A and vitamin C intakes of these small farm households were 1873 kcal, 46.5gm, 8.4gm, 256mg, 24.1mg 972 I.U. and 14.5 mg respectively and intakes of all the nutrients were far below the national overage[29]. About 79 and 56 percent of these households had deficient calorie and protein intakes. In 1981-82 per capita calorie intake was increased by about 13 percent in the post- harvest period compared to pre-harvest period. Similarly significant increases had also taken place in the intakes of protein, fat, carbohydrate, thiamine, riboflavin, niacin and vitamin C in the post- harvest period.

Fourth national nutrition survey conducted in 1995-1996 showed that per capita per day food intake of Bangladeshi population was 728 gm and that of rural population was 730.8 gm[30]. Cereal, roots& tubers, pulses, animal foods, vegetables and fruit intakes of the rural population were 452, 70, 10, 54, 112 and 13 gm respectively. Cooking fat intake was only 6 gm per day per capita. Intakes of cereals, roots& tubers, vegetables, milk & milk products were significantly increased in the post-harvest period compared to the pre-harvest period of main cropping season. Households having monthly household income < Tk. 3000/- per capita per day food intake was 713 gm including cereals-452 gm, roots & tubers-66 gm, pulses-9.6 gm, vegetables & fruits-122 gm, animal foods- 44.6 gm and 5.7 gm of cooking oil. On the other hand, households having per capita monthly income <Tk.400/- food intake was 694 gm including cereals-448 gm, roots & tubers-62 gm, pulses-7.4 gm, vegetables & fruits-119 gm, animal foods-40.5 gm and cooking oil-4.7 gm. Households with < 100 decimals operated land holding including homestead, mean food intake was 725.4 gm including 458.5 gm cereals, 76.9 gm roots &tubers, 9.3 gm pulses, 119 gm vegetables, 7gm fruits, 47 gm animal foods and 5 gm vegetable oils[30].

Regarding per capita nutrient intakes, calorie, protein, fat, calcium, iron, vitamin A and vitamin C intakes of the Bangladeshi population were 1868 kcal, 46.9 gm, 16 gm, 335 mg, 11.4 mg, 1668 I.U. and 32.8 mg respectively, while those for rural population were 1892 kcal, 46.4 gm, 14.1gm, 328 mg, 11mg, 1571 I.U. and 31.9 mg respectively. About 68% of the population was deficient in calorie consumption, while 54 and 75 per cent population respectively were deficient in protein and fat intake. About 79, 87, 56, 48, 99, 30 and 56 per cent population had deficient calcium, iron, vitamin A, thiamine, riboflavin, niacin and vitamin C intake respectively. In rural households having monthly household income <Tk.3000/- intakes of energy, protein, fat, calcium, iron, vitamin A and vitamin C were 1862 kcal, 45 gm, 12.2 gm, 292 mg, 10.8 mg, 1442 I.U. and 29.5 mg respectively, while in households with per capita monthly income <Tk.400/- corresponding figures were 1827 kcal, 43.4gm, 10.7gm, 285mg, 10.5mg, 1428 I.U. and 27.9mg respectively. In rural households with < 100 decimals operated land holdings per capita intakes of energy, protein, fat, calcium, iron, vitamin A and vitamin C were 1889kcal, 47gm, 12.9gm, 315mg, 12mg, 1007 I.U. and 33.3mg respectively[30].

Food and nutrient intake of the beneficiary households of People's Participatory Rural Development Program (PPRDP) undertaken by Christian Commission for Development in Bangladesh (CCDB) in greater Rajshahi district in 1996 showed that per capita per day total food intake was 788gm including 513.2gm, 14.9gm, 131.3gm, 34.1gm and 5.1gm of cereals, pulses, vegetables, animal foods and fats & oils respectively. Per capita per day calorie, protein, fat, calcium, iron, vitamin A and vitamin C intakes were 2126 kcal, 52.1gm, 13.9gm, 437.8mg, 31.1mg, 1952 I.U. and 51.8mg respectively. Protein, iron and vitamin C intakes were more than 100% of the requirement, while calorie, calcium and vitamin A intakes could meet 93.5, 97.3 and 96.9 % of the requirement respectively[218].

Jahan and Hassan[246] studied the nutritional status of children of 100 households in a village of Narayangonj during 1988-98 and showed that the children were mostly deficient in calorie (54%), protein (49%), vitamin A (77%) and vitamin B_2 (73%) intake as compared to their requirements.

Household Expenditure Surveys conducted in Bangladesh[247] showed that average national per day per capita calorie intake increased from 2215 Kcal in1988-89 to 2299 Kcal in 1991-92 with an increment of calorie by 51 Kcal . On the other hand, per capita daily protein intake at the national level in 1988-89 was 64gm which marginally decreased to 63gm in 1991-92.

Rosenberg[248] studied per capita nutrient intake in rural and urban areas of Bangladesh and showed that in rural areas calorie, protein, calcium, iron, vitamin A and vitamin C intakes were 2251 Kcal, 57.5gm, 304mg, 9.7mg, 1590 I.U. and 39.6mg respectively, while in the urban areas the corresponding figures were 1732Kcak, 46.5gm, 226mg, 8.5mg, 1715 I.U. and 38.5mg respectively.

In India per capita per day intake of food grains increased from 395 gm in 1951 to 531 gm in 2000, but pulse intake decreased from 60.7 gm in 1951 to 36 gm in 2000. Present per capita intake of milk, fruits and vegetables is only 197gm, 46gm and 140gm per day respectively[232]. Energy intake was 2296 kcal during 1975 which increased to 2409 kcal in 1981 and then again decreased in 1995 to 2172kcal against the recommended intake of 2425 kcal. Protein, iron and vitamin A intakes also decreased from 64gm, 32mg and 263 μgm respectively in1975 to 56gm, 26mg and 288 μgm in 1995 respectively[135].

As per data generated by National Nutrition Monitoring Bureau (NNMB), average intake of cereals was 548 gm per consumption unit (cu) per day against a RDA of 460 gm / cu/ day and an average intake of fats & oils was 11gm/cu/day among the population of West Bengal[249].

In a tribal community of West Bengal it was found that consumption of cereals and starchy foods was higher in the tribal area and average cereal consumption of tribal people was slightly higher than that of West Bengal. Intake of pulses, milk, flesh, poultry products, oil and sugar was much less than the RDA, while leafy vegetables intake was higher. About 63% families did not consume pulses at all[233].

Per capita food intake in the Philippines, as found in the National Nutrition Survey (NNC) conducted in 1993 was 803gms of raw foods as purchased per capita per day which includes 340gm cereals (42.3%), roots & tubers 17gm (2.1%), meat, milk ,fish ,milk& milk products and egg (animal foods) 203gm (25.3%),pulses & nuts 10gm (1.2%), vegetables 106gm (13.1%), fruits 77gm (9.6%), fats & oils 12gm (1.5%) and sugars 19gm (2.4%)[250]. Regarding nutrients, energy and protein intakes were 1684 kcal and 49.9 gm per capita per day. Only protein met the corresponding RDA (106.2%) and energy was 87.8% of RDA, while intakes of vitamins and minerals were grossly inadequate (57.1% - 88.1%). There was a general downward trend in food consumption since 1978 and as a consequence energy and nutrients intakes decreased with the exception of protein and vitamin A[250].

Sen, P K undertook a cross-sectional study with1280 under five children in the urban slum community of Chetla, the field practice area of All India Institute of Hygiene & Public Health, Calcutta, during 1991 to identify their nutritional status using Wt / age indicator and the children were graded on the basis of the Indian Academy of Pediatrics classification. The result showed that more than half of the children were undernourished including 27.7%, 16.8%, 5.3% and 1.8% being suffering from grade 1, 2, 3 and 4 under nutrition respectively. It was also evident that higher proportion of female children sufferd from undernutrition as compared to the male counterparts: 32.5, 22.1, 7.9 and 2.9% of the female and 23.8, 12.3, 2.6 and 0.75 of the children being in 1, 2, 3 and 4 grade of nutritional status[251].

Macro and micro nutrient deficiencies in traditional Maldivian diet of women and pre-school children were studied by Golder, A. M. et al and found that the diets were sufficient in carbohydrate and protein but deficient in fat. Consumption of beta carotene, vitamin C, dietary fiber and folic acid were low because of low intake of vegetables and fruits. Intake of iron was also low although blood Hb level was normal[252].

In a study by Bhuyan et al among rural pre-school children (aged 24 – 72 months) of Malaysia showed that the intakes of calorie, protein, iron, vitamin A, vitamin B_2 , as estimated by 24 hours dietary recall, were inadequate among 69, 20, 75, 26 and 65 per cent children respectively. Rice and wheat flour were their main source of energy and 71, 18 and 11 per cent of their energy intake was derived from carbohydrate, fat and protein respectively[253].

The food intake of two study samples of 3 years old children born in five years were determined by 24-hours recall method in1975-1980 in a low and middle class neighborhood of Jerusalem. There found no calorie deficiency and protein intake (mainly milk and milk products, poultry and eggs) was twice the RDA – 3.7 and 3.3gm / Kg in the study group interviewed in 1975 and 1980 respectively but iron intake was only 40% of the RDA. Mean calorie and protein intakes were significantly higher in the upper as compared to middle and low social class in 1980. Children from Asian origin had the lowest calorie and protein intake in 1975 and 1980 whereas those of European – American origin had the highest. The expenditure on food was 25% of total income during both periods. The possible factors influencing the stability in dietary intakes are governmental subsidy for essential food, correction of wage and increase in social security payments i.e. buying power as well as the educational effect of the preventive services on feeding practices[254].

A representative sample of French Canadian Montrealers (614 adults age 19 years & above and 182 children aged 5-18 years) were surveyed to collect data on food habit, nutrient intakes, socio-demographic characteristics and 7 days food records. The results showed that energy intakes were 83% to 98% of the 1990 Canadian Recommended Nutrition Intakes (RNIs) with 16-18 years old adolescent girls having lower energy consumption. Calcium was most frequently found below the 66% of the recommended intakes (RNLs). On an average protein comprised 16% of energy, fat 36-37%, and carbohydrates 48–49% of energy. Simple sugars comprised 16–19% of energy among boys and 16 – 20% among girls fluctuating with age. Only 15.4% respondents had low total fat and saturated fat intakes providing 30-34 % and 10-12% of energy respectively. No differences in mean nutrient intake levels were found between low, medium and higher fat consumers. Among those with inadequate intakes, 26% lived in one lower middle income sector of Montreal, however no clear pattern linking dietary adequacy and socio-economic factors was noticed[255].

A survey of 12 school in London borough showed that the protein and energy content of the average school meal was below the standard which resulted from inadequate food purchases, poor menu planning and protein control. A 24-hours dietary recall showed that 5% of the pupils were 'poorly' fed, who were not worse off than their 'adequately' fed peers with regard to absence from school and academic attainment, but there was some slight difference in height and weight. Children having no breakfast increased from 4% in the infant school to 21% in the senior school's pupils, 2% of whom regularly ate no lunch[256].

Mean daily nutrient intakes of 195 women in the first trimester of pregnancy, compared to recommended intakes for non- pregnant 18-55 years old women, showed that more than two-thirds pregnant women were having insufficient energy, iron and cholecalciferol and intakes of other nutrients were unsatisfactory. In second trimester all mothers were having insufficient cholecalciferol and more than 80% had unsatisfactory intakes of energy and iron[257].

A study with 91 families containing 140 children under-4 years of age at enrolment was carried out. At 1 monthly interval the children were weighed and measured and qualitative information about feeding habits was obtained. Weighed dietary surveys for period of 5 days were made at approx. 8 months, 3 years and 5 years of age. At the four specified ages, mean energy intakes were 896, 1203, 1392 and 1613 kcal per day respectively. At 8 months milk provided 43% of total energy intake and commercial baby foods provided 17% of energy, which decreased to 21 and 2% respectively at 20 months and there was little further change thereafter. Average intake of energy and most nutrients met recommended intakes, while iron intakes were marginal and vitamin D intakes were low. Energy intake of boys was significantly higher than that of girls at 3 years of age, but boys were not significantly heavier. Energy intake of children from 'manual-worker' families and from 'large' families was higher than that of children from 'non manual – worker' and 'smaller' families. Energy intakes were correlated with body-weights and with the rates of weight gain[258].

With the aim to contribute to a better understanding of factors influencing the consumption of fruits, vegetables, and potatoes among the consumers a study was carried out in Norway. The study data was collected from two consumers groups; one including 1103 persons and the other one including 13,857 persons. The data indicate that a considerable proportion of the consumers had a very low frequency of consumption when compared to present recommendations of intakes; 31% consumed vegetables, and 24% fruits twice a week or less. Multivariate analysis (logistic regression) showed that age, sex, income and household structure were important determinants for the consumption of fruits. These factors as well as education and place of living were important determinants of the consumption of vegetables and potatoes. Consumers who were very interested in health issues, were more likely to have a high consumption of fruits and vegetables, whereas those who had a preference for quickly prepared food tended to have low consumption of vegetables[259].

1.3.22. Nutrition Situation of the World:

The WHO global Database[260] on protein-energy malnutrition and child growth shows that the prevalence of PEM in under-five children in developing countries has progressively fallen from 42.6% in 1975 to 34.6% in1995. More than 50% deaths of pre-school children in developing countries are related to malnutrition's potentiating effects[261] and 83% of these deaths are attributable to mild to moderate malnutrition[260].

Food and Agricultural Organization's latest estimates indicate that, in 1997-99, there were 815 million malnourished people in the world, of which 777 million in the developing countries, 27 million in transition countries and 11 million in the industrialized countries. For developing countries, the latest figure represents a decrease of undernourished people by 39 million since 1990-92. Only in 32 of the 99 developing countries studied recorded a decrease in their number of undernourished between 1990-92 and 1997-99. The total reduction achieved by this group amounted to 116 million people[194]. Some 30 million infants are born each year in developing countries with impaired growth due to poor nutrition during foetal life[177]. In 2000 33%, 27% of preschool children of developing countries are stunted or chronically undernourished and under weight respectively, showing a decrease from the prevalence of 47% stunting and 37.4% under weight in 1980[177].

New information on consumption of micronutrients such as vitamins and minerals confirms that anaemia is widespread among women, particularly pregnant women, and children. About 2 billion people suffer from iron deficiency anaemia[178]. Iron deficiency and its anaemia affect more than 3.5 billion people in the developing world[262]. Vitamin A deficiencies are widespread in a large number of countries and iodine deficiency disorders (IDD) is a public health problem in 130 countries of the world, with more than 2 billion people are at risk of IDD and about 740 million people are affected with goiter[263]. Improvement in women's education, per capita food availability, health environment and women's status relative to men significantly reduced child malnutrition i.e. under nutrition during 1970- 95[264]. The countries with improved nutrition status had larger increase in the enrollment of women in secondary schools, per capita food consumption and in per capita incomes[177]. Women's schooling, women's status per capita food intake, and per capita incomes are important determinants of child nutrition in Africa.

In South Asia nearly one half of pre-school children are underweight[265] and one third are deficient in at least two micronutrients[266] and most undernourished children live in the rural areas.

1.3.23. Nutrition Situation in Bangladesh and in other Countries:

Alike other developing countries, malnutrition has been considered as one of the major public health problem of national significance in Bangladesh. Its prevalence is severe in rural communities compared to urban areas and women and children are the most vulnerable to malnutrition of various types. Inadequate food intake, loss of nutrients due to faulty milling, high percentage of breakage and loss during washing, cooking elevate the malnutrition in Bangladesh[267]. Illnesses extensively being caused in Bangladesh due to malnutrition are protein energy malnutrition (PEM), vitamin A deficiency disorders specially night blindness, iodine deficiency disorder-goitre, iron deficiency anaemia and so on [268].

In a UNICE report[269] it has been stated that the prevalence of infant, children and maternal malnutrition in Bangladesh is among the worst in the world and also stated the about 10-20% and 50 – 60 % of pre-school children had severe (3rd degree) and moderate (2nd degree) malnutrition.

According to a World Bank Bulletin[270], Bangladesh has the severest malnutrition problem in the world, as 68% and 64% of children of under-5 years are severely and moderately underweight and stunted respectively and 17% are suffering from wasting. Nutritional status of under-5 children of Bangladesh as found in1975-76 national nutrition survey showed that 57.9 and 5.8 per cent respectively were stunted and wasted and 15.8 % were both stunted and wasted according to Waterlow classification; the corresponding figures for 5-11 year old children were 54.2, 2.7 and 9.6 per cent respectively[28]. According to Gomez classification, 96.55 of under-5 children were malnourished of whom 25.8% were third degree (severe) malnourished; while in 5-11 years age group more than 99% were malnourished of whom 36% were severely malnourished. Malnutrition was higher among 0-59 months old girls (97.3% including 27.7% severe) than that in boys (95.7% including 23.8% severe); but among 5-11 years age group the nutritional status of girls was a bit better(98.4% malnourished including 86.7% combined 2nd &3rd degree malnutrition) than boys (99.75 % and 92.3% respectively). The prevalence of anaemia, night blindness and angular stomatitis among 0-4 years old children were 82, 1.3 and 3.3 per cent respectively, while the prevalence among 5-14 years male and female children were 43 & 43; 3.8 & 0.6 and 8.7 & 8.7 pre cent respectively[28].

National nutrition survey in1981-82, the nutritional status of 0-59 months old children according to Waterlow classification showed that 36.1% were normal and 43.9, 7.1 and 12.9 percent respectively were stunted, wasted and both stunted & wasted[29]. The corresponding figures for 5-11 years old children were 24.7, 62.8, 4.2 and 8.2 percent respectively. By Gomez classification, among 0-59 months age group 90 % were malnourished including 46.1% and 15.1% 2nd and 3rd degree malnutrition. The proportion of malnutrition among 5-11 years age group was 98.2% of whom 56.9% and 29.4 %

respectively were second and third degree malnourished. The prevalence of malnutrition was higher among females of 0-59 month old children (94.4%) than the males (85.9%), whereas that was higher in males (99.7%) than females (96.8%) in 5-11 years age group. The prevalence of stunting, wasting and both stunting & wasting among under five children of marginal income group were 48.7, 6.6 and 11.2 percent respectively, while that in 5-11 years old children in the same income group were 68.5, 3.4 and 6.7 percent respectively. According to Gomez classification, the prevalence of malnutrition among 0-59 months and 5-11 years children of the marginal income group was 90.1 per cent (13.2 % 3rd degree) and 99.4% (28.1% 3rd degree) respectively. The prevalence of anaemia, night blindness and angular stomatitis among 0-4 years old children found in 1981-82 were 73%, 0.6 % and 15.1% respectively, while the percentages among 5-14 years boys were 74%, 0.3% and 21.0% and among girls 73%, 0.0% and 18.5% respectively. The prevalence of anaemia among adult males was 60.0% which was 62.0% in 1975-76, while in adult females (NPNL) the prevalence was 74% which was 70% in 1975-76, and among pregnant, lactating or both that was 47% in 1981-82, which was 50% in 1975-76. The prevalence of anaemia among 0-4 yrs., 5-14 yrs. boys & girls, adult males and adult females (NPNL) in marginal income groups were 75%, 81% & 86%, 56% and 71% respectively[29].

The findings in 19795-96 nutrition survey showed that the prevalence of stunting, wasting and underweight among 6-71 months old children were 60.4, 17.0 and 64.2 percent respectively, while the prevalence among 6-9 years old children were 52.5, 18.4 and 59.4 percent respectively[30]. The prevalence of stunting, wasting and underweight were higher among rural children than urban children of both age groups. Stunting and under weight rates were higher (60.9% and 68.2%) among female children (6-71 months), than males (59.% and 60.7%), while wasting was almost same (17.0% each). Among 10-17 years adolescents, 45.7% males and 62.8 % females were normal in respect of BMI, while 54.3% and 36.6% respectively were malnourished (Thinness). Among adults, 47.2% and 49.7% males and females in rural areas respectively were chronic energy deficient (CED), while 2.2% males and 4.7% females were overweight. According to WHO criteria, the prevalence of anaemia in Bangladesh was 74% with 77.1% in rural and 63.7% in urban areas. The prevalence of anaemia among 0-4 years male & female was 69.5%, whereas in 5-14 years age group it was 78.1% in males & 82.9% in females. Among 15 years and above aged population the prevalence was 70.8% for males and 85.2% for females. The prevalence of night blindness among 0- <6 years, 6- <10 years and 10 -15 years children were 1.5, 1.9 and 1.4 per cent respectively, with an overall prevalence of 0.9% in Bangladesh. About 13% children of 0-4 years had angular stomatitis, whereas it was 25.7% in male and 17.9% in females of 5-14 years age group. In adults, 11.1% in males and 10.3% in females had angular stomatitis. The prevalence of visible goiter and dental caries among Bangladeshi population were 24.5 and 23.0 per cent respectively[30].

Bangladesh Bureau of Statistics (BBS) [271] conducted four national level child nutrition survey since 1985 till 1996. The first survey conducted in 1985-86 showed that more than 56.1% of Bangladeshi Children aged 6–71 months were stunted. Only 6.6% children of same age group were normal according to Gomez classification as found in the second child nutrition survey in 1989-90 and the children suffering from second and third degree malnutrition were 47% and 6.8% respectively [272].

In 1992 third child nutrition survey of Bangladesh nutritional status of the 6-71 months old children were categorized in respect of height for age and weight for height percent median and revealed that 69 % children were considered malnourished of whom 52% were stunted but not wasted, 5% were wasted but not stunted and 12% were both stunted and wasted, 33% of all children were severely stunted, while 31.2% were moderately stunted. Total prevalence of stunting and wasting were 64.2% and 17% respectively[273]. The fourth child nutrition survey was conducted in 1995-96[274] in which nutritional status was calculated according to Z-score classification. The findings revealed that 24.2% and 27.2% of all under 6 years children were severely (- 3SD& below) and moderately (-2SD to -2.99SD) stunted amounting total stunting rate to 51.4 per cent which was significantly lower than the previous prevalence as found in 1992 survey[273]. Wasting in respect of weight for height Z-score was 16.6% (2.5% severe and 14.1% moderately wasted). Weight for age Z-score showed that 57.4% were under weight (17.9% severe and 39.5% moderately underweight). Cross classification of stunting and wasting indicated that 40.3% normal, 43.1% stunted, 8.4% wasted and 8.2% both stunted and wasted[274].

Hassan and Barua[275] found that most of the orphans living in the Dhammarajika orphanage of Dhaka city were nutritionally normal by any nutritional indicator, only a few were found to have been suffering from mild or moderately undernutrition. This implies that the organizational feeding in a better hygienic environment can improve the nutritional status of the orphans who are otherwise believed to be malnourished. Begum and Haque[276] studied the health and nutritional status of children in rural Bangladesh and found that only 25.89% girls and 21.21% boys out of total number of sample children had normal nutritional status.

Hassan and Ahmad[277] studied the nutritional status of 1108 children aged 0-12 years from 11 locations of Dhaka city in respect of WFA, WFH and HFA. Only 12% children were found to have normal weight for age as against 58% were second and third degree underweight. In respect of weight for height 39% were normal, while 21% were wasted. About 47% were stunted the proportion of which increased with age. While considering combined stunting and wasting, 47% were found normal as against 12% had severe malnutrition. The incidence of malnutrition was found to be higher among the children of poor families compared to the higher income groups. The overall nutritional situation of the urban children was comparatively better than the rural children.

Nutritional status of under five children of the beneficiary households of People's Participatory Rural Development Program (PPRDP) undertaken by Christian Commission for Development in Bangladesh (CCDB) in greater Rajshahi district in 1996 showed that according to Gomez classification 17% were normal and 83% were malnourished including 4.3% third degree malnourished. By weight for age Z-score classification, 57.4% were underweight of which 14.9% were severely underweight. In both classifications female children were found more malnourished than male children[218].

Nutritional status of 2-5 years children in a slum of Jurain area of Dhaka city was studied by Kamal at al[278] and found that 14.7% children were normal and 85.2% were malnourished according to Gomez classification. The proportion of 1st, 2nd, and 3rd malnourished children were 40.6%, 36.7% and 7.8% respectively. According to Water low classification, 50% were malnourished of whom 39.7 % were stunted, 5.3% wasted and 4.9% were simultaneously stunted and wasted.

Nutritional status of children among 100 households in a village of Narayangonj was studied in 1988-89 and showed that 70 percent children were either stunted or wasted or both stunted and wasted. Almost all of them (98%) were found to suffer from malnutrition of various degrees and 49% were anaemic and vitamin A deficiency disorders were more severe than those of 1981-82 survey[246].

Chowdhury[279] conducted a study with children of under 5 years of age in slum area of Dhaka city and showed that according to Gomez classification 96% were malnourished of whom 29, 49 and 18 percent were respectively suffering from 1st, 2nd and 3rd degree malnutrition.

Karim et al [280] conducted a study among urban primary school children and showed that 41% of the children were nutritionally nourished in respect of weight for age, while 39 and 20 percent of the children were moderately and severely malnourished respectively. According to Waterlow classification they found that 51% were normal, 15% stunted, 33% wasted and 2% were both stunted and wasted. By Gomez classification 49, 35 and 3 percent respectively were suffering from 1st, 2nd and 3rd degree malnutrition, while 13% were normal.

Talukder[281] conducted a study among child patients at the nutritional unit of Dhaka Shishu Hospital and found that 75 percent of the children below 3 years of age had been suffering from various grades of malnutrition.

Sultana et al[282] analyzed medical reports of 2137 children admitted over a period of 6 years to Children Nutrition Unit (CNU) in Dhaka to find out the risk factors contributing to PEM. Among the children 19, 20 and 62 percent respectively were found to had been suffering from marasmus, kwashiorkor and marasmic kwashiorkor according to welcome classification. From the point of socio-economic characterestics, children of slum dwellers, specially those of rikshaw pullers, day labourers and others those earning was <Tk.600/- per month were the most vulnerable group. Of course income was not only the constraint for malnutrition in this group of children. The other contributing factors of PEM equally important are first or second child born of young mothers, illiterate parents, infants & children aged between 4 and 60 months specially females, children who were bottled fed, children with marginal nutritional status who suffered from repeated diarrhoea and infectious diseases, ignorance and faulty infant feeding practices as well.

A study among 200 children (students) between 4 and 8 years of age of two Kinder garten schools, one in urban area and the other one in a rural area, was carried out by anthropometric measurements in 1993. It was found that about 70% students of urban area were well nourished, as against about 50% in rural area. Severe malnutrition was found in more than11% in rural school students, which was 4% among urban children. It was also found that the nutritional status of the children coming from higher socio-economic group was significantly better ($P < 0.01$) than those from lower socio-economic group[283].

National Iodine Deficiency Disorders (IDD) survey conducted in Bangladesh in 1993 revealed that the prevalence of goitre for the entire country was 47.1 percent indicating severe IDD situation in Bangladesh[284]. It showed that nearly 69% of the population was bio-chemically deficient in iodine.

In a study among 2000 under -5 children (6-59 months) attended Paediatric out patient department of Sher-E-Bangla Medical College Hospital, Barisal, showed that 10.0% children had normal nutrition, while 41.3, 33.6 and 13.7 per cent respectively had mild, moderate and severe undernutrition according to McLaren's classification. According to Wellcome classification, 8.6% children had kwashiorkor, 12.2% had undernutrition, 7.8% had marasmic kwashiorkor and 18.7% had marasmas[285].

Prevalence of morbidity among normal and malnourished 0-5 years old children in a slum of Dhaka city was studied and found that the prevalence of morbidity among the malnourished children was higher than the normal children living in the same conditions[286].

A cross-sectional study among two groups of 6-15 years old street children was conducted in Dhaka, Bangladesh to find out the effect of organizational support on the nutrition and health status of the children. A total of 100 street children (50 from Organizationally supported group-OSG, and 50 from Organizationally non-supporting group-ONG) were included in the study. Eighty two per cent children in ONG and 100% children in OSG took 3 major meals daily, where carbohydrate constituted two third of their energy intake. The prevalence of under weight, stunting and wasting were 34, 38 and 18 per cent among ONG children, while 16, 28 and 14 per cent among OSG children respectively, indicating that OSG children had a better nutritional status than ONG children. Prevalence of under weight, stunting and wasting in respect of reference median and cross classification of stunting & under weight and stunting & wasting also showed evidences in favour of better nutritional status of the OSG children. Seventy per cent of ONG children, while 48% of OSG children had clinical signs of PEM; 80% of ONG and 70% of OSG children suffered from anaemia, and 62% in ONG and 30% in OSG children had vitamin A deficiencies. The study clearly indicated that organizational support in different ways has profound effect in the improvement of nutrition and health status of the street children[287].

Agarwal and others[288-290] showed in their study that people in the lower socio-economic groups do not usually get required amount of food and treatment and ultimately they fall prey to ill health.

Roy N. C. measured MAC of 8881 children to determine the effects of diarrhea, breastfeeding and birth spacing on the nutritional status of the children in rural Matlab, Bangladesh in 2000. It was observed that the younger children (<2 yrs.) had significantly higher levels of severe malnutrition than children aged 2 years and above. Children having diarrhea during the last 12 months prior to the study had significantly ($p<0.001$) higher prevalence of severe malnutrition than the children who did not suffer from diarrhea. Children born with a longer birth spacing (24 months +) and who were breast fed for 2 – 3 years were less likely to be severely malnourished than those who were born with a shorter birth interval or who terminated breast feeding before 2 years of age. The study revealed that mother's education, house-space, family size, religion and sex of children had significant effects on the nutritional status of children[291].

Nutritional status of Indian children under 4 years of age (N=500755) excluding 5 states, namely Andhra Pradesh, Himachal Pradesh, Madhya Pradesh, Tamil Nadu and West Bengal showed that 47.1% of all children were stunted (<-2SD Z-score), while 51.9% moderately and 21.2% severely underweight (<-2SD Z-score)[292]. The corresponding figures for the children of Second Quintiles (marginally poor) (N=100151) were 54.0, 59.4 and 26.4 percent respectively. The prevalence of stunting, moderately and severely underweight among male children of the second quintiles were 55.3, 61.5 and 28.0 per cent respectively, while in female children the corresponding prevalences were 52.7, 57.4 and 24.8 percent respectively. The prevalence among the second quintile rural children

(N=62984) were 53.6, 59.3 and 25.9 percent respectively. The nutritional status of the female children seems better than their male counterparts[292]. As many as 43.4% and 7.5% pre school children are suffering from moderate and severe forms of undernutrition, while severe undernutrition decreased from14.2% to 7.5%. Fifty per cent of the adult population and 53.4% of the children are reported to have body mass index below normal. Iron deficiency anaemia is prevalent in 50-80% of the population in different parts of India. About 47% of pregnant women are moderate to severely anaemic in India. Nearly 40 million persons are suffering from goiter and about 145 million are living in goiter endemic regions. About 90,000 still birth and neonatal deaths occurs every year due to iodine deficiency. Prevalence of vitamin A deficiency among pre school children is estimated from 4.4 to 34.1 % in different regions of India. The incidence of low birth weight may be more than 60 per cent[135].

Roy et al studied the nutritional status of a sample of 435 under-five children belonging to the Pavement dweller families randomly selected from clusters of such families from each of the geographical sectors of Calcutta City in 1999. The study revealed that the overall prevalence of PEM was almost similar (about 70%) to that among urban poor children of slum dwellers, but about 16% of them were severely undernourished. About 35% and 70% of street dweller children had wasting and stunting respectively. Severe PEM was more prevalent among 12-23 months old female children belonging to the illiterate parents and housewife mothers rather than wage-earner mothers[293].

In a cross-sectional study in a tribal community in West Bengal showed that the overall prevalence of malnutrition among the under five children was 80.9% including 9.26% severely malnourished. Both overall and severe malnutrition was highest in12 to <24 months age group amounting to 85.7% and 18.2% respectively, while the lowest prevalence was observed amongst the infants[232].

Yadav et al [294] assessed the dietary intake and nutritional status of 1847 children aged 0-6 years from 396 villages of 17 tribal districts of Bihar, India through 24 hours dietary recall method and anthropometric measurements of height and weight. The results showed that the mean intake of energy and other nutrients were lower in all age groups as compared to Indian Council of Medical Research RDA, while protein intake was broadly in line with the RDA in all age groups of children. Calorie deficiency was 38%, whereas protein deficiency was about 19% and more than 50% of the children were calorie deficient in 4 villages. The overall prevalence of stunting was about 60% and under weight was about 55% which were comparable in boys and girls. Wasting was more prevalent among girls (urban 34.5% vs 16.3% and rural 34.9% vs 18%). The level of malnutrition was not very different in rural and urban areas. The author concluded that the dietary intake and nutritional status of tribal children in Bihar was very poor.

A survey on nutritional status on pre-school of urban slum community in Delhi was conducted by Kopil and Bali[295] and found that overall prevalence of PEM was 81.8%, of which 31.8, 44.1, 5.7 and 0.2 percent children had I, II, III and IV grades of PEM respectively. Age, sex and education level were found to have a significant association with PEM.

Sastry et al[296] conducted a anthropometric study on Indian pre-school children (1-5yrs) and showed that the prevalence of stunting i.e. chronic malnutrition was higher compared to wasting as well as both stunting & wasting. The data also showed that the prevalence of stunting declined from 58% to 45% as compared to another study conducted 6 years before.

A study was conducted by Ayesha et al[297] to estimate the prevalence of anaemia among 391 children aged 6-60 months selected randomly from urban slums of Karachi and showed that 30% children were normal and 70% were anaemic. A total of 61% had microcytic and hypochromic anaemia indicating high prevalence of iron deficiency anaemia among these children.

Fernando et al studied the nutritional status and parasitic infections among children of four primary schools in two rural communities in the Moneragala district in Sri Lanka. Heights and weights of the children were measured and their stool and blood samples were examined. The study showed that a greater proportion boys were under weight, wasted and stunted than girls. Over 80% of the children were anaemic, although the prevalence of parasitic infestation such as hook warm was low[298].

In a study by Golder et al among Maldivian women and pre-school children found that 22 % women had BMI <18.5 and 41%, 14% and 51% of the children were stunted, wasted and underweight respectively[252].

A study to estimate the nutritional status of 262 women aged 18 years & above and 183 children aged 2-6 years conducted in rural areas of Malaysia showed that the prevalence of malnutrition among children ranged between 25.5% in the Malaya Felda Settlement Scheme to 80% in the Orang Asli Settlement. Malnutrition was found associated with worm infestation, bottle-feeding and early weaning. More than 30% of Orang Asli women were malnourished compared to less than 15% of Malaya Felda Settlement women. On the other hand, Malaya women in the land settlement scheme had a higher risk of developing overweight and diabetes. Goiter was found among 11% of children[299].

Fifth National Nutrition Survey of Philippine 1998 showed that among pre-school children (0-5yrs) 34%, 32% and 6% were stunted, underweight and wasted respectively. Thus an estimated 3.36 million children of Philippine are underweight, 3.57 million stunted and 630,660 are wasted based on the 1990 National Statistics Office (NSO) population of children. Among the school-age children (6-10yrs) 30.2% were underweight and 40.8 percent were stunted. Among adolescents (11-19 yrs) 57% had normal BMI, 40.2% were underweight, 2.9% were overweight including 0.3% obese. Adolescent males were more underweight (47.1%) than females (33%), while female adolescents were more overweight (4.7%) than their male counterparts (1.2%). About 50% of adults had normal BMI, while the prevalence of chronic energy deficiency (CED) among adults was 13.2%. Prevalence of CED was higher among female (15.4%) than males (11.1%) and the severity of CED was found to increase with age and as such older group of 60 years & above exhibited the highest prevalence of CED (25.4%). The prevalence of obesity among Philippino adult population was 3.3 percent[250].

Chang et al[300] studied the nutritional status of rural Jamaican school children including 388 children in grade 2 -5 attending 16 rural primary and all ages schools in Central Jamaica and they were weighed and their W/A Z-scores were calculated. Heights of a random sample of 793 children of grade-5 were measured and H/A Z- scores and BMI were calculated. It was found that 69% of the total sample children had normal W/A, while 2% were moderately underweight (< -3 SD to <- 2SD Z score) and a further 24% were mildly malnourished (W/A > -2SD to < -1SD Z score) and a few children were overweight. The prevalence of W/A i.e. underweight was similar in boys and girls.

Among the sub-samples, 25.8% had < -1 SD Z score of H/A, of whom 4.9% had <-2 SD score of H/A. Compared with a survey conducted in a similar rural area in the 1960s the children's mean weight for age group categories were 1.1 – 3.7 kg heavier.

Pongpaew et al studied the nutritional status of street children in an endemic area of iodine deficiency disorders (IDD) after one year of iodine supplementation and found that there was a significant difference in weight and height of the children from four schools investigated before and after supplementation in each school. A decrease in the prevalence of anaemia and iodine deficiency was found in all children when compared before and after iodine supplementation, however, serum ferritin did not have changed after iodine supplementation[301].

Nutritional status of a multi-stage randomly selected 365 children aged 1-4 years in an urban slum in the Muslim Local Government Area of Lagos State, Nigeria were studied by Abidoye R. O. et al[302] in respect of H/A, W/H and W/A Z-score below -2SD of NCHS reference standard. The study revealed that the prevalence of under weight, stunting and wasting were 39.2%, 34.5% and 21.9% respectively. The mean W/A, H/A and W/H and MAC were less than the mean of NCHS reference population. The study also revealed that in respect of modified Wellcome Classification of malnutrition, 37.8% of the study children were malnourished.

The prevalence of malnutrition among under 5 children of poor families in general from the North and North-East regions of Brazil fell by more than 60 percent between 1975 and 1989. Regional and socio-economic differentials in the prevalence of malnutrition, therefore, increased between the mentioned periods[303].

To evaluate the nutritional status of 278 hospitalized infant, pre-school and school children in the Nuevo Hospital Civil de Guadalajara, a study was conducted and family socio-demographic information and anthropometric measurements of height, weight were obtained. The result showed that mean height/age, weight/age and weight/height were 95.74, 84.04 and 89.7 percent of NCHS median. There was a high prevalence of acute and chronic malnutrition which night be due to the poor quality of life and higher morbidity[304].

The growth failure and nutritional status of 154 children between 2 and 17 years with diplegic or hemiplegic cerebral palsy were assessed and found that linear growth was significantly reduced compared to normal healthy children. About 30% of the children were undernourished, 8% were overly fatty and 14% were overweight. Twenty three per cent children had stunted growth. Children of youngest age group were the most at risk of poor nutritional status and delayed growth[305].

A community based survey among 426 under-5 children was conducted by Coetzee et al using cluster sampling technique. The height and weight the survey children were measured and compared with clinic-based growth monitoring data. It showed that 5.5% of the children were below the 3rd percentile of weight for age. In respect of height for age, 44.3% boys and 44.1% girls, while in respect of weight for height less than 4% of boys and girls were below the 3rd percentile indicating higher percentage of stunting but not acute malnutrition[306]

Heights and weights of two groups of primary school children were obtained, 1016 were from throughout Oxfordshires, a rural county with few areas of deprivation and 219 children were from an economically deprived part of the city of Newcastle of Tyne. Compared to Tanner and Whitehouse standards, Oxfordshire children were significantly taller but not heavier, while the Newcastle children were significantly shorter and markedly lighter[307].

Rajasree and Soman[308] studied the nutritional status of children in two poor communities of Kerala, India, using conventional anthropometric measurements. Out of 944 children, 246 boys & 242 girls from coastal area, and 213 boys & 249 girls from non-coastal area were under study group. The prevalence of various forms of growth retardation was determined in two communities. In spite of better food intake, the non-coastal children exhibited poorer nutritional status mainly because of poor environmental conditions. Chattopadhya et al[309] studied the nutritional status of urban children based on biochemical parameters and found that almost all the children were anaemic, but their serum iron and ferritin levels were satisfactory. Folate and vitamin B_{12} levels were low which might be a cause of anaemia. 15 percent of the children had serum vitamin A deficeincy.

The nutritional status of 190 children aged 3-6 years living in Besters, a typical urabn shack settlement north of Durban was assessed anthropometrically, and found that 13% were underweight and 27% were stunted[310].

Nutritional deficiency in school children is one of the major health problems in Thailand. Chamruengsri et al[311] investigated the nutritional status among 240 poor adopted school children having lower socio-economic conditions. Bio-chemical parameters were measured for detecting early signs of nutritional deficiency before the clinical signs developed. Amongst them 54.5% of the children showed signs of vitamin B_2 deficiency and prevalence of anaemia among these children was 53 per cent.

A study was carried out to assess the nutritional status of primary school children of a marginal area in Cadiz Province through biochemical, anthropometric and clinical examination. The result showed that body weight for age and quetelex index values were lower compared to the standard. The results obtained might suggest the existence of an unbalanced and / or poor diet among school children, which could be varified on carrying out a complete dietary assessment[312].

Yap and Tesh[313] studied the nutritional status of children in an urban squatter community in Malaysia and showed that about 40% of the infants and toddlers were found to be wasted, while one third of the older children were stunted and also showed some association between income and nutritional status.

Powell et al[314] observed in a study in Kingstone, Jamaica, that 32% of the Jamaica children were first degree malnourished according to Gomez classification and 9% and 1.6% respectively were 2nd and 3rd degree malnourished. Wasting was somewhat higher compared to stunting. Weight for age and weight for height indicators as well as developmental levels declined with the age of the children.

In a study in Brazil, Rees et al[315]showed that in respect of weight for age, 43% of the children were normal being adequately nourished as against only 2% were severely malnourished. Stunting (<85% HFA) was found in 8%, while wasting (<70% of WFH) was found in only 1 per cent.

Abol Fotouh et al[316] in an another study on pre-school children from MCH centers of Alexandria found that 10.5% suffered from underweight (WFA <-2SD of reference median), while 14.1 and 5.5 percent respectively were stunted and wasted.

Kiyan et al[317] in a study on nutritional status of children in Malaysia showed that based on Waterlow classification, 61% were stunted and 44.1% were wasted. According to Gomez classification 81.9% were malnourished. The percentage of malnourished children increased continuously with age and stunting also increased with age but the increase was the sharpest among children of 12 to 23 months old.

Domingvez et al found[318] found that according to Waterlow classification 81, 17 and 2 percent children were suffering from 1^{st}, 2^{nd} and 3^{rd} degree malnutrition, while the corresponding figures for 1^{st}, 2^{nd} and 3^{rd} degree malnutrition respectively were 49.7,14 and 2% according to Gomez classification.

A study conducted by Kikafunda et al[319] in Uganda to assess the dietary and environmental factors influencing stunting and other signs of poor nutritional status of children < 30 months of age in rural and semi urban settings. The result showed that 21.5 % of all study children were found in poor health condition; 3.8% being classified as suffering from kwashiorkor and 5.7% from marasmus. A high proportion of the children were stunted (23.8%), under weight (24.1%), or had low MAC (21.6%). Different socio-economic factors like use of unsafe water supply, lack of fuel, lack of milk consumption and lack of personal hygiene were found as risk factors for marasmus and underweight. Age of child , poor health, prolonged breast feeding, low dietary intake, less education of mothers, low socio-economic status of the family were found to be associated with stunting, while factors associated with low MAC were poor health, low dietary intake, less education and older ages of mothers.

Serenius and Swaibn[320] in a research among less privileged urban children in Saudi Arabia found that according to WHO criteria 14 and 3 per cent children were classified as chronically and acutely malnourished respectively. Serenius et al[321] in an another study in Saudi Arabia found that 41% rural pre-school children were classified as chronically and 12% as acutely undernourished according to WHO criteria.

The nutritional status of a randomly selected sample population was surveyed in Upper Volta in 1978 and found that mortality rate among the pre-school (0-5yrs) was as high as 39% and up to 6% of the children aged 0-9 yrs were found to be stunted and wasted. Older children and adults were regularly underweight although their mid arm circumference was within the range of international standard. The prevalence of anaemia among the entire population was around 30 per cent[322].

A Nutritional survey was conducted among 1739 under-5 years children in 1979 in the Lagaip area of Enga Province and found their growth pattern was similar to that reported for other highland populations; 37% children were classified as malnourished due to stunting growth and most of the under-2 children were wasted[323].

The nutritional status of under- 5 years children of Southern Highlands Papua New Guinea, was estimated in terms of weight for age during 1974-75 and 1978. It was found that no significant change in the proportion of children with <80% mean weight for age was occured, although there was an increase in the proportion of severely malnourished children (<60% WFA)[324]

A survey was carried out to find out the nutritional status of 2152 children aged -5 years living in Urban Refuge Camp, Thailand, in May 1979 and showed that 165 (7.5%) children probably suffered from malnutrition using arm circumference as an index which was validated by comparisons with weight for age and with morbidity in 'malnourished' and 'normal' groups. Arm circumference appeared to be a valid index of nutritional status[325].

In Lao PDR[326] the first nationally representative nutritional survey showed that the prevalence of stunting among under-5 children was 48%, which is greater than the average of developing countries in the world and in south east Asia. The prevalence of wasting and underweight children were10 and 44 per cent respectively. Girls were less malnourished than boys but the differences were not significant. Similar prevalence of stunting and underweight among children were also observed in a national survey conducted in Lao PDR 10 years ago, although the sampling was not the same.

A community based cross-sectional anthropometric study was conducted among 1422 under 5 years pre-school children in North western Ethiopia [327] and found that according to Z-score the prevalence of stunting and wasting rates were 43 and 9 per cent respectively as compared to the NCHS/WHO standard. The highest percentages of stunting and wasting were found among the children of 12 - 23 months age group.

A baseline cross-sectional study was conducted among the children under 15 years of age from 395 households (50%) in 29 out of 83 randomly selected villages of the Mohale

Dam Catchment in Lesotho Highlands before its construction[328]. Anthropometric measurement of height and weight by age and sex indicated varying degrees of under nutrition from high to very high levels in the study children under- 15 years with a few exceptions. Very few clinical signs of nutritional deficiencies were found except for a goitre prevalence of 17.5% in 10-14 years old children. Qualitative analysis of diet eaten by the children showed that a too small variety of food was eaten, with an irregular intake of protein rich foods and milk. Quantitative data among 3-5 years old children showed that micronutrient intakes were low and energy intake of these children was inadequate. The results suggested that these nutritionally vulnerable children should be monitored to see the impact of the dam construction on their nutritional status[328].

A study was carried out among 1050 children of 1-59 months old in the pediatric ward of regional hospital, Moundou, Chad, between June 1992 and May 1993, to assess the prevalence of PEM. At the entry into the study, the prevalence was 63.1% (WFH < -2 SD) including 37% severe malnourished (WFH <-3SD) and 16.1% had stunted growth (HFA <-2SD). Malnutrition was more prevalent among children under-2 years (80%) than higher aged. The prevalence of malnutrition was highest in children with diarrhea (89.8%) followed by ARI (61.3%). Thirty percent deaths were attributed to malnutrition[329].

Nutritional status of a cross-sectional multi-stage stratified sample of 7419 Kuwaiti pre-school children (3749 boys & 3670 girls) was compared with NCHS/CDC reference population and found that obesity (WFH 2.00 – 5.00 SD scores) among these pre-school Kuwaiti children was 8.2% (7.5% in males & 9.0% in females). Underweight (HFA<-2SD to -4SD scores) among boys was 4.2% and 4.1% in girls and stunting rate was 5.8% (6.1% in males and 5.6% in females). In most cases Kuwaiti children were found to be slightly heavier and shoter than American children and they were also found to be heavier and taller a decade ago indicating their improvement of nutritional status during last 10 years[330].

The growth pattern of randomly selected 3795 pre-school(0-5 years) Saudi Arabian children (55.2% male, 44.8% female) were studied through measuring their height and weight and comparing with the NCHS/CDC reference population in Riyadh, Saudi Arabia[331]. It was found that 78.1% children had normal or slightly over normal nutritional status in respect of a combination of stunting and wasting, while only 1.4% were malnourished in respect of both weight for height and height for age and wasting rate was about 20% (<-2SD WFH). Overall Saudi Arabian children are slightly shorter and thinner than the American children.

Present nutritional status of 9459 children between 7and 10 years from 5 pre-fectures and 3 cities of Guangxi was assessed according to weight for height standard as recommended by WHO in 1979 [332] . The results showed that undernutrition rate was 19.94%, while rate of obese children was 1.85% and the later was lower than that reported by other provinces and foreign countries. Undernutrition rate was higher (26.43%) among city children than that of rural children (15.9%), but no statistically significant difference was found between male and female (p>0.05).

A nutrition survey conducted in Nochikuppam and Ayodyakuppam marine fishing communities of Madras City, India, showed that out of 482 under-5 years old children 55% combined mild and moderately malnourished and 3% were severely malnourished accordingly Gomez classification of weight for age reference median[333]. Vitamin A deficiency Xerosis and angular stomatities due to vitamin B_2 deficiency were the major prevalent diseases. Meat, milk and fruits were rarely eaten but fish was consumed almost every day. Another study [334] showed that a considerable number of women and children were found to suffer from partial blindness because of vitamin deficiency and about 70% of the children were suffering from first and second degree malnutrition (Gomez classification).

A community survey in a marine village 'Basanti', Culcutta, West Bengal indicated that 44%, 26% and 5% of the children below 5 years of age were mild, moderate and severely malnourished according to Gomez classification[335].

Six anthropometric surveys using a random cluster sampling design have been conducted in the capital of Zaire between November 1991 and March 1994 and found that the prevalence of acute malnutrition fluctuated with seasons and followed the cyclic movements of the food prices on the market prevalence. It was also found that in March 1994, 10.4% of the children were suffering from acute malnutrition[336].

Nutritional status of 4509 children in poverty condition from urban and rural areas in Chile [337] were studied in respect of weight for age, height for age and weight for height. It was found that 74% of rural children were underweight (W/A), while that of urban children was 34%. Similarly, weight for height i.e. wasting was 7.7% in rural children and 4.6% in urban children. Likewise rural children had higher proportion of height/ age ratio below 90 per cent (13 % vs 5.2%). It was concluded that the significant relationship found between socio-economic, socio-cultural and family variables and nutritional status was relevant as the sample was homogeneous in each geographic area.

Miller and Korenman [338] studied on poverty and children's nutritional status in the USA between 1979 and 1988 and described deficits in nutritional status among poor children. They found the prevalence of stunting and wasting was higher among children in persistently poor families. Differences in nutritional status between poor and non-poor children remained large even when controls for other characteristics associated with poverty.

An anthropometric study of a representative community based sample of under-5 children conducted in the Nquta district of Kwazula indicated that the absence of wasting and the high prevalence of stunting (37.5%) among the children suggested that the main problem was chronic socio-economic underdevelopment rather than a severe or immediate lack of food[339].

Rahman & Islam carried out a study to find out the extent and severity of iron deficiency anaemia in children aged 0-12 years and found that 63% of the total cases were iron deficient. Family income and food habit had significant influence on hemoglobin level, serum iron concentration and nutritional status of children which revealed a complex interaction between socio-economic condition and iron deficiency anaemia[340].

A study among urban school children in Dhaka reported that there was complex interaction between concentration of biochemical indexes of nutritional status and other anthropometric, biochemical and socio-demographic variables. Children who are short and thin were likely to have lower vitamin A and haemoglobin and higher serum copper concentration[341].

Momen[342] studied the apparent correlation between family size and nutritional status of under-5 children and showed that about 38% children were normal in the families having three or more members. About 44% children were normal in weight for age whose mothers were educated at graduation and above level, the proportion of which gradually decreased with the lower level of mother's education indicating that maternal education had a certain role on the nutritional status of under-5 children.

Aryea and Dev [343] in their study showed that nutrients deficiencies, specially PEM, were more prevalent among the pre-school children of illiterate mothers. Food intake pattern was better among children of literate mothers compared to those of illiterate mothers. Milk & milk products, fruits, sugar and jagory intakes were significantly higher among children of literate mothers.

In a study among the urban primary school children of low income group in Dhaka, Bangladesh, Bhuyan et al[344] showed that the children having normal nutritional status in respect of both weight for age and weight for height indicators secured higher marks compared to the malnourished children of the same school. Rahman et al also showed that the examination performance of an urban primary school children was significantly related to their nutritional status[345].

The relationship between malnutrition and intellectual performance was studied by Sultana et al[346] among 110 pre-school children in study and control group each. Dietary intervention was given to the study group and Tandon's Battery of Intelligence Test (TBIT) was done in both study and control groups usually and after one year. Multiple regression analysis showed that there was a relative increase in intelligence score in study group. The overall observation indicated that dietary supplementation played an important role in gaining intellectual capability if the physical and nutritional status could be maintained and followed-up.

Simen et al[347] examined the relationship between varying intensities of infections and school achievement, attendance and nutritional status among 616 children and showed that the un-infected children had higher reading and arithmetic scores than children with infections and the un-infected children were taller than the infected children indicating that infections are associated with pre-school achievement and growth.

To advise a strategy for assessing the nutritional status of a household and specifying the major needs in combating childhood wasting, distinguishing between adequate food availability, poor parental care and of the need for improved public health measures, a study was carried out for evaluation of the relationship between children wasting, stunting, or underweight and mothers or adult women body mass indexes (BMI) in the same households. A household was designated as malnourished on the basis of a single child's weight /height of <-2.0 S.D or at risk of being malnourished if z-score may below - 1.5. Adult women's BMI was taken to signify adequate household food availability. The results show that a wide variety of prevalence of severe (BMI<16.0), moderate (BMI 16.0-16.9) and marginal (17.0- 18.4) malnutrition existed in the various study areas. The worst condition was recorded in India, while 18% of the women in Zimbabwe were classified as obese. Similarly wide variation in the prevalence of child wasting and stunting was observed, with the Indian children again faring worst and those in Zimbabwe the best. Mother's BMI was highly correlated with the BMI of all women was found to be useful as that of the mother for relating children's anthropometry[348]. Household with mother of normal body weight but wasted children were designated as in need of public health measures and improved parental care rather than enhanced food security. The distribution of households on this combined basis of maternal BMI and child nutrition status highlighted very diverse situations in the various study areas, with higher proportion of combined maternal and child malnutrition in India and in some areas of Ethiopia, while in Zimbabwe only 1-2% presented this condition. On this basis, the principal problem in India was food security; while in Zimbabwe Public health measures and maternal care were designated as problems. The study concluded that a relatively simple household based approach is proposed to discrimination the most pressing needs in combating childhood malnutrition and a policy making tool is suggested for setting priorities in community action[348].

To identify caregiver characteristics that influence child nutritional status in rural Chad, a study was carried out with variables classified according to the categories of a UNICEF model of care. Sixty four households with 98 children 12 to 71 months old were a part of this study. Caregivers were interviewed to collect information on number of pregnancies, child feeding and health practice, influence on decisions regarding child health and feeding, overall satisfaction with life, social support, workload, income, use of income, and household food expenditure and consumption. Household heads were questioned about household food production and other economic resources. Caregiver and household variables were classified as two sets of variables, and separate regression models were run for each of the two sets. It was found that caregiver influence on child feeding decision, level of satisfaction with life, willingness to seek advice during child illness, and the number of individuals available to assist in domestic tasks were the caregiver factors associated with child's height for age. Socioeconomic factors associated with children's heigth for age were the amount of harvested cereals, the sources of household income and the household being monogamous. These results indicate that caregiver characteristics influence children's nutritional status, even while controlling for the socioeconomic status of the households[349].

In a study all food and drinks consumed for three consecutive days by 405 Northumberland children of average 11.5 years old on five separate occasions over a 2-years period were recorded food tables. The mean energy intakes were found similar to those of other recent British dietary surveys but were well below those recommended by Widdowson in 1947 and the FAO/WHO/1973 recommended levels and slightly below the current Department of Health and Social Security (DHSS; 1979) recommended intakes. Over the 2-years period, the energy intakes of the boys increased by 13% compared with an increase of only 7% in the girls. The iron and Vitamins A intakes of all groups of children were low compared with current recommendations. Mean calcium intakes were also only marginally in excess of the recommended intakes and those of most of the girls would fall below the recommendation if the proposal to end the fortification of flour (DHSS, 1981) is implemented[350].

1.3.24. Way to Achieve Houschold Food Security:

To achieve household food security, food availability must be coupled with the physical ability of every household to procure it and it must be affordable. But food supply is often disrupted resulting into household food insecurity. Disruption of food supply may be caused by any factor that interferes with the ability of the people to acquire food through normal channels but in general the disruptions are due to decrease in local food production, losses of purchasing power and/or breakdown in the marketing and distribution system[81]. During periods of seasonal food shortage the nutritionally at risk group include poor rural families with limited resources to meet the nutritional need of vulnerable children, pregnant and lactating women. To ensure food security of such groups will involve increasing family income earning opportunities and providing adequate supplies of basic food stuff at a price within their reach.

Agricultural development in developing countries has not lead to significant improvement in the consumption and thereby nutrition of the poor. One reason is that consumption objectives have not been explicitly incorporated in the design of policy and projects. Far grater understanding is required of the way rural people plan their strategies for obtaining household food; external assistance should build on these activities which should lead to improvements in food consumption and nutrition:

first- a review of the way in which export crops should be introduced and promoted so that food security is not adversely affected,

second- a discussion of the need to give greater attention to what are known as minor crops,

third- a discussion of the importance of incorporating seasonality into planning,

fourth- a review of the importance of women; and

fifth- an examination of the way in which crop breading research should involve nutritional concerns. Longhurst R concludes with some observation from Kenya whereby agricultural sector planning could incorporate nutritional objectives[351].

Therefore, to achieve household food security and thereby adequate intake by the vulnerable groups appropriate programmes arc needed to be planned and implemented. But programmes must be atuned to the characteristics of a household food insecurity problem, the nature of food insecure population and resource availability. The programme should ensure that all the households have the means to secure their food intake on a sustainable basis. Secured food intake can be achieved through three dimensions[10]:

Firstly, it is necessary to ensure a sufficient food supply at the household level,

Secondly, it is necessary to have a reasonable degree of stability of food supply both from one year to the next and also throughout the seasons, and

Thirdly, the most critical is the need to ensure that each household have physical and economic access to food and the ability to produce or procure the food that the family needs.

The international community of scientists in the field of nutrition suggested the following key areas where action may be necessary in order to achieve household food availability and thereby food security[10]:

a) **Over all Development Strategy:** Various development strategies can have different effects on poverty alleviation and food security. It is necessary to create condition for the farm population for their economic growth through development programmes with equity so that poverty alleviation and food security programmes remain sustainable in the long run. For this purpose an integrated approach of all the development strategies is needed to be followed at all levels.

b) **Accelerating Growth in the Food and Agriculture Sector:** Growth in agriculture, specially in food production, play a vital role for food security in the households. Appropriate measures needed to increase food production by giving technical training and logistic supports. Producer incentives and new technologies that increase production and employment in the food and agriculture sector can alleviate poverty through increasing income, and improve food security in the households. Programmes for improving access to production factors, increasing skills and providing credit and other inputs can help food insecure groups. Strengthening local leadership, people's participation and community involvement and empowering women, both as producers and consumers, can be of crucial importance.

c) **Giving Credit to Poor Households:** Introduction of income generating activities for promoting self-help employment of the marginal farm household members can be a useful instrument for improving their food security. Credit programmes with technical advice and assistance specially aimed at women's groups have been particularly beneficial to food security.

d) **Increasing Employment Opportunities:** To alleviate rural poverty, augmenting appropriate employment opportunities in agriculture sector and in other sectors can play a very important role. Intensive cropping, multiple cropping and crop diversification can be of useful to create employment opportunities for the rural poor farmers. Labour-intensive public works can be an effective instrument for ensuring food security. Food- for- work programmes in rural infrastructure development can create employment opportunities for the farmers during periods of seasonal unemployment which will help them earning extra income to meet the food need of the households.

e) **Income Transfer Schemes:** Food consumption can be raised through income transfer schemes, such as food subsidies and/or targeted feeding programmes for vulnerable groups. For these programmes distribution of those food are to be selected which are principally consumed by the target farm households and food distribution centres to be located in those areas where the poor farmers live.

f) **Stabilization of Food Supplies:** Policies to be aimed at stabilization of food supplies in periods of crop short fall/crop failure and/or before the harvest. In household level a variety of cropping strategies including greater use of roots, tubers & minor crops, crop rotation, mixed cropping, high yielding varieties selection, promotion of homestead kitchen gardening and planting permanent fruit trees etc. can also help in stabilization of food supply in the poor farm households throughout the year. Rural food supply can best be met by local measures to raise farm output of locally consumed basic food stuffs[352].

g) **Improving Emergency Preparedness Planning:** Natural disaster such as draught, flood, cyclone etc, lead to household food insecurity. Introducing measures that can prevent such disasters e.g. irrigation schemes for drought prone areas and flood control schemes for flood affected areas etc. can help in increasing food production and thus improving food security. Introduction of food reserve system in household may secure food supply during emergency period.

h) **Food Aid:** Food aid during natural and man made emergencies can play a very important role in improving household food security. Open market sales of locally produced and consumed foods lead to lower food prices during crisis which provide an implicit subsidy that can improve food security of vulnerable households.

1.3.25. Method of Assessing Household Food Security:

Household food consumption i.e. dietary intake is considered as an indicator of household food security[353]. Total per capita calorie intake and anthropometric status of the members of the household are considered as the primary indicators of household food security[124]. Therefore, to assess household food security status, measurement of household food availability and average household food consumption level over a period of time is to be measured. The following indicators and methods are needed to be considered to assess the levels of household food intake and, in turn, food security[354]:

- dietary energy intake (cal/person/day, averaged over the household with specified period, preferably one month),
- percentage of total expenditure on food,
- dietary pattern / choice of food,
- experiences of hunger and food unavailability by interview,
- anthropometry (mainly thinness).

An abbreviated method that capture both qualitative and quantitative dimensions of food security is the assessing predictors of energy availability together with a self-perceived household food security scale may provide a valid and reliable method for identifying and monitoring food security levels among poor urban households[237]. The combination of quantitative and qualitative methods is particularly valuable as a means of getting wider and deeper understanding of the nature of the nutritional situation[355].

However, assessment of food security or in other words, food and nutrition situation in a community or a nation is obtained from two different types of studies[239]:

a. The first type deals with the determinations of indicators which apply to the individual directly; several methods, including anthropometric measurements, physical examinations and laboratory investigations are used to estimate the nutritional status.
b. The second type of study is designed to collect quantitative and qualitative information on food availability and consumption usually conducted by trained nutritionists. A comprehensive food consumption survey includes, in additions, the collection of information on socio-economic and other factors relevant to food consumption.

Data on household food availability do not measure nutritional status, rather help in the identification of causes of malnutrition. When food consumption surveys (type b above) and nutritional status survey (type a) are conducted simultaneously, the former type can help in the interpretation of the findings of the later type.

Dietary Survey:

Food consumption often referred to as dietary survey is sometimes the only method used to estimate the nutritional situation. Since it can be used to determine the amounts and sources of nutrients eaten, it helps in identifying those nutrients that are in short supply. In using this type of nutritional situation a ssessment, one needs to accept that the method has certain limitations, like all other nutritional evaluation tools[239,356,357], such as:

- The food intakes are not always accurate, since some individuals may not remember exactly what they ate in exact amount specially in case of dietary recall method.
- Available food composition tables used to calculate food intake data may not always be accurate for the kinds of food eaten.
- Individual variations in nutrient requirements are not always reflected accurately when they are compared with recommended intakes of nutrients, since recommended intakes are more indicative of the needs of groups of people than individual need.
- Individuals or households have a tendency, to adapt to lower or higher intakes of nutrients through under reporting or over reporting depending on the socio-economic condition of the individuals or households.

The most commonly used dietary method is the 24 hours dietary recall method [356 - 362]. It is more accurate when food intake is obtained from the individual or the mother of a young child being studied by trained interviewer. Models or shapes of artificial foods, pictures of food, or examples of approximate amounts of food eaten are used in order to help the person being interviewed to estimate food intakes as accurately as possible.

A more precise, but also more expensive, method is food consumption by weighing method. It consists of weighing the food before preparation- cooking of the meal and/or before consumption, then weighing the waste and the 'left over' after the meal and subtracting that amount from the earlier total amount[361].

Physical and Biochemical Examination:

In a physical examination, evidences of nutritional deficiencies are often detected that are not found by food consumption studies and laboratory examinations. The laboratory methods used most often are those that measure the level of various nutrients and breakdown products in the blood and urine. Stools, urine and blood may also be examined for parasites, since undernutrition is frequently associated with the prevalence of parasite infestation[239, 360,361].

Anthropometry:

An often used and very important way of assessing the nutritional status of an individual is by measuring body growth and dimensions. This type of measurement is called anthropometry[239]. Anthropometry specially utilized in nutritional studies is a relatively recent research technique. Anthropometric data have become increasingly employed as indicators of nutritional status[363,364]. A number of specific measurements of growth have been shown to have a strong relationship to nutrient intake at various ages. Anthropometric methods are economical, safe, non-invasive and effective when used appropriately. Three main anthropometric measurements are mostly employed in community field surveys for protein-energy malnutrition in areas where ages are precisely known; these are height, weight and mid arm circumference[358,360,361,365]. Weight is the single most widely used measurement for the assessment of nutritional status due to its relative ease of measurement and the obvious relationship of weight to food intake, absorption and utilization[366].

Underweight not only indicates inadequate food intake, but it also reflects the recent illness, such as diarrhoea, measles, or other conditions that result in loss of weight-for-age as indicator of an acute food deficiency or a related problem when there is a sudden change in growth rate. The primary indicator of malnutrition (undernutrition) is low weight for age. Weight represents a composite measure of past and present nutritional experiences. However, diagnosis of malnutrition depends on the diagnosis of deficits in absolute weight, on the basis of comparison to expected weight for age and gender. Body weight represents the sum of protein, fat, water, bone mineral mass and does not provide any information on relative changes in the four chemical compounds. But alterations in the body weight may reflect a change in protein, water, minerals and/or body fat content[367].

Height is affected less immediately by diet than is true for weight-for-age. Therefore, low height-for-age usually indicates chronic food deficiency, but alone this measurement does not necessarily indicate that the present diet is inadequate. Low weight-for-height measurements often indicate recent inadequacy in food intake. Drastic food deficiencies are reflected in the degree of under-weight observed[239, 366].

The nutritional status of the people is estimated based on different classifications using heights and weights of the population. The first commonly accepted classification was developed by Gomez et al in 1956 using weight as a percentage of the median weight of North American children of same ages and it subsequently became the standard method of assessing malnutrition[368]. New classification using combinations of weight for height, height for age, and presence of oedema, were later proposed[369-372]. Presently reference standard developed by National Center for Health Statistics (NCHS) and later recognized by WHO, are being use to determine weight for age, weight for height, height for age[373].

It is always preferable to perform additional anthropometric measurements (e.g. mid arm circumference) to ascertain whether the change in body weight has occurred or not[367]. A wasting of body tissue due to a chronic dietary deficiency is indicated in reduced mid-arm circumference (MAC). The mid arm circumference has been used to assess muscle depletion, because of its accessibility, ease of measurement, quickness and less expensiveness. Researchers suggested that MAC, reflecting underlying bulk of muscle and fat, could be a simple index of protein-calorie malnutrition. It was considered that mid arm circumference would give an approximate composite picture of labile stores of energy (fat) and protein (muscle) and that the arm circumference would be diminished in lesser degrees of protein- energy malnutrition, reflecting both fat and muscle depletion [366, 374]. Measurement of the mid arm circumference alone remains as a simple measurement for nutritional screening but it can not differentiate between changes in fat and protein[361, 375-377]. Mid arm circumference to age is now being calculated using Jelliffe norms[360,361]. However, as simple as it is to use, applying MAC is not as accurate as interval weight and height measurements in relation to age.

1.3.26. Measurement of Height, Weight and Mid Arm Circumference:

Height Measurement:

Height is generally measured in the standing position using a stadiometer or portable anthropometer or specially made wooden height measuring scale. In the field, vertical surfaces are not always available. In such circumstances, modified tape measures such as

Microtoise, which measure up to two meters, can be used[378]. Clothing should be minimal when measuring height so that posture can be clearly seen. When measuring height, the subject should stand without shoes and socks keeping the head positioned in such a way that the frankfurt plan is horizontal, feet together, knees straight and heels, buttocks and shoulder blades and back of the head in contact with the vertical surface of the anthropometer. Arms should be hanging loosely at the sides of the body with palms facing the thighs. For younger subjects, it may be necessary to hold the heels to ensure that they do not leave the ground .Some investigators recommended applying gentle up-ward pressure to the mastoid processes to stretch the spine and minimize effects produced by diurnal variation[379]. Subjects are asked to take deep breath and stand erect and shoulders should be relaxed. The movable head piece is then gently lowered until it touches the crown of the head. The height measurement is then taken at maximum inspiration, with the examiner's eyes level with the head piece to avoid parallax errors and is recorded to the nearest 1 millimeter. If reading falls between two values, the lower reading is always recorded[378]. Successive measurements should agree within five millimeters[380-382]. In cases where large amounts of adipose tissue prevent the heels, buttocks and shoulder from simultaneously touching the vertical surface of the anthropometer, subjects should simply be asked to stand erect[383].

Weight Measurement:

The measurement of weight should preferably be done after the bladder has been emptied and before a meal. A beam balance where possible should be used. But beam balances are heavy and bulky and are not suitable for field use. In such cases, bath room scale or spring balance scale, although less accurate and reliable, are often used[360,361,384]. While measuring weight the balance should be placed on a hard flat surface and checked for zero balance before each measurement. The subject, wearing light clothing as much as possible and without shoes, should stand unassisted, in the centre of the platform and be asked to look straight ahead, standing relaxed. Body weight should be recorded to the nearest 0.1 kg [380,381]. The presence of oedema, if any, should also be recorded. The balance should be calibrated with a set of known weights regularly throughout the study period and whenever it is moved to another location.

Mid Arm Circumference (MAC) Measurement:

The arm contains subcutaneous fat and muscle; a decrease in mid arm circumference may, therefore, reflect either a reduction of muscle mass or a reduction in subcutaneous fat or both [360,361]. MAC measurement should be made using a flexible, non stretch tape made of fiber glass or steel or oil paper. While measuring MAC the subject should stand erect and sideways to the measurer, with the head in the frankfurt plane, arms relaxed and legs apart. Sleeves of the subject should be removed or rolled up. The measurement is taken at the mid point of the upper left arm, between the acromion process and the tip of the olecranon process [375-377]. After locating the mid point, the left arm is extended so that it is hanging loosely by the side, with the palm facing inwards. The tape is wrapped gently but firmly around the arm at the mid point, care should be taken to ensure that the arm is not squeezed. Measurements are taken to the nearest 1 millimeter. Precision of MAC measurements; both within and between examiners, can be high, even if the subjects are obese, when trained examiners are used[385].

Body Mass Index (BMI):

Nutritional status is also defined in terms of body mass index (BMI). The BMI or in other words, weight / height ratios are frequently used for adults and are employed in large scale nutrition surveys and epidemiological studies because measurements of weight and height are easy to collect , quick, relatively non- invasive & inexpensive, more precise and easy to analyze[226,386-388] . It is a simple but objective anthropometric indicator of the nutritional status of the adult population and seems to be closely related to their food consumption level. The BMI is highly correlated with weight and consistently independent of height, less biased by height and weight/height[386,387]. It has been shown that BMI correlates well with body fat[389] and shows highest correlation with independent measures of body fat[390]. It is one of the simplest ways of diagnosing CED[391-393] and the index of choice for epidemiological purpose.

Body Mass Index is calculated by dividing weight expressed in kilogram with minimal clothing by the square root of height expressed in meters without shoes (BMI= wt (kg)/ ht^2) and is used in adults with age-independent cut-offs to define overweight or thinness. It has also been used for older children and adolescents but it is not widely used for young children. Body mass index was originally proposed by Quetelet[394] in 1871. Many investigators consider Quetelet's index to be the best body mass index for most adult population groups, as it is the least biased by height and easily calculated[384,386,395,396]. Several investigators have proposed[396] the term 'Body Mass Index' (BMI) for Quetelet's index. Quetelet's index is not a valid index for those under twenty or over sixty five years of age, or for those who are pregnant or lactating[397]. The range of acceptable values for Quetelet's index varies among communities. In the survey of heights and weights of adults of Great Britain [384] values for Quetelet's index are:

< 20 graded as indicative of underweight,

> 25 indicative of over weight, and

> 30 as obese.

The population whether male or female, can be divided for degree of obesity as follows:

Gread	111 =	W / H^2	> 40
Gread	11 =	W / H^2	30 --- 40
Gread	1 =	W / H^2	25 ---29.9
Gread	0 =	W / H^2	20 --- 24.9

A simplified use of BMI in the classification of obesity involves normal values of 20 – 25, a range used for both men and women[363] which was subsequently adopted in a WHO Report (1990)[398].To identify chronic energy deficiency (CED) in adults, body mass index is usually classified into five categories:

BMI < 16.0	Grade 3 CED
BMI 16.0 – 16.99	Grade 2 CED
BMI 17.0 – 18.49	Grade 1 CED
BMI 18.5 – 24.99	Normal
BMI equal or greater than 25	Obese

The BMI less than 18.5 indicating under nutrition in adults, is also considered as an indicator of food insecurity in adults[221]. The BMI range of 20--24.9 classified as normal coincides well with the normal mortality ratio derived from life insurance Table[394]. According to WHO cut-off point of chronic energy deficiency is $W / H^2 \leq 18.5$ and standard BMI[399] for male is 22.1 and for female is 20.6. British Royal College of Physicians have chosen BBMI of 18.6 and 20.0 for women and men as their lower cut-off points[363].

However, each of the nutritional assessment tools complements with the other, thus assist in providing with different types of indicators that support comprehensive evaluation of nutritional status.

The above mentioned literature highlighted the relative importance of food security and nutritional knowledge relevant to assess and evaluate various steps towards household food security of the marginal farm households.

Farm population is the backbone of an agriculture based economy of the developing world. The above cited literature emphasized the need to study the household food security and nutritional status of marginal farmers of Bangladesh, which will uncover the long felt need to study such a neglected work force but economically important population section of the country.

1.4. OBJECTIVES

General Objective:

The aim of the study is to asses the household food security and nutritional status of the marginal farm households by appropriate household survey encanpssing food production, utilization, consumption, income, morbidity, sanitation and anthropometry with seasonal variations. The goal of the study is also to suggest appropriate couping measures, considering the the factors associated with household food security, to increase food production for increasing household food security and thereby food intake of all marginal farm household members towards the ultimate goal of nutritional improvement.

Specific Objectives:

1. To find out household food availability and food security of the marginal farm households through -
   a) household production of various kinds of food and cash crops from crop land and from homestead and farm income (value) from farm production at harvest price / present market price.
   b) household income from secondary occupation of the family members and non-farm income from other sources.
   c) household gross expenditure, expenditure on food and expenditure on food other than food consumed from household production.
   d) per capita food and nutrient intake by different food groups and by age and sex groups.
2. To assess the nutritional status of the marginal farm household members through anthropometric measurements and clinical examination.
3. To find out socio – economic status and health care facilities of the marginal farm households and immunization, sanitation, mortality, and morbidity and to find out interrelationship between food & nutrient intake and socio-economic variables.
4. To find out the seasonal variation in food intake as well as nutritional status.
5. To list the causes of food unavailability and food insecurity.
6. To recommend possible measures to improve food security of marginal farm households.

1.5. HYPOTHESIS:

- Food insecurity exists in marginal farm households of Bangladesh ,
- Low food intake in marginal farm households is a reflection of food insecurity,
- Poor nutritional status of the members of the marginal farm households are the reflection of low food and nutrient intake due to food insecurity ,
- Low household income aggravates food insecurity and nutritional status,
- Modern farming practice and interest-free loan for adopting income generating activities (IGA) may improve food security of the marginal farmers.

CHAPTER – TWO

MATERIALS AND METHODS

MATERIALS AND METHODS

2.1. Study population:

Marginal farm households of Bangladesh constituted the study population. The farm households having 05 to 100 decimal of operated (cultivated) land including homestead gardening are considered in this study as marginal farm households[41,46,47]. The households cultivating less than 05 decimal of land are termed as non-farm landless families and households having 05 to 249 decimal of cultivated land are recognized as small farm households[46]. But in Agriculture Economics, a book for Krishi Diploma course, published by Bangladesh Technical Education Board and Department of Agriculture Extension, it has been stated that farm families having 01 to 100 decimal of land holding are categorized as marginal farm households[47] and in Agricultural Extension Manual it has been stated that farm households having 05 to 50 decimal of land are termed as marginal farmers[400]. For practical consideration and convenience between 05 and 100 decimal of cultivated land, regardless of whether the household owned, or leased or cultivating on share - cropping a part or the whole of the cultivated land, were taken as cut-off point for distinguishing marginal farm households..

2.2. Sampling:

From dietary and nutritional points of view a household was regarded as a suitable sampling unit. For financial and time constraints as well as for in depth study, a sample of 200 marginal farm households were considered as reasonable. About 20 per cent households are marginal and on an average there are 250 households in a village, therefore, 50 target households would be available in a village. Considering these points, 200 households, 50 from each of the four selected villages, were selected. The equation used for the sample size determination is as follows:

$n=Z^2\ PQ / d^2 = 196$ for

$z=1.96$ (95% confidence level of z)

$d=0.05$ (margin of error)

$p=0.15$ (proportion)

$q=0.85$ (l-p)

Hence, for this study the sample size was taken 200.

Before selection of the sample a frame of marginal farmers (cultivating land between 05 and 100 decilals) for each selected village was prepared. The following information of all the marginal farm households in the village was collected:

1. Occupation of the household head (who must be a farmer),
2. Own land cultivation by the owner,
3. Leased land cultivated by the household,
4. Land cultivated by household on share cropping basis.

Then a Sample of 50 households was randomly drawn. For four villages the total sample was 200 households. But for missing or refusal cases number of study households were later increased to 216.

2.3. Study locations:

The study was carried out in randomly selected four villages one each from four original administrative divisions of Bangladesh. For each division, 5 stage sampling design was used. District was first stage, Thana was second stage, Union was third stage, Village was fourth stage and Household was ultimate sampling unit. In the first through fourth stages, one unit was drawn i.e. one district, onc upazilla, one union and one village was drawn using random sampling scheme. List of unions and villages were obtained from the available census schedule. It is to be mentioned that the name of the thanas were listed excluding those thanas where Bangladesh Integrated Nutrition Programme (BINP), Helen Keller International (HKI) and World Food Programme (WFP) assisted nutritional development programmes were then running. In this way, the following four villages from four divisions were selected:

a. Dhonakusha, Nokla upazilla, Sherpur, Dhaka.

b. South Selunia, Laksham upazilla , Comilla , Chittagong .

c. West Salta, Uzirpur upazilla , Barisal , Khulna.

d. Bashuria, Raigonj upazilla , Serajgonj , Rajshahi .

2.4: Instrument of the study:

The main instrument of the study was a set of structured questionnaires, such as:

(A) Village Description Form,

(B) Dietary Form including Intrafamily Food Consumption From,

(C) Socio-economic Form.

(D) Anthrometric and Clinical Form, and

The variables included in these questionnaires were as follows:

i) General information of the village including demographic information; main occupation; education level, health, market, transport facilities; market price rate; wage rate; cropping pattern and intensity; irrigation facilities and other agricultural information.

ii) General information of the studied household.

iii) Land holding, land under cultivation, household food production from cultivated land as well as from homestead gardening including poultry, cattle and fish culture etc.

iv) Income from primary and secondary (subsidiary) occupation and other sources such as gift, remittance, loan etc. Household expenditure, expenditure for food and expenditure for food production etc.

v) Household food intake as well as intra-family food consumption by the individual member of the family by past 24 hours recall method and food preference among the family members.

vi) Anthropometric measurements such as height, weight and mid arm circumference (MAC) to assess nutritional status of the individuals and clinical examinations such as sign and symptom of nutritional deficiency diseases, morbidity and mortality pattern, immunization and vitamine A distribution coverage, diarrhoeal disease episodes and treatment etc for assessing health status.

vii) Housing condition, sources of water, sanitation, disposal of human excreta and environmental cleanliness etc.

2.4.1: Pre - testing and finalization of the questionaries:

The above mentioned set of 5 questionaries was developed following a series of consultation meeting with the experts in this line. The prepared questionnaires were pre-tested for consecutive three days in a village at Sonargoan near Dhaka. During pretesting some lapses were detected and the questionaries were finalized through modifications as needed. After finalization the questionnaires were printed for conducting the study.

2.5. Methods:

Representative sample households were used to assess the food security status and food & nutrient intake as well as nutritional status of the members of marginal farm households of Bangladesh. Various interrelated and influencing factors such as, household food production & utilization, food availability for household consumption, dietary intake, anthropometric, clinical and socio-economic factors were taken into consideration. Methodology adopted to obtain the set objectives is briefly presented below:

Objectives		Data source and methods
i.	Household food security in respect of food production & utilization, food availability for consumption , and household income	Interview of the marginal farm household heads by structured questionnaire.
ii.	Nutrition situation in respect of household and intra-family food consumption by age, sex with seasonal variation.	Dietary survey by 24 hours recall method and partly weighing method.
iii.	Nutritional and health status i.e. Anthropometric and Clinical situations.	Anthropometric measurements of Height, Weight, MAC and Clinical examination.
iv.	Socio-economic and sanitation aspects.	Interview of household heads / housewives.

2.5.1: Study Design:

For collection of relevant data survey method was employed. In order to capture the seasonal variation it was planned to repeat the survey four times in all of the 4 villages. First and third round surveys were conducted during lean period (pre-harvest) while second and fourth round surveys were conducted during abundant period (post harvest) as follows:

First round survey: March - April '98 (Falgun and Baishakh) (Before Boro harvest)
Second round survey: June - July '98 (Jaistha-Sraban) (After Boro & Aus harvest)
Third round survey: October - November'98 (Ashin-Kartic) (Before Aman harvest)
Fourth round survey: January - February '99 (Poush-Magh) (After Aman harvest)

2.5.2: Data collection:

Before starting the survsey, the researcher visited the 4 selected villages in order to select the sample marginal farm households following the set criteria and procedure already mentioned. During the preliminary visit the local government officials, local leaders, teachers, imams and other influential persons were contacted and sought their help and cooperation and other logistic support to the researcher during the stay of the survey team in the field for data collection. In each round, the survey was conducted for ten (10) consecutive days in all locations. The researcher along with the team stationed in the respective village during the whole period of data collection.

Dietary Data Collection:

The researcher collected food consumption data with the help of two trained women interviewers by 24 hours recall method[356-361] from each of the sample households for three consecutive days----day before yesterday (1st day), yesterday (2nd day) and the day of visit (3rd day). But on the visiting day, in most cases, the raw food items were directly weighed before cooking for the whole day. Intra-family food consumption was recorded by 24 hours recall method only. For dietary estimation standardized kitchen scale, measuring pots, plates, spoons, cups etc. were used. In recording the household food consumption, left-over food from the previous day, if any, cooked food left over for the coming day and cooked food coming from and given to other households were carefully taken into consideration and recorded. Food consumed either cooked or uncooked by the individual members of the households were recorded in the corresponding individual intra-family food distribution form. Of course, intra-family food consumption was recorded only for the 3rd day i.e. on the day of visit. At least five households were covered by dietary survey in a day. Thus during four rounds of survey, household food consumption for 12 days and individual food intake for 4 days were recorded.

Anthropometric Measurements:

Anthropometric measurements such as height, weight and mid arm circumference (MAC) were recorded by the researcher with the help of a trained peramedic and a field assistant. For anthropometric measurements, specially made height scale, bathroom scale, salter spring balance, and MAC measuring tape were used.

Height Measurement:

Height was obtained by a specially made height measuring scale, a wooded flat frame placed on a platform with a sliding head piece, measured in standing position with light clothing and without shoes[360,361]. While measuring height, the subjects were asked to stand erectly with the head positioned in such a way that the frankfurt plan was horizontal, feet together, knees straight and heels, buttocks and shoulder blades and back of the head in contact with the vertical surface of the wooden scale. Arms were hanging loosely at the sides of the body with palms facing the thighs and shoulders relaxed. The movable head piece was then gently lowered until it touched the crown of the head. The height measurement was then taken at eye's level with the head piece to avoid parallex errors and was recorded to the nearest 1 mm[378]. In case of children under two years of age length was measured in laying position while the height of others were taken in standing position

Weight Measurement: One Salter weighing scale, standardized everyday with known weights, was used to measure the weights of under two years old children. While taking the weights of other children and adults a bathroom scale, standardized frequently, was used. While measuring weight the balance was placed on a hard flat surface and checked for zero balance before each measurement. The subjects were asked to stand unasisted, in the centre of the platform and were asked to look straight ahead, standing relaxed and wearing light clothings. In most cases the weight measurements were done after the bladder has been emptied and before a meal. Body weight was thus recorded to the nearest 0.1 kg [360,361,380,381].

Mid Arm Circumference (MAC) Measurement: For measuring mid arm circumference Teaching Aids at Low Cost (TALC) produced flexible tape, made of glass paper, was used. While measuring MAC the subject was asked to stand erect, with the head in the frankfurt plane, arms relaxed and legs apart. Sleeves of the subject was removed or rolledup. The measurement was taken at the mid point of the upper left arm, between the acromion process and the tip of the olecranon process[375-377]. After locating the mid point, the left arm was extended so that it was hanging loosely by the side, with the palm facing inwards. The tape was then wrapped gently but firmly around the arm at the mid point and measurements were taken to the nearest 1 mm.

All these measurements were made by house to house visit and the measurements were recorded in the anthropometric and clinical form. Nutritional deficiency symptoms were also recorded in the same form together with morbidity pattern, immunization and vitamin A distribution coverage. To minimize non-response and to cover all the individual members of the sample households by anthropometry repeated visits were made to the same households even before sun-rise and night fall.

Socio – economic Data Collection:

Socio-economic information was collected through interview of the household head and was recorded in the socio-economic form. Since food production in a household is considered as a measure of household food security, we have tried to collect the total amount of different food crops produced in the study households round the year from cultivated farm land and homestead was recorded. In each round, food produced during previous three months was recorded and hence production data collected during first, second, third and fourth rounds stand for the months of January - March, April - June, July - September and October - December respectively. Besides, utilization of household produces, household income by source, household expenditure on different heads of expenditure, specially on food, were also recorded. The researcher also collected general information of the study villages through focal group discussion (FGD). Wage rate, prices of different food commodities were also collected and recorded by visiting local markets.

The researcher himself carried out all the data collection activities with the help of the mentioned trained field assistants and interviewers under the guidance of the supervisors. During data collection the researcher undertook frequent visit to the sample farm households randomly to cross check the data already collected through cross interview of the respondents. In case of any wrong information from any household was detected, the respective interviewer was asked and sent to that household to correct the wrong information. Besides, every day at night filled up questionnaires were checked and rechecked to find out any lacking regarding information. In this way the quality of data was maintained.

However, during March '98 to February '99 four round surveys were completed in all the villages. Of course, due to devasting flood during 1998, third and fourth round survey were conducted one month later than the scheduled date.

2.6: Data Management:

Calculation of dietary intakes by individual member was done very carefully. All the cooked food items consumed were converted into raw weight of edible portion according to conversion factors for specific cooked food items developed by the Institute of nutrition and food Science, university of Dhaka[401]. Dietary calculation of all the households / individuals intakes were checked, rechecked and edited on a regular basis. After completion of dietary calculation, checking and editing coding was done with specific code number for a specific food item followed by checking and then all the data were computed.

2.7: Data Analysis:

After cleaning the computed data, analysis plan was developed and accordingly analysis was done by an experienced programmer cum system analyst. Analysis was done by using SPSS software package, FORTRAN, EPI info and Harvard Graphics.

2.7. 1: Dietary Data Analysis:

Members of Bangladeshi households have different traditions in eating meals. Food consumed in 24 hours may be eaten either by a single meal or two or three or more than three meals depending on the accibility and supply of foods in the households. So, total food consumed in a day by an individual member irrespective of frequency of meals is considerd one consumption unit. By aggregating consumption units of all individual family members food consumption unit of the household is determind by which total household food consumtion is divided to obtain per capita food and nutritient intake per day. The same procedure of estimating consumption units was followed in this study. Mean food intake was estimated by averaging 12 day's (3 days in each time for four rounds) total household food intake and individual intake was also estimated by averaging four day's (one i.e. third day in each time for four rounds) intra-family food consumption records.

The FORTRAN software was used to calculate nutrient values and pattern of dietary intake from individual food intake. Nutritive values of Bangladeshi common foods were used to calculate the nutritive intakes[402]. Ofcourse, due to the absence of an appropriate upto date food composition table for various food items available in Bangladesh we have also used the Indian Food Composition Table for estimating nutrients intake[403].

2.7.2: Anthropometric Data Analysis:

For estimating nutritional status of the study population the anthropometric data were calculated and analyzed according to standard deviation scores (Z-score) classification using NCHS reference standard for height-for-age, weight-for-age and weight-forheight and as percentage of reference median of these indicators[373]. The obtained scores for children according to anthropometric indices found to be - 2SD or below the reference median we have classified them as malnourished. We have also used Gomez and Waterlow classification for convenience to compare with earlier findings.The Anthro software package were used in this regard. The following cut-off levels were used to categorise different forms of malnutrition:

Weight-for-age Z-score (WAZ):

WAZ = Less than or equel to -3SD : Severely underweight

WAZ = -2 SD to -2.99 SD : Moderately underweight

WAZ = Greater than -2 SD : Not underweight

Height-for-age Z-score (HAZ):

HAZ = Less than or equel to -3SD : Severely stunted

HAZ = -2 SD to -2.99 SD : Moderately stunted

HAZ = Greater than -2 SD : Not stunted

Weight-for-height Z-score (WHZ):

WHZ = Less than or equel to -3SD : Severely wasted

WHZ = -2 SD to -2.99 SD : Moderately wasted

WHZ = Greater than - 2 SD & less than + 2 SD : Normal

WHZ = Greater than + 2 SD & less than + 3 SD : Over-weight

WHZ = Greater than or equal to + 3 SD : Obese

Calculation of Z-score:

$$\text{Stunting (HFAZ)} = \frac{\text{Obserbed height at age X} - \text{Standard height at age X}}{\text{Standard deviation at age X}}$$

$$\text{Wasting (WFHZ)} = \frac{\text{Obserbed height at age X} - \text{Standard height at age X}}{\text{Standard deviation at age X}}$$

$$\text{Underweight (WFAZ)} = \frac{\text{Obserbed height at age X} - \text{Standard height at age X}}{\text{Standard deviation at age X}}$$

Gomez Classification:

Normal : $\geq$ 90% of reference median WFA

First degree or mild malnutrition : 89.99 to 75% of reference median WFA

Second degree or moderate malnutrition : 74.99 to 60% of reference median WFA

Third degree or severe malnutrition : <60% of reference median WFA

Mid Arm Circumference (MAC):

Mid arm circumference to age was calculated using Jelliffe norms. We have taken 12.5 cm as the cut-off point of MAC to distinguish severe malnourished children and children with MAC $\geq$ 13.5 cm were considered as normal, while MAC between 13.4 and 12.5 cm were classified as moderately malnourished and less than 11.0 cm as very sever malnourished as advocated in the BBS Child Nutrition Survey, 1992)[266].

Socio-economic data and clinical information were analyzed by using SPSS softwere package.However, after analysis the results were presented in figures and in tabular form on the basis of frequency distribution. Appropriate statistical tests were done wherever necessary. Correletion-coefficient, F- test and multiple regression were done as necessary.

CHAPTER – THREE

RESULTS

RESULTS

3.1. Socio-demographic Pattern of the Marginal Farm Households:

In 216 marginal farm households we studied 1078 people of all ages and sexes from four selected villages of Bangladesh. Among the study population 52.3 per cent were male and the rests 47.7 per cent were female. And 38.3, 1.1 and 8.3 per cent were non-pregnant and non-lactating (NPNL), pregnant and lactating women respectively (Fig 3.1.1).

Age composition of the study population shows that 30.6 per cent were children including 19.7 per cent upto 0-71 months and 10.9 per cent upto 9 years, 43.4 per cent were adults and 4.2 per cent people were of 60 years and above. The adolescent population (up to 18 years) was 21.8 per cent. Working population between 19 and 59 years of age was 43.4 per cent (Fig 3.1.2). Mean family size was 5. Among the study population, 85.6 per cent were Muslims and only 14.4 per cent were Hindus (Fig 3.1.3).

Table 3.1.1 shows that 54.4 per cent members were unmarried, while 42.4 per cent were married. Thirty one and two women were widows and divorced respectively and two were found living alone being left away by their husbands.

Education level of household members excluding under six years children showed that 54.6 per cent were illiterate including another 17.0 per cent who can put signature only. Some 34.5, 9.1 and 1.6 per cent of the population had primary, secondary and S S C level of education. There were only two marginal farmers in Laksham upazilla who had education up to higher secondary level. Excluding under- 6 years old children the literacy rate was 62.4 per cent (Table 3.1.2). Illiteracy rate was highest in Nokla (55.6%) and lowest in Laksham (26.8%). On the other hand, the proportion of primary to S S C level educated person were more in Laksham (58.1%), while that was very low in Nokla (2.6 per cent).

Table–3.1.3 shows that 219 members (20.3%) of the marginal farm households were cultivators of whom 216 were household heads as against about one fourth (24.1%) were either housewives or engaged in household activities. Among the cultivators 8.6 per cent were cultivating their own land only, 11.7% cultivating own land plus other's land on share-cropping basis. About one fourth (24.7%) of the population had no occupation as they were children under six years of age or elderly people or disabled or retired persons. Some 20.7, 5.6 and 2.4 per cent were students, labours including 3.9 % agricultural / day labours, and service holders respectively.

Figure 3.1.1: Distribution of study population by sex

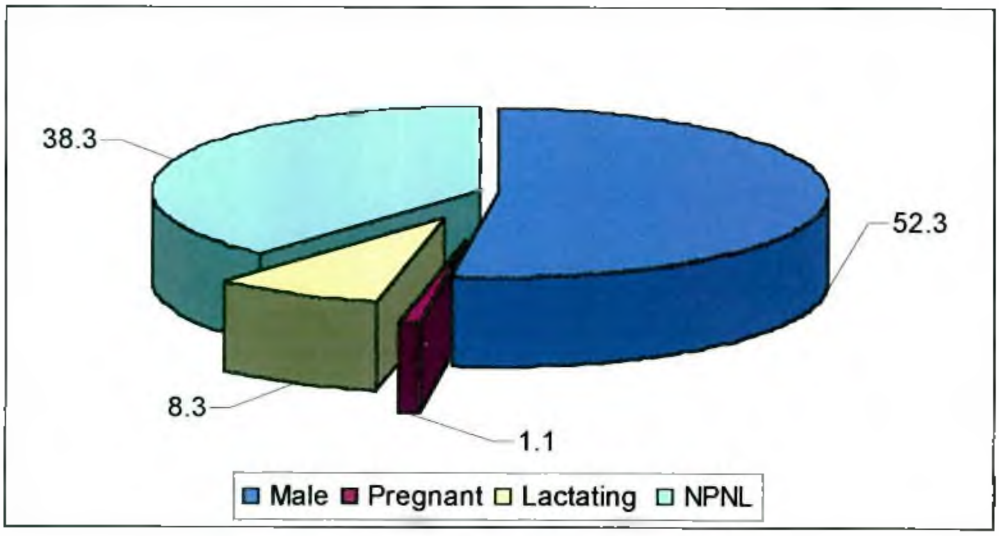


Figure 3.1.2: Distribution of population by age group

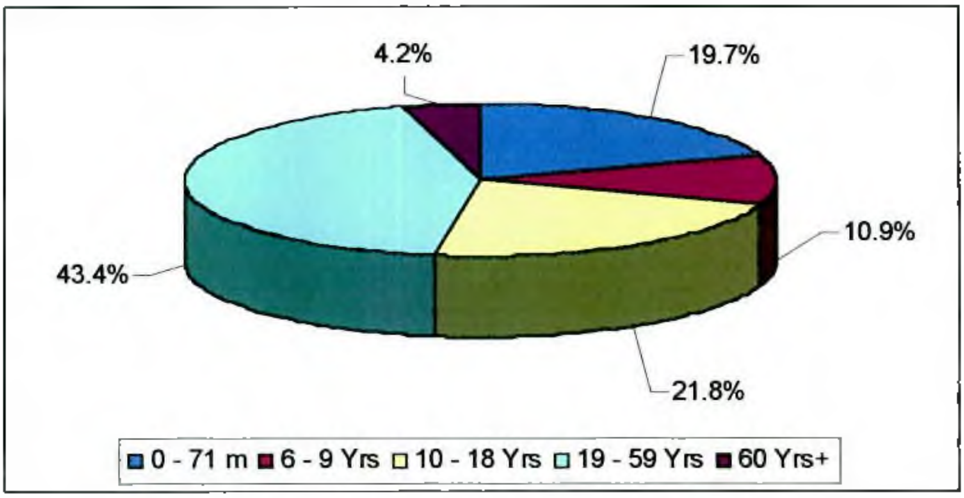


Figure 3.1.3: Distribution of the study population by religion

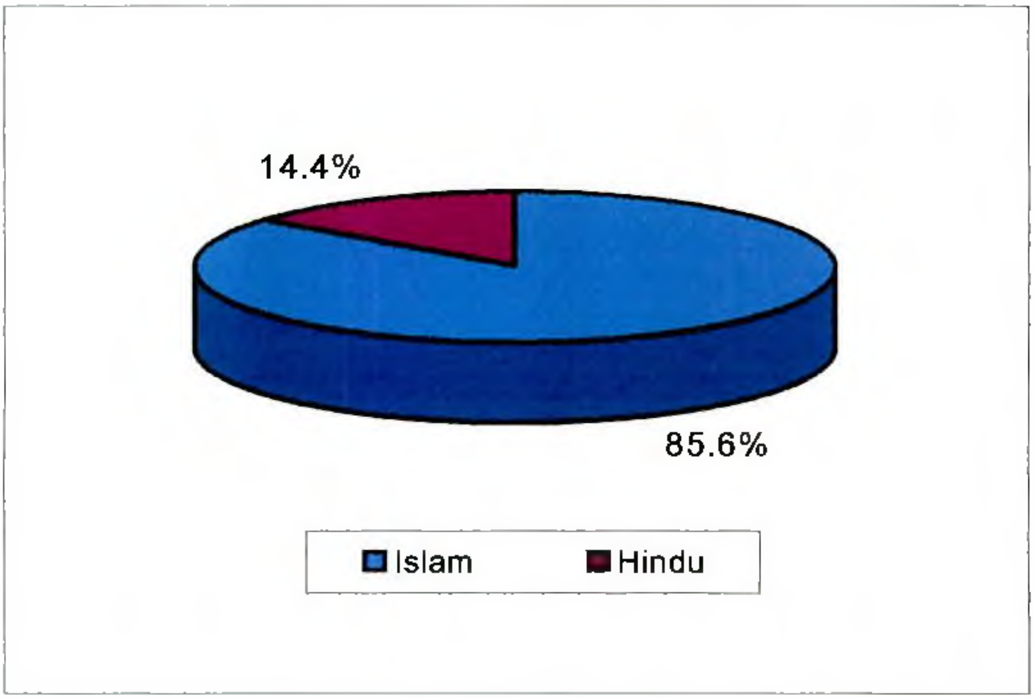


Table 3.1.1: Distribution of study population by marital status

Marital status	No. of population	Percentage
Unmarried	586	54.3
Married	457	42.4
Widows	31	2.9
Divorced	2	0.2
Separated	2	0.2
Total	1078	100.0

Table 3.1.2: Distribution of study population aged more than 6 years, by level of education and by location

Education Level	Location									
	Nokla		Laksham		Uzirpur		Raigonj		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Illiterate	105	55.6	62	26.8	78	34.5	82	36.6	327	37.6
Can sign only	41	21.7	33	14.3	47	20.8	27	12.1	148	17.0
Class I-V	38	20.1	96	41.6	78	34.5	88	39.3	300	34.5
Class VI-X	4	2.1	35	15.2	19	8.4	21	9.4	79	9.1
S S C Passed	1	0.5	3	1.3	4	1.8	6	2.7	14	1.6
H S C Passed	0	0.0	2	0.9	0	0.0	0	0.0	2	0.2
Total population	189		231		226		224		870	

Literacy Rate: 62.4 %

Table 3.1.3: Distribution of marginal farm household members by occupation

Occupation	Number	Percentage	Cumulative %
Cultivator (cultivated own land only)	93	8.6	8.6
Cultivator (own land plus share cultivation)	126	11.7	20.3
Agriculture / Day Labourer	42	3.9	24.2
Other Labours (Industrial /Cosntruction /Transport /Blacksmith /Carpenter /Hhousehold servants etc).	18	1.7	25.9
Rickshaw / Van puller / Boatman	6	0.6	26.5
Small shop keepers / Hawker / Grocer	9	0.8	27.3
Service holder	26	2.4	29.7
Students	223	20.7	50.4
Housewife / Household activities	260	24.1	74.5
Unemployed (No work)	9	0.8	75.3
Others (<6 years / elderly / disabled and retired persons)	266	24.7	100.0
All	1078	100.0	100.0

3.2: Food Security Status of the Marginal Farm Households:

Food security of the marginal farm households was analysed from different point of views such as household food production;sources of food supply; utilization of produced food from cultivated land and homestead; expected level of food security from production if sold and if not sold; level of staple food purchased during last year; seasons of food scarcity faced by the households and food and nutrient intake pattern. The results are presented in the following sub-headings a, b, c & d.

3.2a. Food Production by the Marginal Farm Households:

Table 3.2.1 presents the mean annual food production by the marginal farmers from cultivated farm land and homestead by food items. It shows that a total of 1193.8 kg of all food items were produced per household annually, of which 971.1 kg and 222.7 kg were produced from cultivated farm land and homestead respectively. About 81 per cent of total production was obtained from cultivated farm land where as 18.7 per cent was obtained from homestead. Out of total food production 837.8kg of rice, 5.4 kg of wheat, 28.3 kg of potato and 48.0 kg of oil seeds were produced from cultivated farm land, while 50.3 kg of milk, 3.3 kg of egg and 23.7 kg of fish were produced in the homestead respectively. And 32.6 kg of leafy vegetables, 114.6 kg of non-leafy vegetables and 38.2 kg of fruits were produced from both cultivated farm land and homestead. Per capita annual food production was 238.8 kg, of which 167.6, 22.8, 9.6, 7.6, 6.5 and 5.7 kg were rice, non-leafy vegetables, oil seeds, fruits, leafy vegetables and potato respectively. Per capita annual production of milk, fish and egg were 10.1, 4.7 and 0.7 kg respectively.

Food production in the marginal farm households during different seasons (rounds), presented in Table 3.2.2, shows that highest production of food from cultivated farm land (626.7 kg) was obtained in the second round during June-July and the lowest production (58.5 kg) in the third round during October-November which was the lean period with only some aus paddy production.The highest rice production (616.7kg) was obtained during June-July (second round) which was the period of boro paddy production, while lowest production (6.5kg) was obtained in first round during March-April. Potato (24.8kg) and oil seeds (28.7kg) productions were the highest during first round in March-

April, while leafy (10.6kg) and non-leafy (18.0kg) vegetables productions were the highest in fourth round during October-November indicating seasonal variation in food production. On the other hand, in the homestead highest and equal amount of all foods (66.7 kg) were produced in second and third rounds during June-July and October-November, while lowest amount (35.5 kg) was produced in fourth round during January-February. In the homestead, highest production of leafy vegetables (6.5 kg) was obtained during lean period in October-November (3rd round), while highest non-leafy vegetables (32.1 kg) was produced in the first round during March-April. Highest production of fruits (24.5 kg), milk (14.8 kg) and fish (10.8 kg) were obtained during June-July (2nd round), while that was lowest in fourth round during January-February respectively.

Table 3.2.3 shows the distribution of marginal farm households by amount of annual food production from cultivated farm land as well as from homestead. It was found that annual food production of about 49 per cent households was less than 300 kg, as against in 21.3 per cent households annual production was 1000 kg & above. Annual production of <300 kg from cultivated fram land was obtained by only 18.1 per cent households, while that from homestead was produced by 77.7 per cent marginal farmers. On the other hand, annual production of 1000 kg & above from cultivated land was produced by 39.8 per cent households, while only 2.8 per cent households produced this amount of food from homestead.

Pattern of different kinds of vegetables cultivation, fruit trees plantation and rearing of domestic animals in the homestead are considered as the indicator of future food security of the households. Only a small proportion of the marginal farm households were found to cultivate various kinds of leafy and non-leafy vegetables in the fellow land of their homestead as well as in the kitchen gardens (Table 3.2.4). Leafy vegetables like - data sak, kachu sak, lal sak and pui sak were cultivated by 27.0, 15.2, 11.2 and 11.2 per cent households respectively, while about 52 per cent of the households were found to cultivate sweet pumpkin and broad beans (seam) in their homestead. Among other non-leafy vegetables gourd, water pumpkin, brinjal, chichingha, sajna and korolla were cultivated by 34.3, 38.2, 13.5, 20.8, 11.2 and 7.9 per cent of the marginal farm households respectively.

In respect of fruit trees plantation in the homestead, more than 90 per cent of the marginal farmers did not have planted fruit trees like- lichi, amloki, jalpai, amra, jambura, kamranga, black berry, lemon, banana etc in their homestead. On the other hand, about 35, 32, 21, 18 and 12 per cent households were found to have planted varied number of mango, jack-fruit, coconut, guava and papaya trees permanently in their homestead (Table 3.2.5).

Regarding animal food production by the marginal farmers Table 3.2.6 shows that about 54 and 80 per cent of the households did not have domestic animals like cow and goat respectively, as against about 85 per cent households had poultry like - hen / cock / duck etc in different numbers ranging from 2 to 11 & above. In 27 households there were milky cows and five households were found to rear peagons ranging from 1 to 10 in number.

Table 3.2.1: Annual food production by the marginal farmers from cultivated farm land and homestead (Kg)

Food Items	Annual Production (kg)			Per capita Annual Food Production
	From Cultivated land	From Homestead	Total Annual Production	
Rice (Paddy)	837.8	-	837.8	167.6
Wheat	5.4	-	5.4	1.1
Pulses	1.7	-	1.7	0.3
Potato	28.3	-	28.3	5.7
Oil Seeds	48.0	-	48.0	9.6
Leafy vegetables	16.5	16.1	32.6	6.5
Non-leafy vegetables	30.4	83.7	114.1	22.8
Fruits	3.0	35.2	38.2	7.6
Milk	-	50.3	50.3	10.1
Egg	-	3.3	3.3	0.7
Fish	-	23.7	23.7	4.7
Other foods	-	10.4	10.4	2.1
All Food Crops	971.1	222.7	1193.8	238.8
% of total production	81.3	18.7	100.0	

Table 3.2.2: Food production by the marginal farmers from cultivated land and homestead by seasons

Food Items	Cultivated land				Homestead				Total annual productin
	1 R* Mar.-Apr.	2 R* Jun.-Jul.	3 R* Oct.-Nov.	4 R* Jan.-Feb.	1 R Mar.-Apr.	2 R Jun.-Jul.	3 R Oct.-Nov.	4 R Jan.-Feb.	
Rice (Paddy)	6.5	616.7	51.0	163.6	-	-	-	-	837.8
Wheat	3.5	1.9	0.0	0.0	-	-	-	-	5.4
Pulses	1.6	0.1	0.0	0.0	-	-	-	-	1.7
Potato	24.8	2.1	0.0	1.4	-	-	-	-	28.3
Oil Seeds	28.7	0.4	0.0	18.9	-	-	-	-	48.0
Leafy vegetables	4.0	0.5	1.4	10.6	0.3	3.3	6.5	6.0	32.6
Non-leafy vegetable	1.4	5.0	6.0	18.0	32.1	12.4	24.8	14.4	114.1
Fruits	1.0	0.0	0.1	1.9	4.2	24.5	6.4	0.1	38.2
Milk	-	-	-	-	11.8	14.8	12.6	11.1	50.3
Egg	-	-	-	-	1.1	0.9	0.6	0.7	3.3
Fish	-	-	-	-	4.1	10.8	5.6	3.2	23.7
Other foods	-	-	-	-	0.2	0.0	10.2	0.0	10.4
Total	71.5	626.7	58.5	214.4	53.8	66.7	66.7	35.4	1193.8

* (1R = First round, 2R = Second round, 3R = Third round, 4R = Fourth round)

Table 3.2.3: Distribution of marginal farm households by annual food production from cultivated farm land and homestead

Annual Food Production (kg)	Cultivated land		Homestead		Total	
	No. of Households	Percentage	No. of Households	Percentage	No. of Households	Percentage
< 300	39	18.1	168	77.7	104	48.9
300 - 499	28	13.0	24	11.1	26	12.0
500-749	37	17.1	12	5.6	24	11.1
750-999	26	12.0	6	2.8	16	7.4
1000 +	86	39.8	6	2.8	46	21.3
Total	216	100.0	216	100.0	216	100.0

(Mean annual household food production=1193.8 kg; Per capita annual food production=238.8 kg)

Table 3.2.4: Distribution of marginal farm households by homestead vegetable cultivation

Name of Vegetables	No. of Households	Percentage
Lal Sak	20	11.2
Pui Sak	20	11.2
Data Sak	48	27.0
Kalmi Sak	2	1.1
Mula Sak	3	1.7
Kachu Sak	27	15.2
Sajna	20	11.2
Sweet Pumpkin	93	52.2
Gourd	61	34.3
Water Pumkin	68	38.2
Broad Beans (Seam)	92	51.7
Brinjal	24	13.5
Korolla	14	7.9
Tomato	5	2.8
Chichinga	37	20.8
Others	33	18.5

Table 3.2.5: Distribution of marginal farm households by number of different types of fruit trees planted in the homestead

Name of Fruit-giving Trees	No. of Fruit Trees planted in the homestead									
	None		Up to 2		3 – 5		6 & above		Total	
	No. of H/Hs	%	No. of H/Hs	%	No. of H/Hs	%	No. of H/Hs	%	No. of H/Hs	%
Mango	141	65.2	52	24.1	17	7.9	6	2.8	216	100.0
Jack-Fruit	148	68.5	51	23.6	14	6.5	3	1.4	216	100.0
Black Berry	201	93.0	14	6.5	1	0.5	0	0.0	216	100.0
Lichi	215	99.5	1	0.5	0	0.0	0	0.0	216	100.0
Kamranga	204	94.4	12	5.6	0	0.0	0	0.0	216	100.0
Coconut	170	78.7	39	18.1	5	2.3	2	0.9	216	100.0
Banana	196	90.7	8	3.7	4	1.9	8	3.7	216	100.0
Amlaki	214	99.1	2	0.9	0	0.0	0	0.0	216	100.0
Guava	177	81.9	36	16.7	1	0.5	2	0.9	216	100.0
Jalpai	210	97.2	5	2.3	1	0.5	0	0.0	216	100.0
Lemon	200	92.5	12	5.6	4	1.9	0	0.0	216	100.0
Jambura	205	94.9	11	5.1	0	0.0	0	0.0	216	100.0
Papaya	190	87.9	21	9.7	4	1.9	1	0.5	216	100.0
Amra(Woodapple)	208	96.2	6	2.8	1	0.5	1	0.5	216	100.0
Others	196	90.7	19	8.8	1	0.5	0	0.0	216	100.0

Table 3.2.6: Distribution of marginal farm households by number of domestic animals/poultry

Type of Domestic Animals /Poultry	No. of Animals /Poultry											
	None		Up to 2		3 – 5		6 – 10		11 & above		Total	
	No. of H/Hs	%	No. of H/Hs	%	No. of H/Hs	%	No. of H/Hs	%	No. of H/Hs	%	No. of H/Hs	%
Total Cow	116	53.7	84	38.9	15	6.9	1	0.5	-	-	216	100.0
Total Goat	173	80.1	32	14.8	10	4.6	1	0.5	-	-	216	100.0
Total Poultry *	33	15.3	48	22.2	46	21.3	56	25.9	33	15.3	216	100.0
Milky Cow	189	87.5	26	12.0	1	0.5	-	-	-	-	216	100.0
Milky Goat	214	99.1	2	0.9	-	-	-	-	-	-	216	100.0
Peagon	211	97.7	1	0.5	2	0.9	2	0.9	-	-	216	100.0

(* Hen + Cock + Duck)

3.2b. Food Availablity in the Marginal Farm Households:

Figure 3.2.1 shows the distribution of households by sources of food supply. It appears that 97.7 per cent households usually obtained their food supply from both household production in the cultivated farm land and homestead as well as by purchasing from market. Only 3 and 2 households respectively reported that household food production and purchasing from market was the only source of their food supply round the year.

Table-3.2.7 presents the utilization of produced food from cultivated farm land. It was found that 402.8 kg (41.5%) out of 971.1 kg total food produced from cultivated farm land was consumed by the household members, while 52.1 per cent (506.2 kg) were sold. Only 2.4 per cent was utilized as seeds or for plantation. About 46 and 47 per cent of total rice production was utilized for household consumption and for sale respectively. Some 48.1, 64.7 and 62.9 per cent of produced wheat, pulses and potato were also found to be sold respectively. About 95 per cent of oil seeds, while 90 per cent of vegetables were utilized for sale, whereas only 1.3 and 4.1 kg respectively were consumed.

Utilazation of foods produced in the homestead showed that more than 55 per cent (123.4 kg) were utilized for household consumption, as against 43.1per cent (96.0 kg) were utilized for sale (Table-3.2.8). About 88 per cent (14.1 kg) of leafy vegetables, while 67.6 per cent (56.6 kg) of non-leafy vegetables produced in the homestead were consumed by the household members and only a small portion of leafy vegetables were sold. About half of the produced fruits were consumed and the rest half was sold. About 40, 55 and 51 per cent of produced milk, egg and fish respectively were consumed.

Figure 3.2.2 presents the utilization of all foods produced from both cultivated farm land and homestead. It was found that out of 1193.8 kg of total food production 44.2 per cent was consumed by the family members, while 50.4 per cent food was used for sale in order to meet-up other household expenditures as well as to bear the expenses of successive cultivation of different crops. Some 1.9 and 0.6 per cent foods were utilized as seeds or for plantation and used for jakat/gift/donatation respectively, while 2.9 per cent was used for other purposes such as animal feeds.

Table 3.2.9 shows the per capita food availability for consumption from household production. It was found that per capita per annum availability of all food items was 105.4 kg of which 77.8 kg was cereals, followed by 14.9 kg of all types of vegetables. Similarly, per capita per day availability of foods was 0.290 kg including 0.213, 0.041, 0.011, 0.007 and 0.011 kg of cereals, vegetables, fruits, fish and milk respectively. However, 80.7 kg and 0.221 kg of foods produced from cultivated farm land were available per capita per annum and per day respectively, of which 77.8 kg and only 0.213 kg respectively were cereals. The corresponding figures from homestead were 24.7 kg and 0.069 kg per annum and per day respectively, the major portion of which was vegetables.

Regarding expectation of household food security from own production if not at all sold and if partly sold, about 36 per cent respondents stated that they could have food security round the year if the produced foods not at all sold for other purposes, but if partly used for sale, the expected level of food security was found to be more or less opposite (Figure 3.2.3). The proportion of respondents came down to only 4.2 per cent who expressed to have food security round the year if produced food was partly sold. About one fifth (18.5%)and one quarter (25.5%) of the respondents also mentioned that produced foods would be available to attain household food security for 2 - 3 and 6 - 8 months of the year if partly sold, the corresponding figures were 8.8 and 31.0 per cent if not sold at all.

Regarding months of food shortages or scarcity usually faced by the marginal farm households, it was found that about 85 per cent households mentioned Fulgun - Choitra i.e. mid February to mid April was the usual food shortages period (Table 3.2.10). This period is now widely considered as critical lean period before boro paddy (IRRI) harvest which, a decade ago, was generally considered in Ashin - Kartik i.e.mid September to mid November as main lean period in Bangladesh. Some 30.1, 17.1 and 45.4 per cent respondents respectively also mentioned Boishakh - Joistha (mid April to mid June), Bhadra - Ashin (mid August to mid October) and Kartik -Agrahayan (mid October to mid December) respectively as the food shortages period facing by thire households. Only 6 respondents also reported that they have faced food shortages even during post harvest period of aman paddy in Poush - Magh months (mid December to mid February).

Regarding food purchase by the marginal farmers during the study period one year, 20.8 per cent mentioned that they did not have purchased rice during the mentioned period (Table 3.2.11). On the other hand, about 44 per cent farmers stated that they had purchased for 3-5 months, while 34.3 per cent purchased for 1-2 months. Only one marginal farmer stated that he had to purchase rice for six and more months.

In respect of amount of rice purchased by the marginal farm households during the study period, 63 respondents (29.2%) stated that no rice was purchased by their households, while 6.0 per cent households had purchased less than 50 kg of rice as against 300 and more kg was purchased by only 8 (3.7%) households (Table-3.2.12). Highest number of marginal farm households (19.4%) was found to have purchased 50 to 99 kg of rice and 100-149 kg and 200-299 kg of rice respectively were also found to have purchased by equal number of households (14.8%).

Figure 3.2.1: Distribution households by sources of household food supply

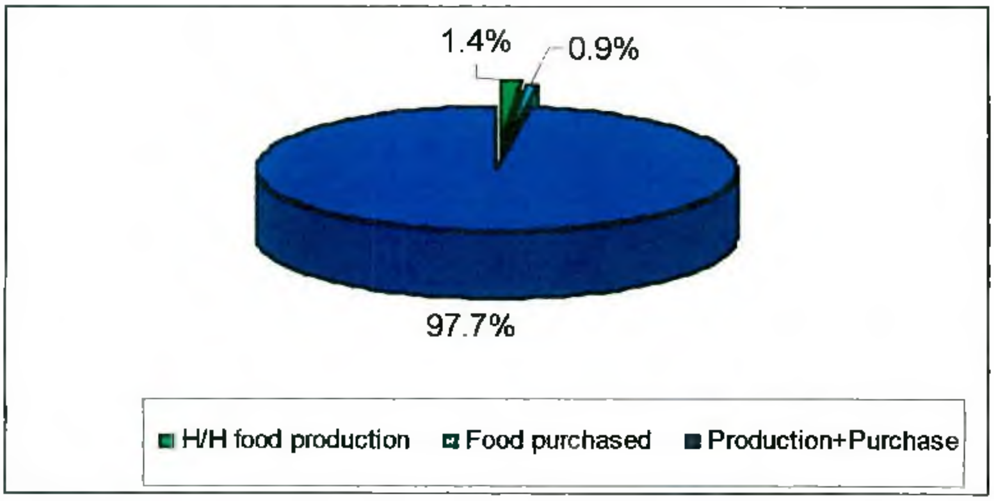


Table 3.2.7: Household Utilization of food produced from cultivated farm land by food items

Food Items	Utiliation of Food (kg)					
	H/H food consumption	Planted or used as Seeds	Given as Jakat, gift, donation	Foods sold	Other uses	Total
Rice (Paddy)	386.7	20.7	4.8	395.4	30.2	837.8
	(46.2)	(2.5)	(0.6)	(47.2)	(3.5)	(100.0)
Wheat	1.5	0.0	0.0	2.6	1.2	5.4
	(27.8)	(0)	(0)	(48.1)	(24.1)	(100.0)
Pulses	0.4	0.1	0.0	1.1	0.1	1.7
	(23.5)	(5.9)	(0)	(64.7)	(5.9)	(100.0)
Potato	7.6	1.9	0.0	17.8	1.0	28.3
	(26.9)	(6.7)	(0)	(62.9)	(3.5)	(100.0)
Oil seeds	1.3	0.3	0.0	45.5	0.9	48.0
	(2.7)	(0.6)	(0)	(94.8)	(1.9)	(100.0)
Leafy & other vegetables	4.1	0.0	0.0	42.0	0.8	46.9
	(8.7)	(0)	(0)	(89.6)	(1.7)	(100.0)
Fruits	1.2	0.0	0.0	1.8	0.0	3.0
	(40.0)	(0)	(0)	(60.0)	(0)	(100.0)
Total	402..8	23.0	4.8	506.2	34.3	971.1
	(41.5)	(2.4)	(0.5)	(52.1)	(3.5)	(100.0)

(Figures in the Parentheses indicate percentage)

Table 3.2.8: Household utilization of food produced in the homestead by food items

Food Items	Utilization of Foods (kg)					
	H/H food Consumption	Planted or used as Seeds	Given as Jakat /gift /donation	Foods Sold	Other uses	Total
Leafy vegetables	14.1	0.0	0.0	2.0	0.0	16.1
	(87.6)	(0)	(0)	(12.4)	(0)	(100.0)
Other vegetables	56.6	0.1	1.0	25.8	0.2	83.7
	(67.6)	(0.1)	(1.2)	(30.8)	(0.3)	(100.0)
Fruit	17.4	0.0	0.1	17.7	0.0	35.2
	(49.4)	(0)	(0.3)	(50.3)	(0)	(100.0)
Milk	20.3	0.0	0.0	30.0	0.0	50.3
	(40.4)	(0)	(0)	(59.6)	(0)	(100.0)
Egg	1.8	0.1	0.1	1.3	0.0	3.3
	(54.6)	(3.0)	(3.0)	(39.4)	(0)	(100.0)
Fish	12.0	0.0	1.2	10.0	0.5	23.7
	(50.6)	(0)	(5.1)	(42.2)	(2.1)	(100.0)
Other foods	1.2	0.0	0.0	9.2	0.0	10.4
	(11.5)	(0)	(0)	(88.5)	(0)	(100.0)
Total	123.4	0.2	2.4	96.0	0.7	222.7
	(55.4)	(0.1)	(1.1)	(43.1)	(0.3)	(100.0)

(Figures in the parentheses indicate percentage)

Figure 3.2.2: Utilization of all food produced in the households

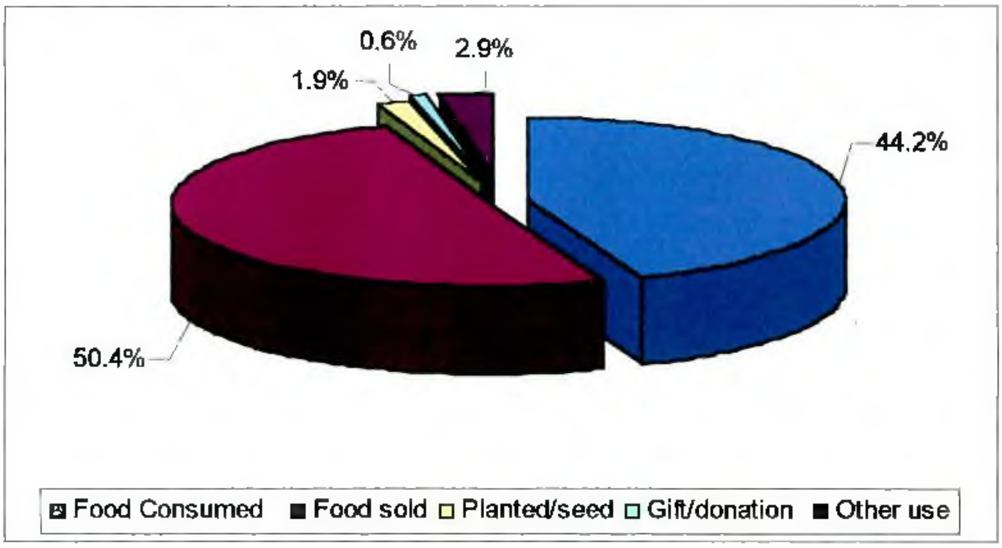


Table 3.2.9: Per capita availability of different food items from production in the marginal farm households

Food Items	Per Capita Food Availability (kg)					
	Farm Land		Homestead		Total	
	Per Annum	Per Day	Per Annum	Per Day	Per Annum	Per Day
Cereals	77.8	0.213	-	-	77.8	0.213
Potato	1.5	0.004	-	-	1.5	0.004
Pulses	0.1	0.000	-	-	0.1	0.000
Oil Seeds	0.3	0.001	-	-	0.3	0.001
Vegetables	0.8	0.002	14.1	0.039	14.9	0.041
Fruits	0.2	0.001	3.5	0.010	3.7	0.011
Fish	-	-	2.4	0.007	2.4	0.007
Milk	-	-	4.1	0.011	4.1	0.011
Egg	-	-	0.4	0.001	0.4	0.001
Other Foods	-	-	0.2	0.001	0.2	0.001
All Foods	80.7	0.221	24.7	0.069	105.4	0.290

Figure 3.2.3: Distribution of households by expected level of household food security from own food production if not sold or partly sold (staple only)

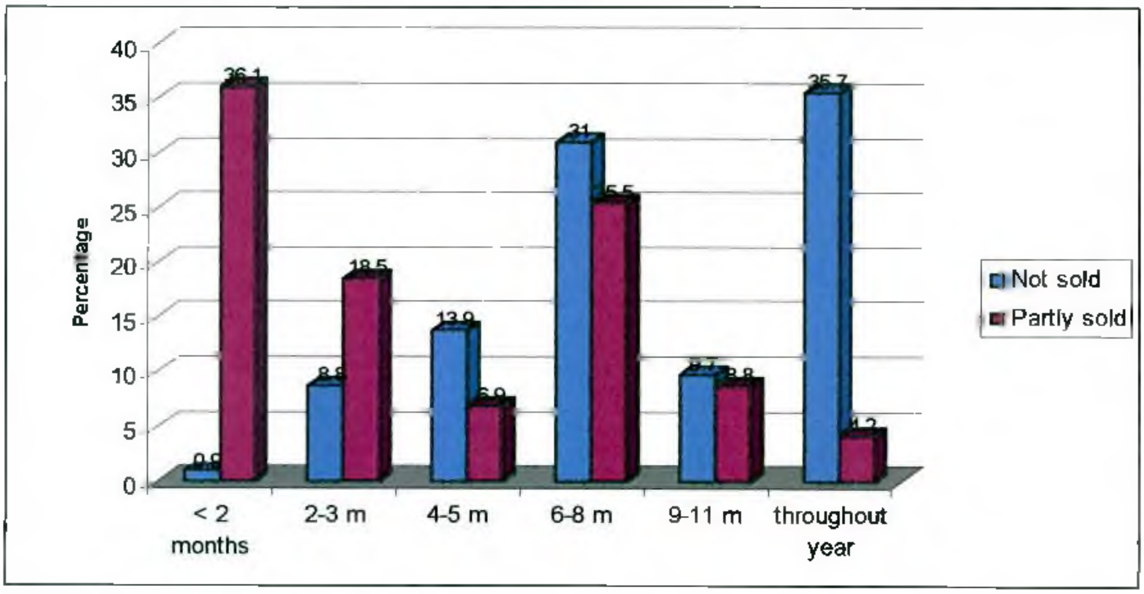


Table 3.2.10: Distribution of marginal farm households by months of food scarcity / shortages (Multiple responses)

Month of food scarcity / shortages	No. of Households	Percentages
Falgun – Choitra (Mid February to mid April)	183	84.7
Boishakh – Joistha (Mid April to mid June)	65	30.1
Ashar – Srabon (Mid June to mid August)	19	8.9
Bhadra – Ashin (Mid August to mid October)	37	17.1
Kartik – Agrahayan (Mid October to mid December)	98	45.4
Poush – Magh (Mid December to mid February)	6	2.8

Table 3.2.11: Distribution of marginal farm households purchased rice during the study period by months

Rice purchased for number of months	No. of Households	Percentage
No Purchase	45	20.8
Purchased for 1 - 2 months	74	34.3
Purchased for 3 - 5 months	96	44.4
Purchased for 6 months and above	1	0.5
Total	216	100.0

Table 3.2.12: Distribution of marginal farm households by amount of rice purchased during study period of one year

Amount of rice purchased during one year study period (kg)	No. of Households	Percentage
0 kg	63	29.2
1 –49 kg	13	6.0
50 – 99 kg	42	19.4
100 – 149 kg	32	14.8
150 – 199 kg	26	12.0
200 – 299 kg	32	14.8
300 kg and above	8	3.7
Total	216	100.0

3.2c. Pattern of Food Intake in the Marginal Farm Households:

Per capita per day food intake by marginal farm household was 678.3 gm (Table 3.3.13). About 91% of the consumed food was provided by plant sources including 66.4% cereals, 18.6% vegetables & fruits and 7.4 % roots & tubers, while animal foods provided only 4.6 % of the total intake. Mean food intake was highest (722.0 gm/day) in Raigonj and was lowest (641.2 gm/day) in Uzirpur. By food groups, mean cereal intake was 450.5 gm, of which rice and wheat intakes were 403.6 gm and 44.7 gm per day respectively. Rice intake was highest (438.7 gm) in Raigonj and the lowest (353.2 gm) in Uzirpur but with highest wheat intake (63.7 gm). Intakes of pulses, vegetables and fruits were 6.3, 118.9 and 7.3 gm respectively, while that of animal food was 31.8 gm, of which 23.4 gm was fish. Fats & oils intake was only 2.4 gm which was almost similar in all the locations. Roots & tubers (64.1gm), fish (27.6 gm), vegetables (136.1 gm) and fruit (12.7 gm) were found to be more consumed, whereas pulses (1.8 gm), milk & milk products (1.6 gm) and sugar (0.5 gm) were least consumed in Nokla as compared to other locations, while meats, vegetables and fruits were least consumed in Uzirpur.

Food consumption in different rounds showed that mean per capita food consumption was the lowest 588.3 gm during October-November in third round before aman paddy harvest, while that was the highest 774.3 gm during fourth round in January-February after aman harvest (Table 3.2.14). The difference in mean intake was found statistically significant ($p < .001$). Pulse intake continuously decreased from 9.2 gm in the first round to 2.8 gm over the study period. Fish intake increased from 10.0 gm in the first round to 24.4 gm in the fourth round with highest increase in the third round (37.6 gm) as it was the pick period of natural fish catching in rural Bangladesh. Vegetables intake significantly decreased from 143.4 gm in first round through second round to 50.9 gm in the third round and then again significantly increased to 190.0 gm in the fourth round. Fruit intake was the highest 24.2 gm during second round in June-July, which was the pick period of native fruit harvesting, while that was the lowest 0.6 gm during third round in October-November. Leafy vegetables intake was the highest in first round and non-leafy vegetables intake was the highest during fourth round in January-February, while intakes of both vegetable groups were the lowest during third round in October and November. The differences in intakes of cereals, wheat, pulses, fish, fats &oils, both leafy & non-leafy vegetables and sugar between third and fourth round were statistically significant ($p<.001$).

Food intake by marginal farm households and rural people in different survey periods is shown in Table 3.2.15. It shows that intakes of all food groups except vegetables were found to be lower in marginal farm households compared to rural population as found in 1995-96 survey. However, 52.5 gm of food per day was less consumed by the marginal farm households than the intake of rural people and the highest difference of low intake was found in case of roots & tubers (-18.8 gm) followed by intakes of fish (-8.6 gm) and milk & milk products (-8.6gm).

The marginal farmers between 20 and 59 years, who are the main food growers, were found to consume lesser amount of food of all groups compared to rural adult population (Table 3.2.16). About 202 gm of all foods was less consumed by the marginal farmers including highest 77.4 gm of cereals, followed by roots & tubers (33.9gm), vegetables (27.6gm), fish (16.6gm), milk & milk products (12.6gm) and pulses (8.1gm). It reveals that the consumption of major food items by the hard working marginal farmers might have caused lower intake of macro nutrients indicating their food insecurity.

Table 3.2.17 indicates the male and female disparity in food intake by food groups. It shows that intake of all the food groups except milk & milk products and other non-specific foods by females was less than those taken by males. Highest difference was observed in cereals intake (-62.4gm) followed by vegetables (-13.4gm). The differences in intakes of all the food groups except meat, fruits and other non-specific foods between male and female members were significant ($p < .001$).

Per capita food intake by age group shows that total food intake increased monotonicalley with age upto 49 years with an exception in 16-19 years age group (Table 3.2.18). Food intake decreased to the level of 520.8 gm for people aged 70 years &

above. Intakes of cereals, roots & tubers, vegetables, meat and fish followed more or less similar trend. Cereals intake was the highest (483.1gm) among adults of 40-49 years age group, while roots & tubers intake was the highest (52.8 gm) in 20-39 years age group. Highest amount of pulse was found to be consumed by the old people (10.0 and 10.8 gm by 60-69 years and by 70 years & above age group respectively). The household members aged 70 years & above consumed the highest amount of meat (4.5 gm), while those between 60 and 69 years consumed highest amount of fish (26.6 gm). Highest amount of vegetables (131.6gm) and fruits (11.1gm) were consumed by adults of 50-59 years and adolescents of 13-15 years age group respectively. Highest amount of milk & milk products were consumed by 1-3 years children and old people of 70 years & above. Pregnant women were found to consume more sugar, pulses, fruits, meat, fish, milk & milk products and fats & oils compared to lactating women who were found to consume more cereals, roots & tubers, vegetables and eggs than pregnants.

Per capita per day food intake by age and sex groups shows that the male members of all age groups consumed more cereals, sugars and roots & tubers compared to females except 1-3 years & 16-19 years girls, elderly & old women. With the exception of adolescents and elderly, all the male members of all age groups were found to consume more pulses than females. In case of vegetables and fruits, except 7-9 years girls for vegetables and 1-3, 4-6, 13-15 & 16-19 years girls & 20-39 years adult females for fruits, all the female were found to consume lesser amount of vegetables and fruits than the males. Highest amount of fruits (15.7gm) was found to consume by 13-15 years girls and adult males of 40-49 years (15.2gm). The male members were found to consume meat and fish in more amounts, except 7-9 years and 16-19 years boys, 50-59 years males for meat and 4-6 years boys and old man for fish. Milk & milk products were also consumed in lesser amount by the females than males except 1-3, 7-9, 16-19, 50-59 and 60-69 years age groups, with highest (15.9gm) intake by old man (Appendix Table A-1).

Table 3.3.13: Per capita food intake (gm/day) of the marginal farm households by food groups and location

FOOD GROUPS	LOCATIONS				
	Mean All Location (N=2586)	**Dhonakusha Nokla (N=644)**	**Selunia Laksham (N=623)**	**West Satla Uzirpur (N=673)**	**Bashuria Raigonj (N=646)**
Cereals	450.5	438.5	455.5	419.1	491.5
Rice	*403.6*	*400.1*	*425.1*	*353.2*	*438.7*
Wheat	*44.7*	*34.6*	*28.1*	*63.7*	*51.1*
Root & Tubers	51.2	64.1	44.6	41.2	55.1
Pulses	6.3	1.8	8.3	5.9	9.3
Meat	3.4	4.3	4.3	1.9	3.4
Fish	23.4	27.6	25.5	23.3	17.2
Milk & Milk Prod.	4.4	1.6	4.6	5.0	6.2
Egg	0.6	0.4	0.7	0.4	0.7
Fats & Oils	2.4	2.6	2.2	2.4	2.5
Vegetables	118.9	136.1	117.9	103.8	118.3
Leafy vegetables	*53.8*	*42.6*	*70.9*	*53.3*	*49.0*
Non-leafyr vegetables	*65.1*	*93.5*	*47.1*	*50.6*	*69.3*
Fruits	7.3	12.7	4.0	3.2	9.5
Sugars	1.2	0.5	0.9	1.9	1.3
Other foods	8.6	15.8	5.5	6.0	7.2
All Foods	678.3	705.9	674.0	614.2	722.0

Table 3.2.14: Per capita food intake (gm/day) of the marginal farm households by food groups and by rounds

FOOD GROUPS	ROUND OF SURVEY					[a]Value of Z Test	Level of Significance
	All Rounds (Average) (N=2586)	First Round Mar-Apr (N=648)	Second Round Jun-Jul (N=648)	Third Round Oct-Nov (N=646)	Fourth Round Jan-Feb (N=644)		
Cereals	450.8	438.8	446.0	432.8	485.6	- 5.21	**
Rice	*403.6)*	*357.9*	*428.7*	*404.3)*	*423.6*	- 1.74	*
Wheat	*44.7*	*78.9*	*12.9)*	*26.8*	*60.4*	- 6.89	**
Roots & Tubers	51.2	59.8	45.0	44.4	55.5	- 1.36	*
Pulses	6.3	9.2	7.3	6.0	2.8	3.72	**
Meat	3.4	2.4	5.0	3.0	3.4	- 0.45	*
Fish	23.4	10.0	21.4	37.6	24.4	5.89	**
Milk &Milk prod.	4.4	3.7	8.7	2.4	2.6	- 0.19	*
Egg	0.6	0.9	0.8	0.2	0.4	-0.74	*
Fat & Oils	2.4	2.5	2.5	2.2	2.5	-2.73	**
Vegetables	118.9	143.4	91.5	50.9	190.0	-24.20	**
Leafy vegetables	*53.8*	*87.6*	*50.1*	*18.4*	*59.0*	-19.24	**
Non-leafy veget.	*65.1*	*55.8*	*41.4*	*32.5*	*131.0*	-17.34	**
Fruits	7.3	3.6	24.2	0.6	0.9	-0.8	*
Sugar	1.2	0.8	0.7	1.0	2.1	-2.68	**
Other foods	8.6	3.2	19.8	7.1	4.3	-2.77	**
All Foods	678.3	678.2	672.9	588.3	774.3		

* * = Significant (p<.001);   * = Not Significant

a = Z-test was done between results of third and fourth round

Table 3.2.15: Per capita food intake (gm/day) by food groups by rural population in 1995-96 and by marginal farm households

Food Groups	Rural people in 1995-96	Marginal farm households in 1998-99	Differences of intakes
Cereal	452.0	450.8	-1.2
Roots & Tubers	70.0	51.2	-18.8
Pulses	10.0	6.3	-3.7
Meat	6.0	3.4	-2.6
Fish	32.0	23.4	-8.6
Milk & milk prod.	13.0	4.4	-8.6
Egg	3.0	0.6	-2.4
Fats & oil	6.0	2.4	-3.6
Sugars	6.0	1.2	4.8
Vegetables	113.0	118.9	+5.9
Fruits	13.0	7.3	-5.7
Other Foods	6.8	8.6	+1.8
All foods	730.8	678.3	-52.5

Table 3.2.16: Food intake pattern (gm/ capita/day) by the marginal farmers (aged 20-59 years) compared to the rural adult population of Bangladesh

Food groups	Marginal farmers in 1998-99	Rural adult population in 1995-96	Differences in intakes
Cereals	471.8	549.2	-77.4
Roots &tubers	49.5	83.4	-33.9
Sugar	1.2	8.8	-7.6
Pulses	6.9	15.0	-8.1
Meats	2.8	8.9	-6.1
Fish	24.6	41.2	-16.6
Milk & milk Products	4.1	16.7	-12.6
Egg	0.6	3.0	-2.4
Fats & oils	2.7	8.4	-5.7
Vegetables	126.1	153.7	-27.6
Fruits	7.5	13.0	-5.5
Other foods	10.8	6.8	+4.0
All foods	708.6	908.7	-201.7

Table 3.2.17: Per capita food intake (gm/day) of the marginal farm households by food groups and by sex

Food Groups	Both	Male	Female	Difference	Value of z-test	Level of significance
Cereals	450.8	480.6	418.2	-62.4	8.35	**
Roots & Tubers	51.2	53.8	48.2	-5.6	2.86	**
Sugar	1.2	1.4	0.9	-0.5	2.45	**
Pulses	6.3	7.0	5.5	-1.5	2.63	**
Meats	3.4	3.8	3.1	-0.7	1.83	*
Fish	23.4	24.9	21.6	-3.3	3.51	**
Milk & M. products	4.4	4.2	4.5	+0.3	-0.386	**
Egg	0.6	0.7	0.4	-0.3	2.03	**
Fats & Oils	2.4	2.5	2.2	-0.3	3.26	**
Vegetables	118.9	125.2	111.8	-13.4	3.80	**
Fruits	7.3	8.0	6.5	-1.5	1.05	*
Other foods	8.6	7.1	9.8	+2.7	-0.85	*
All Foods	678.3	719.3	632.7	-86.6	4.11	**

* * = Significant;

* = Not Significant

Table 3.2.18: Food intake (gm per capita per day) of marginal farm households by different age group

Age Group in years	Cereals (gm)	Roots & Tubers (gm)	Sugar (gm)	Pulses (gm)	Vegetable (gm)	Fruits (gm)	Meats (gm)	Eggs (gm)	Fish (gm)	Milk & milk products (gm)	Fats & Oils (gm)	Other foods (gm)	Total foods (gm)
Children													
1-3	126.5	12.1	1.8	1.7	30.9	7.1	0.6	0.4	6.4	10.6	0.7	3.1	201.9
4-6	283.7	29.2	1.0	4.0	72.9	10.4	1.9	0.3	14.1	3.7	1.4	16.2	438.7
7-9	374.3	36.6	0.8	5.0	93.4	7.1	1.8	0.4	19.3	2.6	1.8	8.1	551.2
Adolescent													
10-12	405.0	41.1	0.8	5.0	97.5	8.5	1.7	0.2	20.1	4.4	1.9	7.9	594.2
13-15	459.3	43.8	1.5	7.5	111.9	11.1	2.1	0.6	23.8	4.5	2.2	8.1	676.4
16-19	411.1	41.4	0.8	6.1	98.4	3.0	2.9	0.4	21.6	4.1	2.1	7.0	598.8
Adults													
20-39	461.4	52.8	1.5	7.0	124.6	9.1	2.5	1.1	24.8	5.1	2.9	14.6	707.5
40-49	483.1	50.9	1.3	5.8	122.2	8.8	2.7	0.6	25.3	3.4	2.6	10.1	716.9
50-59	470.8	44.2	0.8	8.0	131.6	4.6	3.2	0.1	23.8	3.1	2.7	8.2	701.7
60-69	469.4	41.2	1.3	10.0	115.9	3.4	1.7	1.0	26.6	5.7	2.6	6.5	685.2
70 & above	352.2	35.1	1.0	10.8	86.4	0.9	4.5	1.0	21.7	9.2	2.0	6.0	520.8
Pregnant	406.2	43.7	2.7	5.1	103.0	22.3	5.0	0.6	27.3	8.4	3.6	10.2	638.2
Lactating	440.5	48.7	1.1	4.9	118.6	6.8	2.3	1.0	21.2	2.9	2.5	7.6	657.9
Average	450.8	51.2	1.2	6.3	118.9	7.3	3.4	0.6	23.4	4.4	2.4	8.6	678.3

3.2d. Pattern of Nutrients Intake by the Marginal Farm Households:

In the marginal farm households per capita per day calorie intake was 1768.3 kcal. Protein, fat, carbohydrate intakes were 42.2, 7.7 and 380.1gm per capita respectively (Table –3.2.19). Minerals like calcium, iron and zinc intakes were 251.4 mg, 13.1 mg and 6.8 mg per capita respectively. Vitamin A intake from animal sources was only 35.3 I.U. but carotene intake was 3184.5 μg per capita. Thiamine, riboflavin and niacin intakes were 1.27, 0.49 and 19.0 mg respectively. Location-wise, calorie, protein, carbohydrate, fat, calcium, thiamine and niacin intakes were the lowest, while iron and vitamin A intakes were the highest in Uzirpur compared to other locations. On the other hand, highest intakes of calorie, protein, carbohydrate, thiamine, riboflavin, niacin and zinc were found in Raigonj and that of calcium and carotene in Laksham.

Nutrient intake during different periods of the study is shown in Table-3.2.20: It was found that calorie, protein, fat as well as calcium, thiamine, niacin and zinc intakes were increased over the study period. On the other hand, iron, vitamin A, carotene, riboflavin and vitamin C intakes were decreased in the fourth round from those consumed in the first round. By rounds, lowest intake of fat, carbohydrate, iron, carotene, thiamine, riboflavin, niacin, vitamin C and also zinc were found during third round in October-November. At the beginning of the study mean calorie intake was 1710.2 kcal which incresed by about 50 kcal to 1759.8 kcal in the second round. But the intake was decreased by about 41 kcal in the third round (Oct.-Nov.) which was the typical lean period in Bangladesh before aman paddy harvest. Calorie intake again increased by 165.4 kcal to 1884.5 kcal in the fourth round (Jan-Feb) which might be due to the increased intake of foods, particularly, cereal foods after aman harvest. The differences in intakes of calorie, protein, fat, carbohydrate, iron, carotene, thiamine, riboflavin, niacin and zinc between lean (3^{rd} round) and abundant period (4^{th} round) were statistically significant ($p<.001$).

Nutrient intake pattern by marginal farmers and rural adult population of Bangladesh shows that with an exception of iron, intake of all the nutrients was much lower among the marginal farmers compared to rural population (Table 3.2.21). Nutrients intake of both groups, however, fairly corresponds to their respective food intake pattern. About 464 kcal, 13.0 gm protein and 147.5 mg calcium were less consumed by the marginal farmers than the rural population. From the Table it reveals that although the marginal farmers belong to one section of rural adult population, their lower nutrients intake is indicative of chronic food insecurity resulting chronic energy deficiency and thereby poor nutritional status.

Per capita nutrient intake by sex shows that all the nutrients were consumed by the females in lesser amount compared to their male counterparts (Table-3.2.22). Intakes of calorie, protein, fat, carbohydrate, thiamine, riboflavin, niacin, and zinc were highly significantly different ($p<.001$) between males and females.

Nutrient intake by different age groups shows that intake of calorie, protein, carbohydrate, calcium, iron, thiamine, riboflavin, niacin, vitamin C and zinc increased with age up to 40-49 years, while that of fat, vitamin A, carotene increased up to 20-39 years with the exception in 16-19 years age group (Table 3.2.23). The intake of nutrients decreased from 50-59 years age group through old ages with the exception of 60-69 years age group, where intake of protein, calcium and iron was higher compared to its immediate upper and lower age groups. Of course highest intakes of vitamin A (58.8 I.U.) and carotene (3339.9 μg) were consumed by the elderly people of 50-59 years age group. Nutrients intake by age group, however, followed the similar pattern as was observed in food intake by age group.

Regarding nutrients obtained by marginal farmers from different food groups, Table 3.2.24 shows that about 88, 75, 92, 73, 84, 69, 91 and 77 per cent of calorie, protein, carbohydrate, iron, thiamine, riboflavin, niacin and zinc respectively were obtained from cereal foods. Only about one third and about one fourth of fat and calcium respectively were obtained from cereals. Although cereals provided about three fourth of total protein, animal foods supplied about 13 per cent of which 10.7 per cent came from fish. Next to fish, vegetables and pulses were found to supply 3.6 and 4.6 per cent of total protein intake respectively. Out of 7.7 gm fat intake, cereals and fats & oils provided more than 62% of which 29.6% was from cooking oils, while vegetables, fish and pulses provided 11.3, 9.5 and 4.5 per cent of total fat intake. Fish was found as the main source of calcium (38.4%) followed by vegetables (23.9%) and milk & milk products supplied only 2.0 per cent of total calcium intake. Just after cereals, vegetables supplied the second major portion of iron (14.1%), followed by pulses (2.8%) and fish (2.7%). About 97 per cent of vitamin A supply came from animal foods of which about 47 and 24 per cent came from milk & milk products and meats respectively. On the other hand, about 99 per cent of carotene was supplied by vegetables (89.4%) and fruits (9.2%). Vegetables were found to be the main source vitamin C (51.7%) followed by roots & tubers (27.0%). Fruits provided only 7.9 per cent of vitamin C intake.

Nutrient intake by age and sex groups shows that calorie, protein, carbohydrate, thiamine, ribaflavin, niacin and zinc intakes were higher among males of all age groups except 1-3 years female children. Vitamin C intake was also higher in males of all age groups with an exception in old women of 70 years & above. With the exception of 1-3, 4-6 and 16-19 years age groups, fat intake was higher among males. Calcium and iron intakes were found comparatively higher among males than females. Vitamin A intake was found to be higher in females of 1-3, 7-9, 13-15, 16-19, 50-59 and also 60-69 years age groups than males (Appendix Table A-2).

Table 3.2.19: Per capita per day nutrient intake of the marginal farm households by locations

NUTRIENTS	LOCATIONS				All Locations (N=2586)
	Dhonakusha, Nokla (N=644)	South Selunia, Laksham (N=623)	West Satla, Uzirpur (N=673)	Bashuria, Raigonj (N=646)	
Calorie (kcal)	1768.4	1771.7	1629.9	1908.8	1768.3
Protein (gm)	42.1	42.5	39.2	45.0	42.2
Fat (gm)	8.4	7.2	7.0	8.2	7.7
Carbohydrate (gm)	377.1	382.3	350.4	411.8	380.1
Calcium (mg)	251.7	276.4	229.2	250.1	251.4
Iron (mg)	12.3	11.3	14.5	14.1	13.1
Vitamin 'A' (I.U.)	19.3	37.5	50.7	33.1	35.3
Carotene (μg)	2648.0	3715.2	3214.3	3176.4	* 3184.5
Thiamine (mg)	1.25	1.24	1.20	1.41	1.27
Riboflavin (mg)	0.47	0.46	0.49	0.55	0.49
Niacin (mg)	19.0	19.1	17.4	20.6	19.0
Vitamin 'C' (mg)	30.7	20.5	21.5	25.6	24.6
Zinc (mg)	6.8	6.5	6.6	7.3	6.8

* Total Vit. A from both animal foods and Carotene was 1802.69 I.U.

Table 3.2.20: Per capita daily nutrient intake of the marginal farm households by round

NUTRIENTS	ROUND OF SURVEY					[b]Value of Z Test	Level of Significance
	All Rounds (Average) (N=2586)	1st Round Mar-Apr (N=648)	2nd Round Jun-Jul (N=648)	3rd Round Oct-Nov (N=646)	4th Round Jan-Feb (N=644)		
Calorie (kcal)	1768.3	1710.2	1759.8	1719.1	1884.5	-4.15	**
Protein (gm)	42.2	41.4	41.0	41.4	44.9	-3.5	**
Fat (gm)	7.7	8.0	7.2	6.8	8.7	-2.7	**
Carbohydrate (gm)	380.1	368.3	381.9	363.8	406.5	-4.91	**
Calcium (mg)	251.4	231.6	258.7	257.9	257.4	0.04	*
Iron (mg)	13.1	16.7	10.3	10.0	15.2	-9.29	**
Vitamin 'A' (I.U.)	35.3	58.7	40.7	21.3	20.4	0.19	*
Carotene (μg)	[a] 3184.5	5439.1	3378.1	1208.3	2703.3	-6.996	**
Thiamine (mg)	1.27	1.36	1.23	1.12	1.39	-9.31	**
Riboflavin (mg)	0.49	0.58	0.48	0.39	0.53	-8.8	**
Niacin (mg)	19.0	18.9	18.7	17.9	20.6	-6.28	**
Vitamin 'C' (mg)	24.6	34.6	21.0	10.8	31.9	-11.4	*
Zinc (mg)	6.8	7.2	6.3	6.2	7.5	-7.7	**

a. Total Vit. A from both animal foods and Carotene was 1802.7 I.U.

b. Z-test was done between results of third round and fourth round

* * = Significant; * = Not Significant

Table 3.2.21: Nutrient intake pattern (per capita/day) by the marginal farmers compared to the rural population (aged 20-59 years) of Bangladesh

Nutrients	Marginal farmers in 1998-99	Rural adult population in 1995-96	Differences in intakes
Energy (kcal)	1858.4	2322.0	- 463.6
Protein (gm)	44.3	57.3	- 13.0
Calcium (mg)	265.5	413.0	- 147.5
Iron (mg)	13.9	13.6	+ 0.3
Vitamin A (I.U.)	1785.0	2182.0	- 397.0
Thiamine (mg)	1.34	1.42	- 0.08
Riboflavin (mg)	0.52	0.58	- 0.06
Niacin (mg)	19.9	22.4	- 2.5
Vitamin C (mg)	25.6	38.2	- 12.6

Table 3.2.23: Nutrient intake (per capita per day) of marginal farm households by age groups

Age Group in years	Calorie (kcal)	Protein (gm)	Fat (gm)	Carbohydrate (gm)	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Carotene (µg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)	Zinc (mg)
1-3	515.8	12.3	2.7	109.7	81.0	4.0	27.8	872.3	0.37	0.16	5.3	6.9	2.0
4-6	1154.7	27.2	5.5	247.9	171.7	10.4	16.8	2109.9	0.82	0.32	12.2	16.4	4.3
7-9	1458.4	34.7	6.0	314.3	203.5	11.0	18.1	2712.3	1.06	0.41	15.7	19.5	5.6
10-12	1576.7	37.4	6.7	339.7	220.5	12.5	19.9	2562.3	1.16	0.46	17.0	19.4	6.1
13-15	1798.8	42.7	7.4	388.4	247.1	13.1	85.4	3194.2	1.29	0.49	19.2	22.7	6.8
16-19	1603.9	37.8	6.5	346.2	230.8	10.8	26.7	3021.4	1.11	0.42	17.3	19.0	5.9
20-39	1836.2	43.7	8.4	394.1	265.9	13.3	41.4	3261.0	1.32	0.51	19.5	26.6	6.9
40-49	1893.5	45.5	8.2	407.2	267.6	15.1	25.3	3213.4	1.37	0.53	20.3	25.4	7.2
50-59	1845.4	43.8	8.1	396.9	262.9	13.4	58.8	3339.9	1.32	0.51	19.9	24.9	6.9
60-69	1834.3	44.7	8.0	394.5	276.9	13.8	30.8	2856.3	1.33	0.52	19.8	21.0	7.1
70 & above	1412.7	34.8	6.7	300.6	202.8	8.7	17.2	2041.4	1.00	0.38	15.0	21.7	5.2
Pregnant Women	1652.1	39.7	8.1	350.8	258.3	11.8	27.6	3550.9	1.14	0.46	17.3	22.2	5.9
Lactating Mother	1723.5	40.2	7.4	372.4	229.2	12.9	33.2	3025.1	1.24	0.48	18.6	23.4	6.6

Table 3.2.24: Per cent of nutrient obtained by the marginal farm households (per capita) by food groups

Food groups	Per cent of nutrients obtained												
	Calorie (kcal)	Protein (gm)	Fat (gm)	Carbohydrate (gm)	Calcium (mg)	Iron (mg)	Vit. A (IU)	Carotene (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vit. C (mg)	Zinc (mg)
Cereals	88.0	74.8	32.5	92.2	23.8	73.0	0.0	0.4	84.0	68.5	90.9	0.0	76.8
Roots &Tubers	3.2	2.12	4.6	2.9	3.4	2.6	0.0	0.4	4.0	2.8	2.1	27.0	3.2
Sugar	0.2	0.01	0.02	0.3	0.5	0.6	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Pulses	1.3	3.6	4.5	0.9	3.1	2.8	0.0	0.3	2.2	2.6	0.8	0.1	2.3
Vegetables	3.0	4.6	11.3	2.5	23.9	14.1	0.0	89.4	6.4	17.0	2.2	51.7	8.6
Fruits	0.2	0.3	0.2	0.2	1.0	0.4	0.0	9.2	0.6	1.8	0.1	7.9	0.4
Meats	0.2	1.8	1.2	0.0	0.2	0.4	24.1	0.0	0.3	1.0	1.2	0.1	0.9
Egg	0.1	0.2	0.8	0.0	0.1	0.1	15.4	0.1	0.1	0.3	0.0	0.0	0.1
Fish	1.5	10.7	9.5	0.2	38.4	2.7	10.8	0.0	0.2	1.9	1.4	7.3	7.5
Milk & Milk Products	0.2	0.3	2 2	0.1	2.0	0.1	46.8	0.0	0.2	1.5	0.0	0.3	0.3
Fat & Oils	1.1	0.0	29.6	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Other foods	1.0	1.7	3.5	0.8	3.8	3.4	3.0	0.2	2.1	2.5	1.2	5.5	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Average intake	1768.3	42.2	7.7	380.1	251.4	13.1	35.3	3184.5	1.3	0.5	19.0	24.6	6.8

3.3: Nutritional Requirements and Intake Deficiencies:

Nutritional Requirements:

Nutrients are required by the body to supply energy for physical and physiological activities, physical and mental growth & development, repair and maintanace of body tissues and also to fight against diseases. But all the six groups of nutrients are not required in equal amounts. Similarly, the requirements of nutrients are not the same for all individuals. Nutrients requirement depends on the age, sex, body size, physical activity level and also physiological status of individuals. So, the nutrient requirement differs among individual members. Since the major occupation of rural Bangladeshi population is farming and marginal farmers belong to one section of this rural population. So, the estimated requirement of different nutrients, specially calorie & protein, for different age and sex groups of rural population (as shown in Appendix Table B-1) can also be considered as the nutritional requirement of marginal farm household members [30] which is reasonable and justified. Hence, we have taken these as the requirement of the marginal farm household members.

Deficiencies in Nutrient Intakes:

Figure 3.3.1 shows the daily per capita intake of energy (kcal) as per cent of requirement by male and female members of the marginal farm households by age group. It shows that the females of 18-29 years and males of 60 years & above could meet the highest level of energy requirement by 92.4 and 97.5 per cent respectively, while the corresponding figures for opposite sex of the same age group were 68.0 and 81.6 per cent respectively. Male children of 1-3 years age group could meet only about one third (36.5%) of their energy requirement, while the female children of the same age group could meet about 43 per cent. The female members of 1-3, 16-17, 18-29 and 30-59 years age groups were found to be better off than the males, while the males of 4-6, 10-12, 13-15 and 60 years & above age groups were found to be better off than females in respect of meeting energy requirements. The only exception in the 7-9 years age group, both male and female children could meet 79.1 per cent of their requirement.

Regarding fulfillment of protein requirement, Figure 3.3.2 shows that with the exception of male adolescent of 13-15 years age group, no one could meet the protein requirement. The male adolescents were found to consume about 2 per cent more protein than their requirement.The male children of 10-12 years and females of 18-29 years age group could meet about 98 per cent, while both male and female members of 30-59 years could meet about 90% of protein requirement. The male and female children of 1-3 years were found to meet only about 36 and 42 per cent of their requirement.

Table 3.3.1 shows the daily per capita intake of fat as per cent of requirement by age and sex groups. It is to be mentioned here that fat requirement by age and sex groups of Bangladeshi population has not yet been estimated and hence the fat requirement for Indian population was taken as the fat requirement of marginal farm household members. since Bangladesh and Indian population have many characteristics alike and therefore, are comparable. For 1-9 years old children, adolescents of 10-17 years and for adults of both sexes 25, 22 and 20 gm of fat respectively were taken as average requirement. It was found that no one of the study households could meet about half of the fat requirement. Fat intake by both males and females in all age groups could meet about 11 to 43 per cent of requirement and that could meet only about 2 to 4 per cent of the energy requirement. The children of 1-3 years met only 10.8 % of requirement providing only about 2 per cent of the energy requirement. Males of 4-6 years and females of 7-9 years respectively met 19.6 and 22.0 per cent of fat requirement. Adult males were found to meet about 43 per cent, which was much below in female adults.

Per capita per day nutrient intake as percent of requirement by rural population in 1995-96 and by marginal farmers in 1998-99 is shown in Figure 3.3.3. It shows that major nutrients such as calorie, protein, fat, carbohydrate, calcium and vitamin C intakes of marginal farm households were lower, where as iron, vitamin A, thiamine, riboflavin and niacin intakes were higher compared to the intakes of rural population in 1995-96. It reveals that the marginal farm households were able to meet 86.7, 94.6, 30.8, 124.2, 49.8 and 52.3 per cent of their calorie, protein, fat, carbohydrate, calcium and vitamin C requirement, while the rural population could meet those by 92.8, 104.0, 56.4, 129.1, 64.9

and 67.9 per cent respectively. On the other hand, higher percentages of iron, vitamin A, thiamine, riboflavin and niacin requirement (59.6%, 105.3%, 124.5%, 42.7% and 138.9% respectively) could be met by marginal farm households than the rural population (50.0%, 91.8%, 116.7%, 37.9% and 135.8% respectively). Zinc intake of the marginal farm household was about half of the requirement[404], while zinc intake of rural population was unavailable because of non-estimation of zinc in any national nutrition surveys (Figure 3.3.3). However, the marginal farm households were able to meet calorie, protein, fat, carbohydrate, calcium and vitamin C requirement by about 6, 9, 26, 5 and 11 per cent respectively lower than the rural population indicating their susceptibility to food insecurity and thereby poor nutritional status.

Figure 3.3.1: Energy intake as per cent of requirement in marginal farm households by age and sex groups

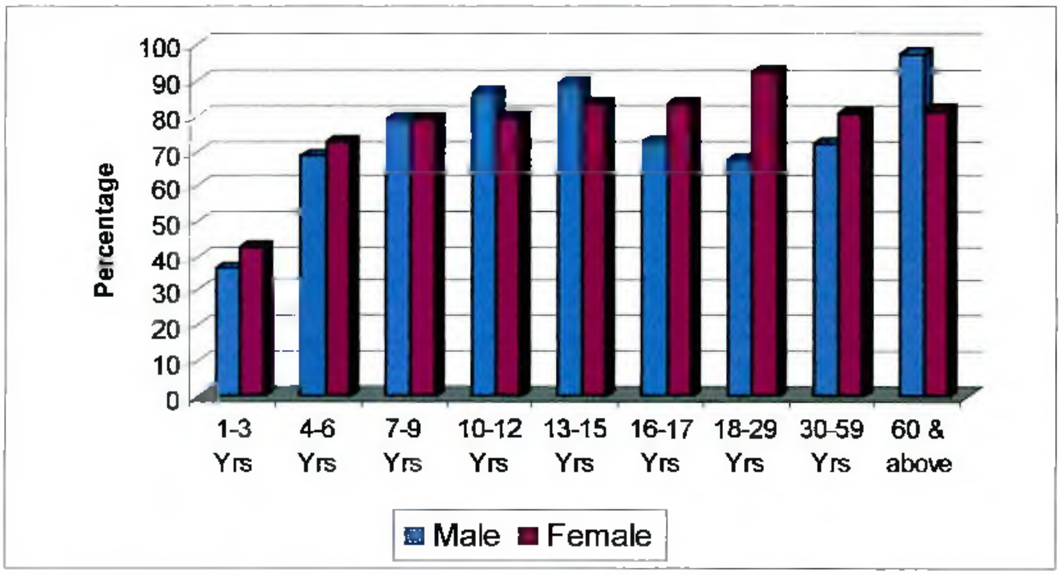


Figure 3.3.2: Protein intake as per cent of requirement in marginal farm households by age and sex groups

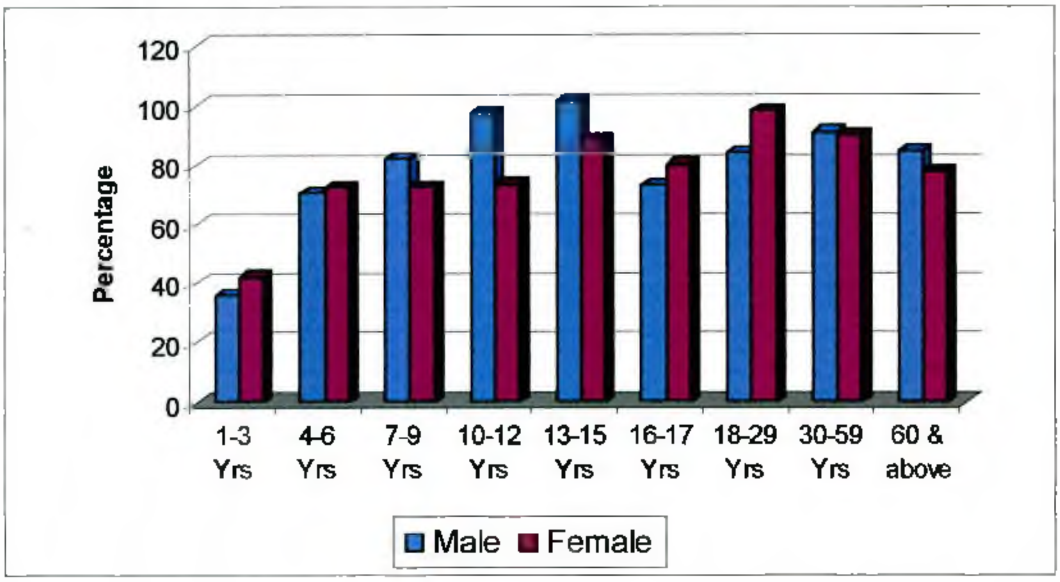
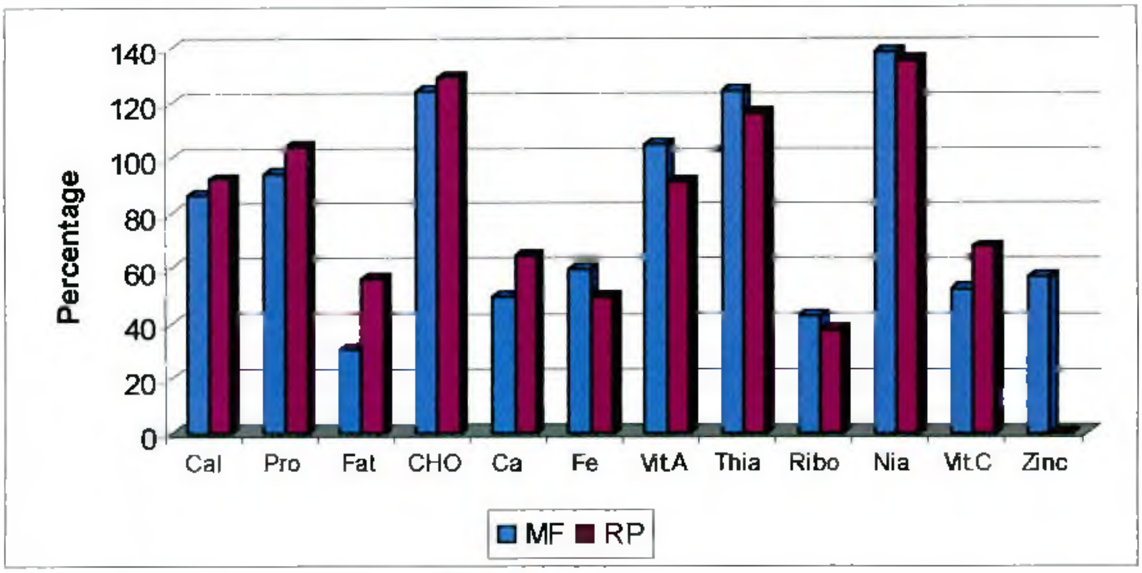


Table 3.3.1: Fat intake as per cent of requirement and as per cent of energy requirement by age and sex groups

Age Groups	Male				Female			
	Fat Require ment	Mean Fat Intake	% of require ment	% of energy require ment	Fat Require ment	Mean Fat Intake	% of require ment	% of energy require ment
1-3 Years	25	2.7	10.8	1.8	25	2.7	10.8	1.9
4-6 "	25	4.9	19.6	2.6	25	6.0	24.0	3.5
7-9 "	25	6.5	26.0	3.0	25	5.5	22.0	2.9
10-12 "	22	7.3	33.2	3.3	22	6.0	27.3	3.0
13-15 "	22	7.9	35.9	3.3	22	6.4	29.1	3.1
16-17 "	22	6.1	26.8	2.4	22	6.8	30.9	3.3
18-29 "	20	8.7	43.5	2.8	20	8.0	40.0	3.7
30-59 "	20	8.7	43.5	2.8	20	7.5	37.5	3.3
60 and above	20	8.6	43.0	4.1	20	6.4	32.0	3.4

Figure 3.3.3: Nutrient intake as % of requirement meeting by marginal farm households compared to rural Bangladeshi population



MF= Marginal Farm households, RP = Rural Population

3.4: Food Preferences among Marginal Farm Household members:

Food discripency or in other words mal-distribution of foods among the household members is also considered as the indicator of household food security. Figure 3.4.1 shows that in only one fourth (25.5%) of the marginal farm household members stated that they used to take meals together, but in the rest households (74.5%) the members used to take their meals rather separately. Household heads in 36.8 per cent households, while young children in 35.7 per cent households usually used to take meals first of all members in the family (Table 3.4.1).Other adult males and elderly members were also the first eater as mentioned by 5.9 and 4.0 per cent respondents respectively. Some 7.2 and 6.1 per cent respondents respectively stated adolescent males and females, while 4.0 per cent mentioned housewives were the first eater. But in 88.8 per cent of those households not eating meals together, housewife usually used to take meals last of all (Figure 3.4.2). Of course, household heads in 8.7 per cent households were reported to be the last man to take meals in the family.

It was also observed that female members of the marginal farm households were given less amount of food as compared to other members during food scarcity in the households (Table-3.4.2). It was found that about 99.1, 13.4, and 13.0 per cent respondents respectively mentioned that housewife, pregnant women and lactating women were usually given less amount of food during food searcity in the households. Servents of 23.2 per cent households were also given less amount of food.

Regarding food preferences in respect of good quality foods like fish, meat, egg, milk and fruits, it was found in Table 3.4.3, that the earning members /household heads of 96.2 per cent households were given preference to eat good quality foods in more quantity than other members. Male and female growing children were preferred only in 2 and 1 households respectively, while not a single household was found to give preference to pregnant women to eat these good quality foods in more amounts.

Figure 3.4.1: Distribution by habit of households members in eating meals together

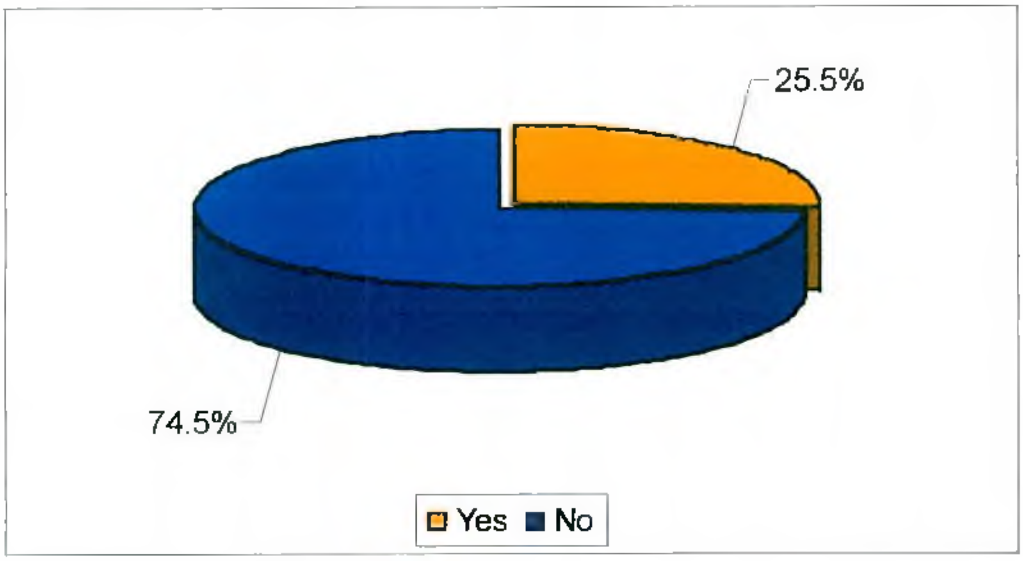


Table 3.4.1: Distribution of households by family member eating meals first of all in the family (Multiple responses)

Household members taking meals first of all		
Household members	**No**	**%**
Household head	138	36.8
Other adult males	22	5.9
Young children	134	35.7
Elderly members	15	4.0
Housewife	15	4.0
Adolescent males	27	7.2
Adolescent females	23	6.1
Others	1	0.3
Total responses	375	100.0

Figure 3.4.2: Distribution of households not eating meals together by family member taking meal last of all (N=161)

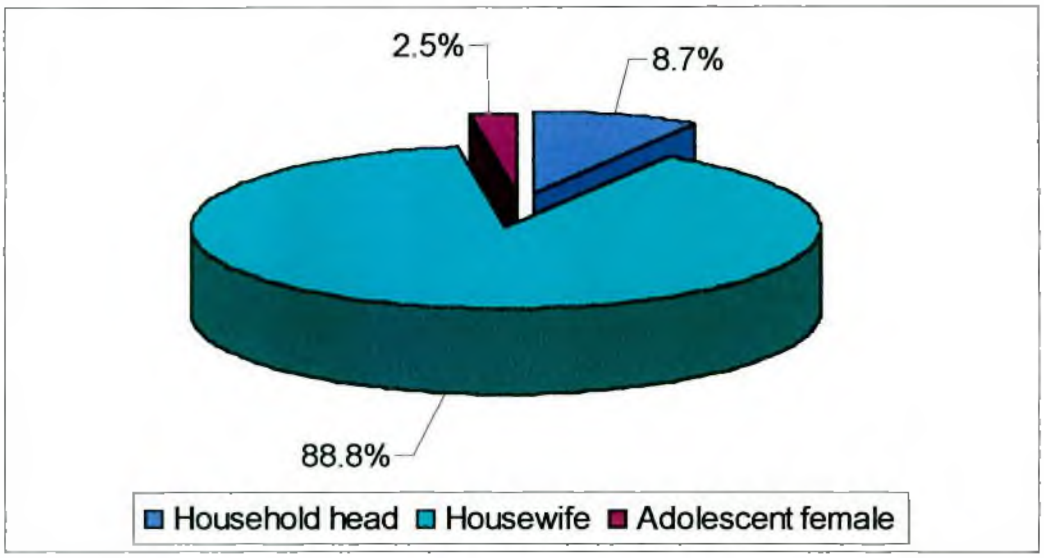


Table 3.4.2: Distribution of households by family member given less amount of food during food scarcity (Multiple responses)

Family members	No. of Households	Percentage
Adult male /Household head	3	1.4
Adult female /Housewife	214	99.1
Female adolescent (10-18 years)	2	0.9
Pregnant Women	29	13.4
Lactating Women	28	13.0
Servant /Maid servant	50	23.2

Table 3.4.3: Distribution of households by family members given preference in eating comparatively more good quality foods (fish, meat, egg, milk & fruits)

Household members given more good quality food	No. of Households	Percentage
Male growing children	2	0.9
Female growing children	1	0.5
Pregnant women	0	0.0
Lactating women	1	0.5
Earning male members /Household heads	208	96.2
Equally given to all the family members	4	1.9
Total	216	100.0

3.5 Anthropometric Measurements and Nutritional Status:

In this section the physical growth of the survey population in respect of anthropometric measurements such as Height, Weight and MAC is presented. In this study out of 1078 individuals, the anthropometric measurements could be made for only 1017 (94.3%) in the first round and 968 (89.8%) in the fourth round. A total of 804 (79.1%) subjects, of whom male 389 (48.4%) and female 415 (51.6%) were followed up consecutively in all the four rounds.

In this study, we have estimated the proportion of chronic energy deficiency among adult population, followed by adolescents (10-18 years) in respect of Body Mass Index (BMI). For 6-71 months and 6-9 years old children proportions of stunting, underweight, wasting were estimated by using Z-score and Gomez classification on comparing the observed heights and weights with NCHS reference values. Mid Arm Circumference (MAC) for age was estimated for children of 6-71 months only. Height for age and weight for age estimations were also determined for 10-17 years old adolescents.

Nutritional Status of Adult Population:

Nutritional status of adult members of marginal farm households in respect of body mass index (BMI) shows that 41.3 per cent of adults irrespective of sex were found to have normal physical status, while those suffering from thinness due to chronic energy deficiency (CED) were 58.1 per cent (Table 3.5.1). Chronic energy dificient people were 59.8 per cent at the beginning which decreased to 56.7 per cent in second round, again increased through 57.4 per cent in third to 58.3 per cent in the fourth round with an over all reduction of CED by 1.5 per cent.

The proportion of female adults having normal BMI was higher compared to males in all the rounds, while the proportion of adults suffering from thinness (CED) due to low BMI was higher in males than females upto third round and in the fourth round both the groups attained equal proportion (Table 3.5.2a). Chronic energy deficiency was found to be increased with age , where about 54 % in 18-39 years age group, 60.3 % in 40-59 years and as high as 83.4 % among elderly people were chronic energy deficient (Table 3.5.2b).

Table 3.5.1: Per cent distribution of nutritional status of adult population of marginal farm households according to BMI by rounds

Rounds	Nutritional Status			
	Thinness (CED) BMI < 18.5	Normal BMI between 18.5 to 24.9	Overweight BMI ≥ 25.0	Total
First Round (N=503)	59.8	39.6	0.6	100.0
Second Round (N= 464)	56.7	42.9	0.4	100.0
Third Round (N = 462)	57.4	42.2	0.4	100.0
Fourth Round (N= 465)	58.3	40.8	0.9	100.0
All Rounds (N=1894)	58.1	41.3	0.6	100.0

* Thinsess = BMI ∠ 5th Percentile: ∠18.5 (CED= Chronic Energy Deficiency)
** Normal = BMI between ∠5th and ≥ 85th Percentile = 18.5 to 24.9
*** Overweight = BMI ≥ 85th Percentile: ≥ 25.0

Table 3.5.2a: Per cent distribution of nutritional status of adult population according BMI by round and sex

Rounds	Nutritional Status									
	* Thinness (CED)			** Normal			*** Over weight			
	Male	Female	Both	Male	Female	Both	Male	Female	Both	Total
First Round	60.7	59.0	59.8	38.9	40.2	36.9	0.4	0.8	0.6	100.0
Second Round	58.5	55.0	56.7	41.5	44.2	42.9	0.0	0.8	0.4	100.0
Third Round	60.3	54.5	57.4	39.3	45.1	42.2	0.4	0.4	0.4	100.0
Fourth Round	58.3	58.3	58.3	40.4	41.3	40.8	1.3	0.4	0.9	100.0
All Rounds	59.5	56.7	58.1	40.0	42.7	41.3	0.5	0.6	0.6	100.0

* Thinness = BMI: ∠18.5 (CED= Chronic Energy Deficiency)
** Normal = BMI Between 18.5 to 24.9
*** Overweight = BMI ≥ 25.0

Table 3.5.2b: Per cent distribution of nutritional status of adult population of marginal farm households according to BMI by age groups

Age groups	Nutritional Status									
	* Thinness (CED)			** Normal			*** Over weight			Total
	M	F	B	M	F	B	M	F	B	
18-39 years	56.1	52.1	53.9	43.3	47.7	45.8	0.6	0.2	0.3	100.0
40-59 years	58.1	62.8	60.3	41.3	35.3	38.5	0.6	1.9	1.2	100.0
60 years +	83.7	83.0	83.4	16.3	17.0	16.6	0.0	0.0	0.0	100.0
Total	59.5	56.7	58.1	40.0	42.7	41.3	0.5	0.6	0.6	100.0

* Thinsess = BMI $\angle$ 5th Percentile : $\angle$18.5
** Normal = BMI between $\angle$5th and $\geq$ 85th Percentile = 18.5 to 24.9
*** Overweight = BMI $\geq$ 85th Percentile : $\geq$ 25.0

Nutritional Situation of Adolescents:

The nutritional status of adolescents in respect of height for age Z-score indicates that 65.4 per cent adolescent were stunted (Table 3.5.3). At the beginning, 64.8 per cent were stunted, the proportion of whom increased through 65.4 per cent in second round to 67.0 per cent in the third and then again decreased to 64.3 per cent in fourth round with an overall reduction of stunting by only 0.5 per cent. The proportion of stunting was higher in males (66.8%) than females (63.7%) throughout the study period. Regarding weight for age, 63.0 per cent of the adolescents were underweight, the proportion of which was much higher in males (68.9%) than females (56.2%) and same was the case in all rounds. The proportion of underweight continuously decreased from 68.7 per cent in first to 60.8 per cent in the fourth round indicating an improvement. The nutritional status of female adolescents was better off than that of males.

Nutritional status in respect of body mass index for adolescents (10-17 years) was classified according to percentiles for cut off points of BMI for age for adolescents as shown in Appendix Table C-1. It was found that about 54 per cent were normal (BMI between 18.5 and 24.9) and rest 46 per cent were found to have been suffering from chronic energy deficiency (Table 3.5.4). In all rounds female adolescents were found to have better nutritional status than males with lowest proportion of chronic energy deficiency among female adolescents (34.0%) in the third round.

Table 3.5.3: Per cent distribution of adolescents (10-17 years) based on Height for Age and Weight for Age Z-score by round and sex

Rounds	Height for Age			Weight for Age		
	Male	Female	Both	Male	Female	Both
First Round (N=179)	64.9	64.7	64.8	72.3	64.7	68.7
Second Round (N=179)	66.3	64.2	65.4	66.3	58.0	62.6
Third Round (N=185)	68.9	64.6	67.0	68.0	50.0	60.0
Fourth Round (N= 171)	67.0	61.4	64.3	69.3	51.8	60.8
All Rounds (N=714)	66.8	63.7	65.4	68.9	56.2	63.0

Table 3.5.4: Per cent distribution of nutritional status of adolescents (10-17 years) according to BMI by round and sex (N = 874)

Nutritional status	First Round (N=211)			Second Round (N= 215)			Third Round (N= 223)			Fourth Round (N= 225)			All Rounds (N= 874)		
	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B
Normal (Between 5th and 85th percentile)	43.1	47.4	45.0	48.3	64.9	55.8	47.2	66.0	55.6	54.5	65.7	59.6	48.3	61.2	54.1
Thinness (CED) (<5th percentile)	56.9	52.6	55.0	51.7	35.1	44.2	52.8	34.0	44.4	45.5	34.3	40.4	51.7	38.8	45.9
Overwight (≥ 85th percentile)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0			100.0			100.0			100.0			100.0		

Nutritional Status of Children aged 6-9 years:

Table 3.5.5 shows the mean values of anthropometric indicators of 6-9 years children. It shows that mean height and weight were 113.9 ± 9.0 cm and 18.1 ± 3.3 kg respectively, which were 90.0, 72.2 and 90.4 per cent of NCHS median for height for age, weight for age and weight for height respectively. The mean Z-score for both height for age and weight for age were less than -2 SD and – 2.1 SD respectively, while the value of weight for height Z-score was -1.1 SD.

Table 3.5.6 shows that 71.9 per cent children of 6-9 years were malnourished when both height for age and weight for age were considered. On the other hand, while considering both height for age and weight for height, 65.3 per cent were found to be malnourished. Children suffering from both stunting & underweight and both stunting & wasting were 49.4 and 6.1 per cent respectively. On an average 59.3, 12.0 and 62.0 per cent children were stunted, wasted and underweight respectively. Girls were less malnourished than boys in respect of both stunting and underweight and the situation was the reverse in respect of both stunting and wasting. If only stunting is considered girls were found to be more growth retarded than boys, while in respect of undereweight and wasting boys were found to be more affected than girls.

Round and sex-wise, 57.6 per cent children were stunted at the beginning, which increased to some extent by 1.6% throughout the study period with highest increase in the third round by 4.7 per cent compared to that of first round (Figure 3.5.1). Female children were more growth retarded than the boys. Stunting decreased in male children, while that increased in females during the course of the study with slight increase in males during second round and significant increase in females during third round.

Regarding weight for height Z-score, 12.0 per cent children of both sexes were wasted (Figure 3.5.2). The overall picture of wasting in females (10.9%) was found better than that of male children (13.1%). Prevalence of wasting significantly decreased in fourth round compared to first round. The number of wasted boys significantly decreased from

19.4 per cent in the first round to 10.2 per cent in the fourth with highest decrease in the third round to 8.6 per cent, while that in girls was decreased to some extent by 2.5 per cent over the study period with remarkable increase in wasting during second round to as high as 15.3 per cent.

Figure 3.5.3 shows that over all 62.0 per cent children were found to have been suffering from underweight. The prevalence of underweight continuously decreased from first round (67.0%) through the fourth (55.8%) by 11.2 per cent indicating an improvement of underweight situation over the study period. Significantly higher proportions of boys were underweight compared to that of girls in all rounds.

Table 3.5.7 shows that according to Gomez classification 95.6 per cent children were malnourished, of whom 60.6 and 8.0 per cent were second and third degree malnurished respectively. The prevalence of malnutrition decreased by 3.3 per cent from 97.5 per cent in the first round to 94.2 per cent in the fourth. Female children were more malnourished than males in all rounds except in the fourth round when the prevalence of malnutrition was found higher in males than females by 1.5 per cent.

Table 3.5.8 presents the comparative situation of nutritional status of 6-9 years old children as found in 1995-96 nutrition survey and in 1998-99. It reveals that stunting was more prevalent among the children of marginal farmers compared to rural children of all socio-economic strata indicating that the marginal farmer's children were chronically deficient in food intake which was manifested by stunting. Underweight for age among these children was also higher than that of rural children, but in respect wasting, situation was found better in marginal farmer's children (12.0%) than that of all rural children (18.4%).

Table 3.5.5: Mean, Standard deviation and Skewness of anthropometric indicators of children aged 6-9 years

Indicators	Children of marginal farm households in 1998-99		
	Mean	St. Deviation	Skewness
Height (cm)	113.9	9.0	-0.07
Weight (kg)	18.1	3.3	0.98
Height for age Z-score	-2.2	1.2	0.95
Weight for age Z-score	-2.1	0.9	2.64
Weight for height Z-score	-1.1	0.8	-0.17
Height for age (% median)	90.0	5.0	0.90
Weight for age (% median)	72.2	11.3	3.34
Weight for height (% median)	90.4	6.7	0.08

Table 3.5.6: Nutritional status of children (6-9 years) of marginal farm households by using Z-score by sex

Nutritional Status	Percentages		
	Male	Female	Both
Stunted and Underweight :			
Normal	24.8	31.4	28.1
Malnourished	75.2	68.6	71.9
Stunted but not underweight	5.9	13.8	9.9
Underweight but not stunted	16.8	8.4	12.6
Both stunted and underweight	52.5	46.4	49.4
Stunting and Wasting :			
Normal	33.3	36.0	34.7
Malnourished	66.7	64.0	65.3
Stunted but not wasted	53.6	53.1	53.3
Wasted but not stunted	8.0	3.8	5.9
Both stunted and wasted	5.1	7.1	6.1
Total stunted	58.4	60.2	59.3
Total wasted	13.1	10.9	12.0
Total underweight	69.3	54.8	62.0

Figure 3.5.1: Distribution of stunted children (6-9 years) using Z-score by round and sex

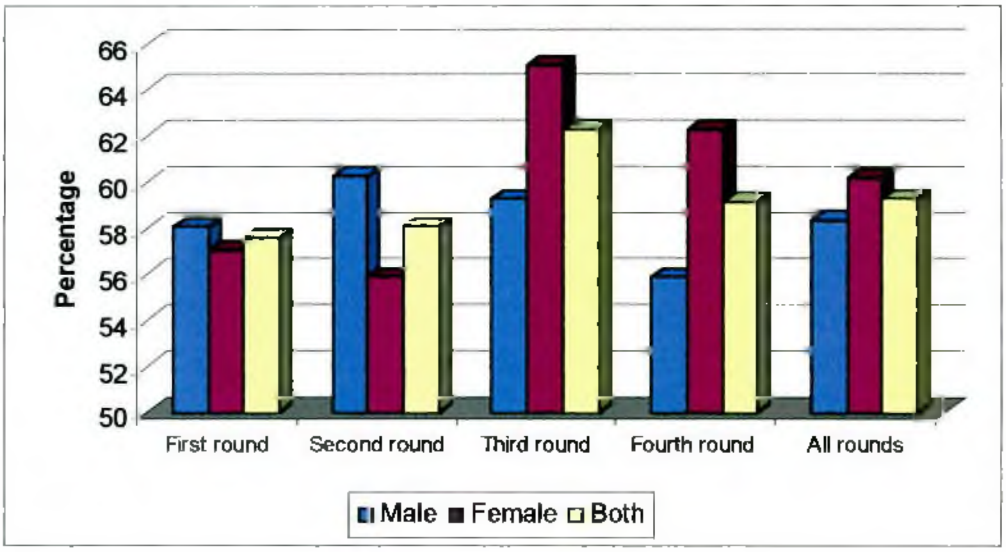


Figure 3.5.2: Distribution of wasted children (6-9yrs) by round and sex

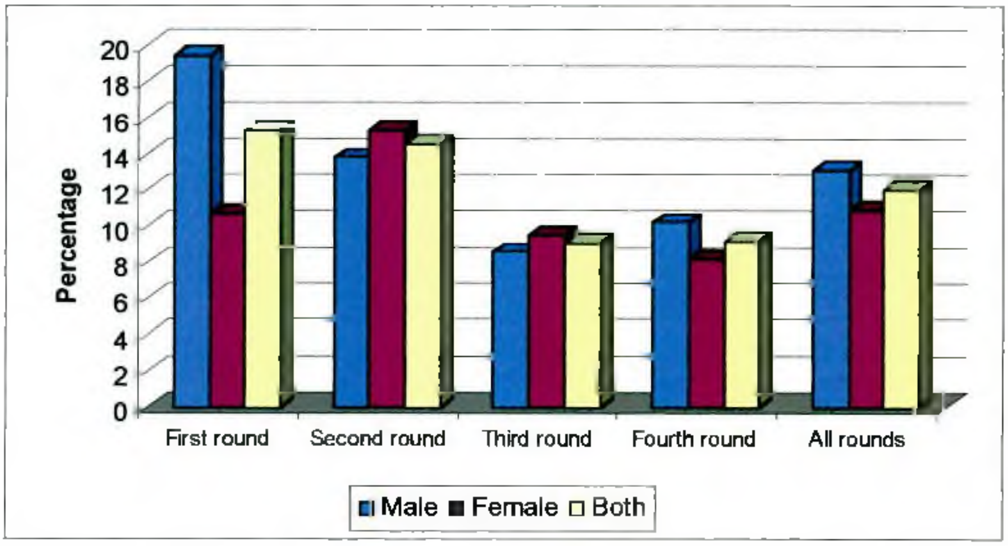


Figure 3.5.3: Distribution of underweight children (6-9 yrs) by round and sex

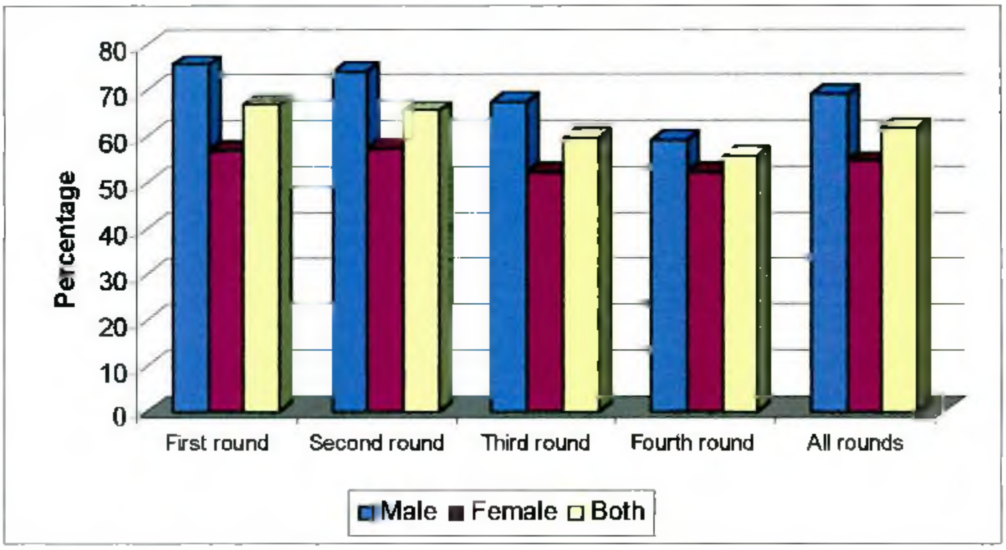


Table 3.5.7: Per cent distribution of children (6-9 yrs) by Gomez classification by round and sex

Rounds	Nutritional Status (weight for age median)												
	Normal			First Degree			Second Degree			Third Degree			Total
	M	F	B	M	F	B	M	F	B	M	F	B	
First Round	3.2	1.8	2.5	16.1	28.6	22.0	72.6	60.7	66.9	8.1	8.9	8.5	100.0
Second Round	5.2	3.4	4.3	20.7	28.8	24.8	69.0	55.9	62.4	5.2	11.9	8.5	100.0
Third Round	6.8	3.2	4.9	23.7	30.2	27.0	64.4	55.6	59.8	5.1	11.1	8.2	100.0
Fourth Round	5.1	6.6	5.8	35.6	32.8	34.2	54.2	52.5	53.3	5.1	8.2	6.7	100.0
All Rounds	5.0	3.8	4.4	24.0	30.1	27.0	65.1	56.1	60.6	5.9	10.0	8.0	100.0

Table 3.5.8: Comparison of nutritional status of rural children (6-9 years) as found in National Nutrition Survey, 95-96 and marginal farmer's children in 1998-99 by Z-score

Indicators	National Nutrition Survey 1995-96	Survey of Marginal Farm households 1998-99	Deference between the findings of two periods: 1995-96 and 1998-99
Height for age (-2SD & below)	52.5	59.3	+6.8
Weight for height (-2SD & below)	18.4	12.0	-6.4
Weight for age (-2SD & below)	59.4	62.0	+2.6
No. of population	756	477	
Reference standard used	NCHS	NCHS	
Population type	All rural children	Children of marginal farmers	

Nutritional Status of Children aged 6-71 months:

Table-3.5.9 presents the mean, standard deviation and skewness of the anthropometric indicators such as height, weight etc of the 6-71 months old children. It shows that mean height and weight of marginal farmer's children were 85.5 ±12.8 cm and 10.9 ± 2.8 kg, which were 90.1, 74.9 and 90.4 per cent of NCHS median height for age, weight for age and weight for height respectively. The mean Z-score of both height for age and weight for age were less than –2 standard deviation i.e. below the cut-off point for distinguishing malnutrition, while the mean value of weight for height Z-score was -1.1 SD.

Table 3.5.10 shows that while considering both stunting and underweight, 78.5 per cent children of 6-71 months were found malnourished, of whom 55.7 per cent were simultaneously stunted and underweight. Nutritional status from the point of view of stunting and wasting, 73 per cent of the children were malnourished including 9.3 per cent both stunted and wasted. However, the proportion of total children suffering form chronic undernutrition i.e. stunting was nearly 70 per cent and that of wasting and underweight were 12.9 and 64.8 per cent respectively. Stunting and underweight rates among girls were significantly higher than that of the boys, but wasting rate was higher in boys than girls.

Figure 3.5.4 shows the status of stunting, underweight and wasting among 6-71 months old children by different rounds. It was found that stunting rate was more or less same in first (68.6%), second (68.9%) and fourth round (68.3%) with slight increase by 3% to 71.6% in third round. On the other hand, wasting rate increased from 11.1 per cent in the first round to 20.3 per cent in the second round, which again decreased in third round and continued to decrease in the fourth round to 6.7 per cent with an overall reduction of wasting by 4.4 per cent. Underweight rate followed the similar trend as stunting upto third round and then decreased to 57.8 per cent in the fourth round, which was 66.0 per cent at the beginning.

Table 3.5.11 presents the distribution of stunted children (6-71 months) according to Z-score by location and round. It was found that on an average 69.4 per cent children were stunted, and 32.3 per cent were severely stunted (-3SD & below HFA). The proportion of stunting remained more or less same throughout the study period. Severely stunted children showed the similar trend of increase and decrease with corresponding changes in total stunting during different rounds. By location, severe stunting was 35.6, 29.5, 33.8 and 29.2 per cent respectively in Nokla, Laksham, Uzirpur and Raigonj. In the first round severe stunting in Nokla, Laksham and Raygonj respectively were 34.1, 34.7 and 31.4 per cent, which correspondingly decreased to 32.6, 27.3 and 24.3 per cent in the fourth round indicating improvement of growth retardation. But severe stunting in Uzirpur increased from 28.3 per cent in first round to 33.9 per cent in the fourth indicating the deterioration of the situation. Prevalence of stunting increased over the study period by 5 per cent in Uzirpur and by 7.8 per cent in Raigonj, while that decreased in Laksham by 12.1 per cent, but the situation remained more or less unchanged in Nokla.

Figure 3.5.5 provides a comparative picture of stunting between boys and girls and shows that the nutritional status of boys was better compeared to that of girls. The proportion of stunting among boys was 66.5 per cent, while that was 72.4 per cent among girls. The proportion of stunting among boys was decreased slightly by only 0.8 per cent over the study period with an increase in the third round by 4.7 per cent. But stunting among girls progressively increased upto third round and then slightly decreased by only 1.1 per cent in the fourth round.

As regards wasting situation, it was found that on an average 12.8 per cent were wasted including 1.2 per cent severely wasted (Table 3.5.12). The prevalence of wasting decreased from 11.1 per cent in the first round to 6.7 per cent in the fourth round showing an improvement during the study period. By location, wasting was the highest in Laksham (19.7% including 2.9% severe) and lowest in Uzirpur (6.4% including 0.4% severe). In the first round highest prevalence of wasting was found in Raigonj (17.1%), which continuously decreased to 5.4 per cent by fourth round. It is interesting to note that there was no child in Raigonj suffering from severe wasting in any round compared to other locations. Again, wasting rate was significantly lower in Uzirpur throughout the study period compared to other locations, while that was the highest in Laksham althrough except first round. Severe wasting was also higher in Laksham in all rounds compared to other locations.

From Figure 3.5.6 it is evident that higher proportions of male children were found to have been suffering from wasting compared to their female counterparts. Wasting rate significantly increased in both male and female groups in second round and then decreased through third round till fourth round showing an overall decrease of wasting by 3.0 and 6.0 per cent respectively.

Among the children 64.8 per cent were underweight including 22.7% severely underweight (Table 3.5.13). The prevalence of underweight was decreased by 8.2 per cent and that of severe underweight by 6.2 per cent over the study period indicating an improvement of the nutritional status of the children. By location, prevalence of underweight was highest in Nokla (70.0%) and lowest in Raigonj (60.5%), but severe underweight was highest in Laksham (27.7%) compared to other locations. By rounds, highest proportion of underweight children was found in Nokla (70.4%) in first round, which remained the highest (65.2%) at the end in the same location, while the situation in Uzirpur was vice-versa. The proportion of underweight increased in Nokla and Uzirpur, while decreased in Laksham and Raigonj during second round, but in the third round the proportion though decreased in Nokla but highly increased in other locations, while in the fourth round the proportion of underweight children decreased in all the locations.

Female children were found more underweight than the males in all rounds and over all 60.1 per cent boys, while 69.8 per cent girls were underweight (Figure 3.5.7). The prevalence of underweight in boys decreased in second round and then increased in the third round by 4.6 per cent, but again significantly drcreased in fourth round by 12.1 per cent with an over all decrease of underweight by 7.5 per cent. In case of females, underweight increased upto third round and then significantly decreased by 12.4 per cent in the fourth round, with an over all reduction of underweigh by 8.7 per cent.

Nutritional status by Gomez classification shows that on an average 94.5 per children were malnourished, of them 44.5, 46.0 and 4.0 per cent were found to have been suffering from first degree, second and third degree malnutrition respectively (Figure 3.5.8). The prevalence of malnutrition was highest in Nokla (97.2%) and lowest in Raigonj (92.4%). Lowest proportion of third degree malnourished children (1.7%) was found in Uzirpur, while the overall situation was comparatively better in Raigonj. In the first round, 94.7 per cent children were malnourished including 52.1 per cent combined second and third degree malnourished, which decreased by 1.9% to 92.8 per cent over the study period (Figure 3.5.9). The proportion of malnourished children increased during second round by 0.9 per cent and again decreased in third round by 0.6 per cent and continued to decrease in fourth round by 2.2 per cent. The proportion of severely malnourished children increased to as high as 5.6 per in third round, which again remarkably decreased to 1.1 per cent in fourth round. The proportion of malnutrition was higher althrough in females than that of males with an exception in first round. Although the proportion of normal female children in first round was higher than that of males, the proportion of sever malnutrition in them was about two fold of the male children (Table 3.5.14). The situation was improved significantly in males over the study period with progressive decrease in the proportions of third and second degree malnourished children. In case of female children, although the over all malnutrition increased by 1.8 per cent, yet the proportion of severe and moderately malnourished children markedly decreased, even there was none to suffer from third degree malnutrition in the fourth round.

Regarding mid arm circumference (MAC) Table 3.5.15 shows that 34.6 per cent children were malnourished including 7.9 and 6.4 per cent severely and very severely malnourished respectively.The level of MAC showed gradual detrioration of the situation with an exception in fourth round. However, the over all prevalence was decreased by 5.5 per cent. The nutritional situation was comparatively better in male children than females in all rounds, but the proportion of very severely malnourished children was higher in males than females during third and fourth rounds (Table 3.5.16).

Table 3.5.17 shows the comparison of nutritional status of 6-71 months old rural children as assessed in different survey periods and in marginal farmer's children in 1998-99. It appears that the proportion of stunting was higher, while that of wasting was much lower among the marginal farmer's children compared to rural children in previous different survey periods.The proportion of underweight was also lower to some extent compared to the previous survey findings.

Table 3.5.9: Mean, standard deviation and skewness of anthropometric indicators of 6-71 months old children of marginal farmers

Indicators	Children of marginal farmers in 1998-99		
	Mean	St. Deviation	Skewness
Height (cm)	85.5	12.8	0.72
Weight (kg)	10.9	2.8	-0.04
Height for age Z-score	-2.5	1.2	1.21
Weight for age Z-score	-2.3	0.9	-0.49
Weight for height Z-score	-1.1	0.9	-1.18
Height for age (% median)	90.1	6.0	7.56
Weight for age (% median)	74.9	9.4	-0.38
Weight for height (% median)	90.4	8.8	-0.36

Table 3.5.10: Nutritional status of children aged 6-71 months old using Z-score by sex.

Nutritional status (N=731)	Percentages		
	Both	Male	Female
Stunted and Underweight :			
Normal	21.5	24.1	18.7
Malnourished	78.5	75.9	81.3
Stunted but not underweight	13.7	15.8	11.5
Underweight but not stunted	9.2	9.4	8.9
Both stunted and underweight	55.7	50.7	60.9
Stunting and Wasting :			
Normal	27.0	28.2	25.7
Malnourished	73.0	71.8	74.3
Stunted but not wasted	60.1	57.0	63.4
Wasted but not stunted	3.6	5.1	2.0
Both stunted and wasted	9.3	9.7	8.9
Total stunted	69.4	66.5	72.4
Total wasted	12.9	14.8	10.9
Total underweight	64.8	60.1	69.8

Figure 3.5.4: Stunting, Underweight and Wasting among 6-71 months children by round

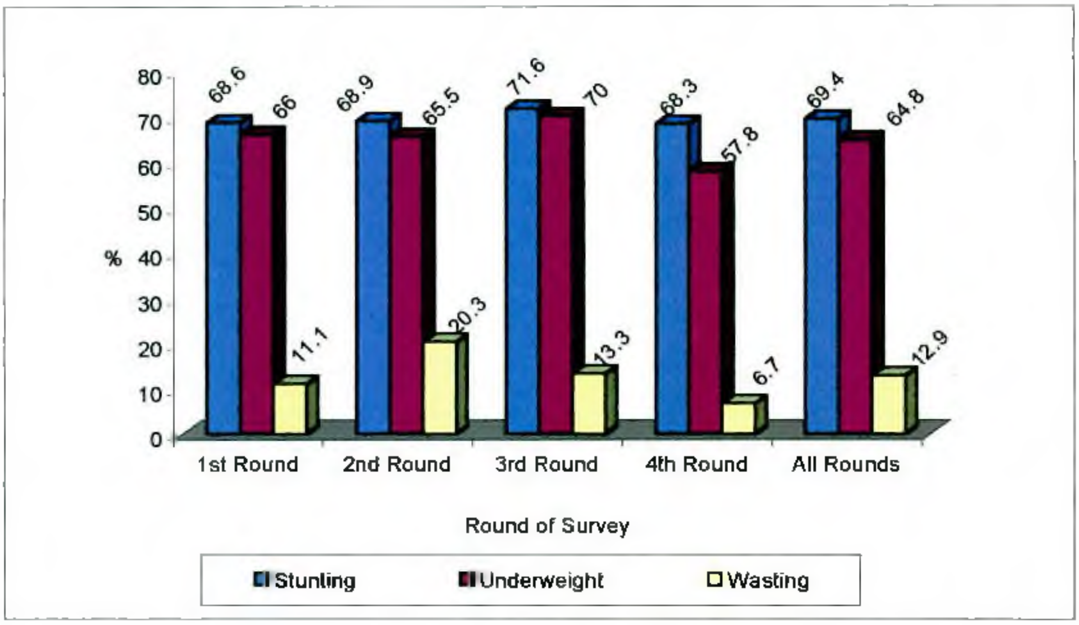


Table 3.5.11: Per cent distribution of stunted children (6-71 months) by location and round

Rounds	Nokla		Laksham		Uzirpur		Raigonj		All locations	
	Stunted *	Severely stunted **	Stunted *	Severely stunted **	Stunted *	Severely stunted **	Stunted *	Severely stunted **	Stunted *	Severely stunted **
First Round (N=188)	72.7	34.1	73.5	34.7	70.0	28.3	54.3	31.4	68.6	31.9
Second Round (N=183)	74.5	38.3	61.9	26.2	74.1	36.2	61.1	27.8	68.9	32.8
Third Round (N=180)	69.6	37.0	76.3	28.9	76.7	36.7	61.1	33.3	71.6	34.4
Fourth Round (N=180)	72.1	32.6	61.4	27.3	75.0	33.9	62.1	24.3	68.3	30.0
All Round (N=731)	72.3	35.6	68.2	29.5	74.0	33.8	59.8	29.2	69.4	32.3

* Stunted = - 2.00 SD and below HFA
** Severely stunted = - 3.00 SD and below HFA

Figure 3.5.5: Distribution of stunted children (6-71 months) by round and sex

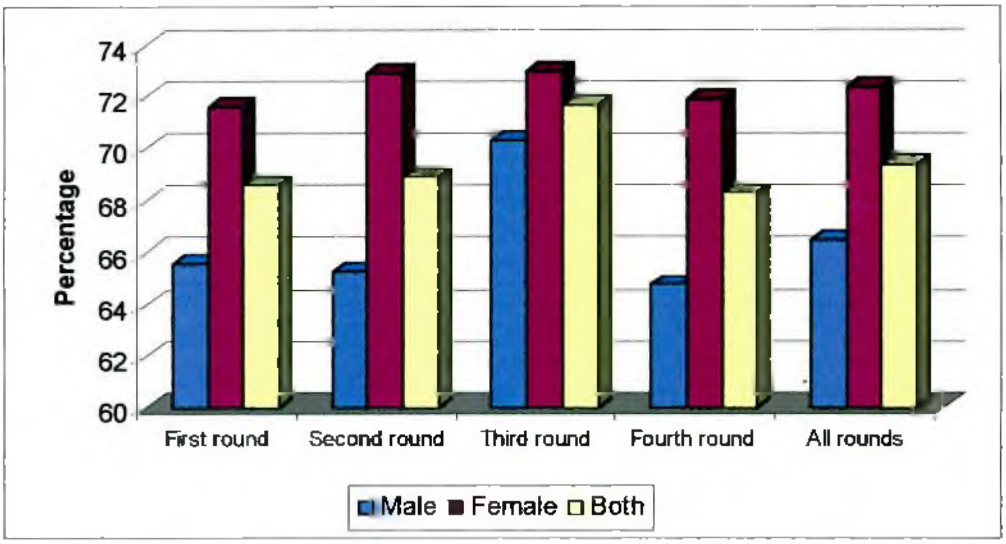


Table 3.5.12: Per cent distribution of wasted children (6-71 months) by location and round

Rounds	Nokla		Laksham		Uzirpur		Raigonj		All locations	
	Wasted *	Severely Wasted **	Wasted *	Severely Wasted **	Wasted *	Severely Wasted **	Wasted *	Severely Wasted **	Wasted *	Severely Wasted **
First Round	13.6	0.0	14.2	2.0	3.3	0.0	17.1	0.0	11.1	0.5
Second Round	25.6	4.3	33.4	4.8	8.8	1.8	16.7	0.0	20.3	2.7
Third Round	15.2	2.2	15.8	2.6	10.0	0.0	13.9	0.0	13.3	1.1
Fourth Round	2.3	0.0	15.9	2.3	3.6	0.0	5.4	0.0	6.7	0.6
All Rounds	14.5	1.7	19.7	2.9	6.4	0.4	13.2	0.0	12.8	12.2

* Wasted = - 2.00 SD and below WFH

** Severely Wasted = - 3.00 SD and below WFH

Figure 3.5.6: Distribution of wasted children (6-71 months) by round and sex

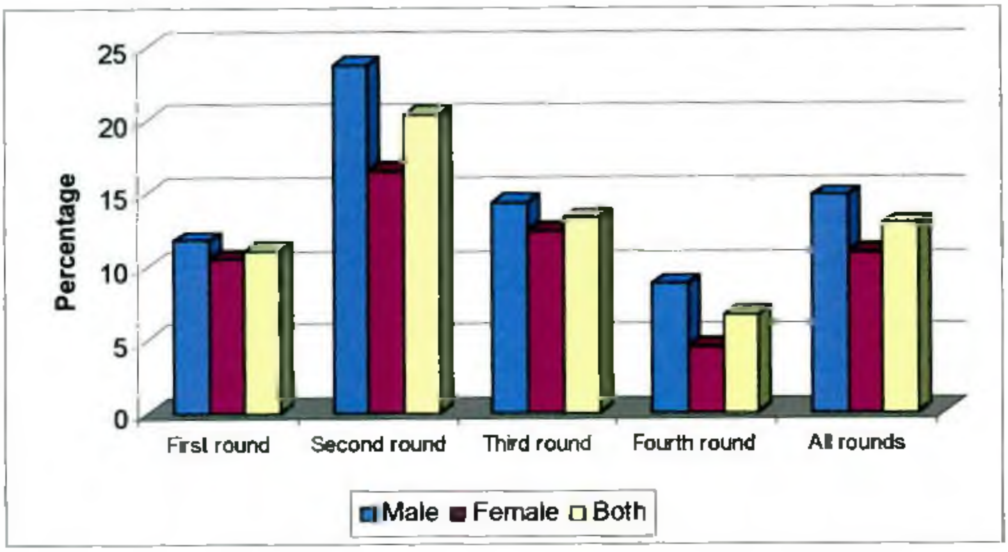


Table 3.5.13: Per cent distribution of underweight children (6-71 months) by location and rounds

Rounds	Nokla		Laksham		Uzirpur		Raigonj		All locations	
	Under weight *	Severely Underweight **	Under weight *	Severely Underweight **	Under weight *	Severely Underweight **	Under weight *	Severely Underweight **	Under weight *	Severely Underweight **
First Round	70.4	29.5	69.4	30.6	58.3	15.0	68.6	20.0	66.0	23.4
Second Round	74.5	27.7	66.7	28.6	63.8	25.9	55.5	22.2	65.5	26.2
Third Round	69.6	23.9	76.3	28.9	70.0	23.3	63.8	19.4	70.0	23.9
Fourth Round	65.2	23.3	63.6	22.7	50.0	10.7	54.0	13.5	57.8	17.2
All Rounds	70.0	26.1	68.7	27.7	60.7	18.8	60.5	18.8	64.8	22.7

* Underweight = - 2.00 SD and below WFA

** Severely Underweight = - 3.00 SD and below WFA

Figure 3.5.7: Distribution of underweight children (6-71 months) by round and sex

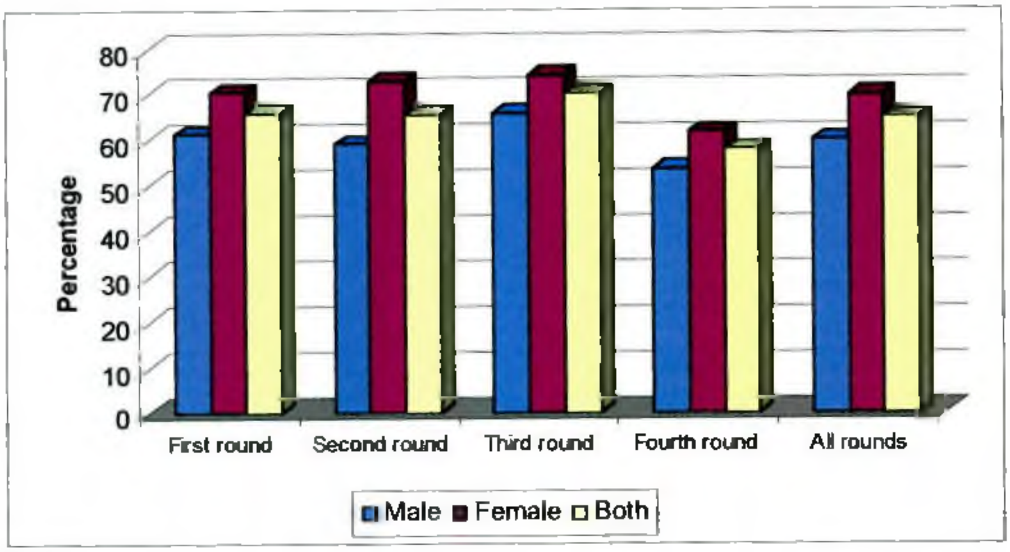


Figure 3.5.8: Nutritional status of children 6-71 months old by Gomezclassification by location

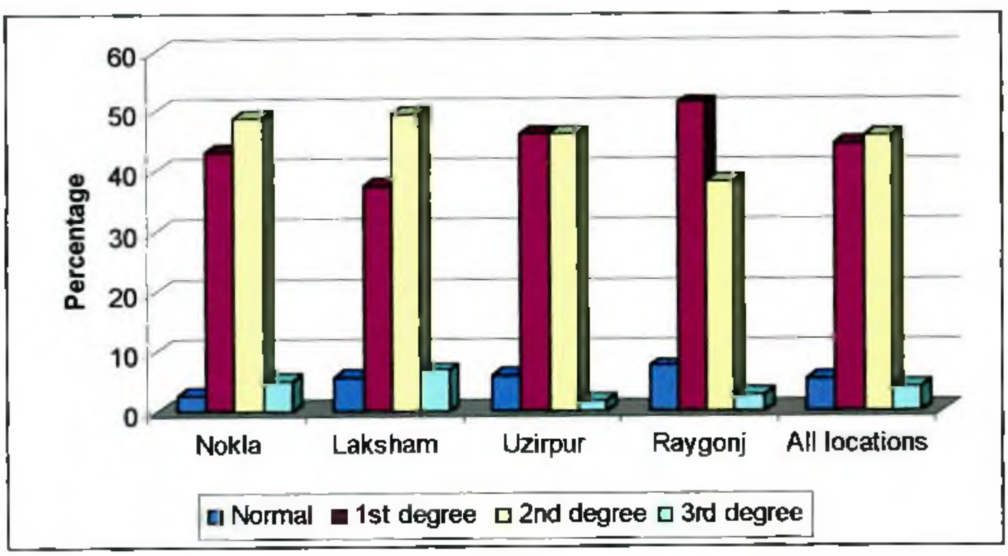


Figure 3.5.9: Nutritional Status of children (6-71 months) by Gomez classification by round

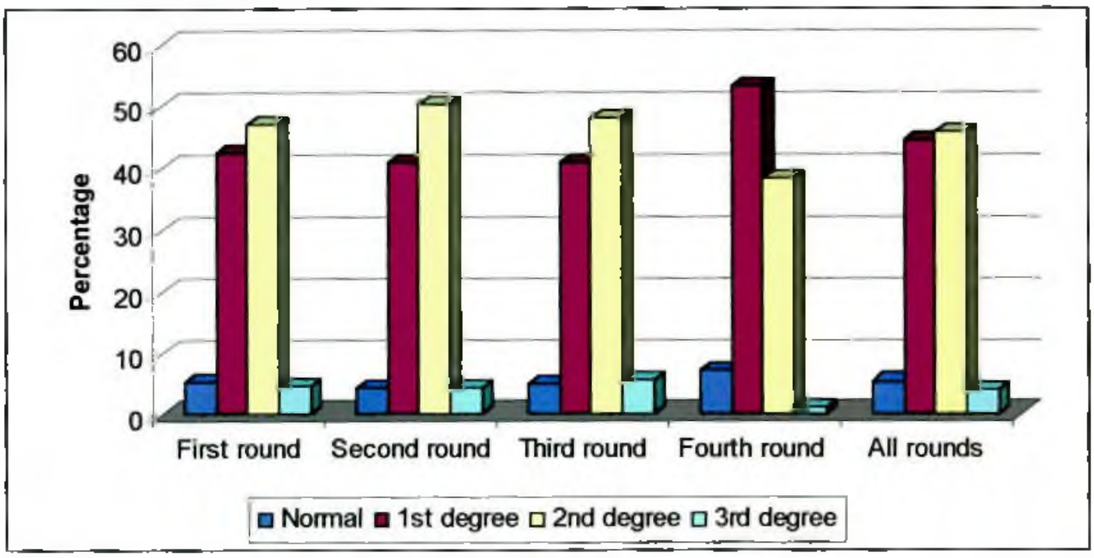


Table 3.5.14: Nutritional status of children (6-71 months) according to Gomez classification by round and sex

Round	Nutritional Status (Weight for Age median)								Total
	Normal		First degree		Second degree		Third degree		
	Male	Female	Male	Female	Male	Female	Male	Female	
First Round (N=188)	4.3	6.3	48.4	36.8	44.1	50.5	3.2	6.3	100.0
Second Round (N=183)	6.1	2.4	44.9	36.5	42.9	58.8	6.1	2.4	100.0
Third Round (N=180)	7.7	2.2	38.5	43.8	45.1	51.7	8.8	2.2	100.0
Fourth Round (N=180)	9.9	4.5	54.9	51.7	33.0	43.8	2.2	0.0	100.0
All Rounds (Average)	5.5		44.5		46.1		4.0		100.0

Table 3.5.15: Distribution of children (6-71 months) by different categories of MAC by rounds

MAC (cm)	First Round		Second Round		Third Round		Fourth Round		All Rounds	
	No.	%	No.	%	No.	%	No.	%	No.	%
<11.0	5	2.6	12	6.2	19	9.6	14	7.3	50	6.4
11.0 - 12.4	17	8.9	17	8.8	16	8.1	11	5.7	61	7.9
12.5 - 13.4	33	17.2	40	20.6	44	22.2	41	21.2	158	20.3
≥ 13.5	137	71.3	125	64.4	119	60.1	127	65.8	508	65.4
Total	192	100.0	194	100.0	198	100.0	193	100.0	777	100.0

Table 3.5.16: Per cent distribution of children (6-71) by different categories of MAC by round and sex

MAC (cm)	First Round		Second Round		Third Round		Fourth Round		All Rounds		
	M	F	M	F	M	F	M	F	M	F	B
<11.0	3.2	2.1	3.0	9.6	11.8	7.3	8.2	6.3	6.6	6.3	6.4
11.0 - 12.4	6.3	11.3	6.0	11.7	6.9	9.4	5.1	6.3	6.1	9.7	7.9
12.5 - 13.4	14.7	19.6	18.0	23.4	19.6	25.0	18.4	24.2	17.7	23.0	20.3
≥ 13.5	75.8	67.0	73.0	55.3	61.7	58.3	68.3	63.2	69.6	61.0	65.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Population measured	95	97	100	94	102	96	98	95	395	382	777

Table 3.5.17: Comparison of nutritional status of children (6-71 months) between the findings of different surveys by Z- score

Indicators	Type of population surveyed	BBS 1992	INFS (BNNS) 1995-96	Study of marginal farm households 1998-99	Difference between 1995-96 and 1998-99 surveys
Height for Age (-2SD & below)	Rural	65.8	63.0	69.4	+6.4
Weight for Height (-2SD & below)	Rural	16.9	17.5	12.9	-4.6
Weight for Age (-2SD & below)	Rural	69.8	66.0	64.8	-1.2
Sample size	Rural	1325	897	731	
Reference standard used		NCHS	NCHS	NCHS	

BBS = Bangladesh Bureau of Statistics.

INFS = Institute of Nutrition and Food Science, University of Dhaka.

BNNS = Bangladesh National Nutrition Survey.

3.6: Nutritional Deficiency Disorders, Morbidity, Sanitation and Immunization:

Regarding nutritional deficiency symptoms, Table 3.6.1 indicates that 20.8 per cent of the total population was found to have been suffering from dental caries. Prevalences of enlarged thyroid gland, angular stomatitis and nightblindness were 13.0, 12.0 and 1.5 per cent respectively. The population suffering from discolouration of hair and sparse hair were 3.2 and 0.5 per cent respectively. A few less than two per cent (1.7%) were also found to have been suffering from dermatosis. In Nokla and Raiganj the prevalence of nightblindness and enlarged thyroid gland respectively were highest, since these two areas are generally included in the goitre endemic areas of the Bangladesh.

The situation of nutritional deficiency symptoms in different rounds showed that the prevalence of almost all the nutritional deficiency symptoms had decreased over time (Table 3.6.2). The prevalence of sparce hair, discolouration of hair, nightblindness, cheilosis and dental caries was higher, while that of enlarged thyroid gland was much higher among females than the males. On the other hand, angular stomatitis, swollen red gum and dermatosis were found to be more prevalent among males than their female counterparts (Table 3.6.3).

Morbidity Pattern of Marginal Farm Household:

Almost half of the study population (47.4%) was found to be diseased. Morbidity pattern shows that the prevalence of Fever/cold was 55.3 per cent which was highest among diseases followed by Dysentery 19.2 per cent, Diarrhoea 11.3 per cent and Gastric ulcer 3.2 per cent. Some 2.4 and 1.1 per cent household members were found to have been suffering from Scabies and Measles respectively. Only 15, 4 and another 4 persons were reported to have suffered from Jaundice, Typhoid and Heart-disease respectively. Of course, 6.3% reported that they had suffered from other illnesses which were not specifically identified. Prevalence rate per 1000 population for Fever/cold, Dysentery, Diarrhoea, Scabies, Gestric ulcer and Measles were found to be 261.1, 91.1, 53.8, 11.5, 15.4 and 5.0 respectively (Table 3.6.4). By round, the percentages of diseased persons significantly decreased from 59.1 per cent in the first round through second and third to

34.2 per cent in the fourth round with slight increase in the third round compared to second round by 4.4 per cent. Morbidity of Fever/cold, Measles and Scabies found in the first round were 53.3, 2.8 and 3.7 per cent respectively, which decreased to 52.5, 0.3 and 0.0 per cent respectively in the fourth round. The morbidity of Dysentery and Gestric ulcer were increased from 11.5 and 3.7 per cent to 21.2 and 4.0 per cent respectively in course of the study. Prevalence of diarrhea significantly decreased by 7.6 % from 14.5 per cent in the first round to 6.9 per cent in the second round and then again increased through third round (9.5%) to 14.6 per cent in the fourth round.

Regarding type of treatment received by the diseased persons showed that 78.6 per cent received allopathic treatment as against 16.3 per cent who did not receive any sort of treatment. Only 3.2 per cent adopted homeopathic treatment, while traditional curative measure such as kabiraji was adopted by 1.7 per cent patients. By disease, 78.9, 84.9, 83.6, 66.7, 72.5, 85.3 and 57.8 per cent patients respectively received allopathic treatment for Fever/Cold, Dysentery, Diarrhoea, Jaundice, Gestric ulcer and other non-specific diseases, while that received by 100 per cent patients suffered from Pneumonia, Typhoid and Heart-disease respectively. About 64 per cent patients suffering from measles did not adopt any sort of treatment (Table 3.6.5). Reasons for non- treatment as stated by non-receiving group indicated that 55.9 per cent stated negligence, while 39.4 per cent pointed out their inability due to poor economic condition as the main cause of non-treatment (Figure 3.6.1). Lack of communication/ transportation and taboos respectively were mentioned by 1.2 and 3.5 per cent patients as the cause of non-treatment.

Vitamin A distribution and Immunization coverage:

Figure 3.6.2 presents the Vitamin A distribution coverage among under-6 years children. It shows that only about 21 per cent children were covered by Vitamin A capsule feeding programme as against 79 per cent who did not receive it. This too low coverage might be due to the fact that the mothers or the responsible family members of the marginal farm households were neither conscious enough about the need of immunization, nor could inform the interviewer correctly whether their children had taken Vitamin A capsule or not. Regarding immunization coverage among under five years old children it was found that 90.4, 73.2, 72.9 and 72.2 per cent children were given complete doses of BCG,DPT, Polio and Measles respectively (Table 3.6.6).

Sanitation or Hygienic Condition of the Marginal Farm Households:

Table 3.6.7 presents the distribution of marginal farm households by use of water by sources. It was found that 94.9 per cent of study households used tube-well water for drinking purpose, while in two thirds of the households (67.6%) it was also used for cooking and washing purposes. The residents of 4.2 and 0.9 per cent households used river /canal and pond water for drinking respectively. It is evident from the Table that although about 95% of the study households have access to safe drinking water, yet a good number of households did not use tube-well water for cooking and washing. Some 19.9 and 12.5 per cent households were found still using pond and river /canal water for cooking and washing purpose.

Regarding latrine facilities in the marginal farm households, it was found that there was no latrine in 28 households (13.0%) as against in 7.4 per cent households there were healthy i.e. sanitary / water sealed latrines (Figure 3.6.3). Open or hanging type latrine was found in 16.6 per cent households, while in the majority of the households (63%) latrine was found made on a definite hole / well. Regarding hand washing practice after defecation, the members of about 97 per cent households were found to use hygienic practice of hand cleaning of whom 94.9 and 2.3 per cent respectively were reported to use ash /mud & water and soap & water, while only water was used by the members of 6 households (Figure 3.6.4). It was reported that the members of about 61 per cent households were using sandle / shoe while going to latrine for defecation (Figure 3.6.5).

Table 3.6.1: Distribution of marginal farm household members suffering from different nutritional deficiency symptoms by location

Nutritional Deficiency Symptoms	Nokla		Laksham		Uzirpur		Raigonj		All Locations	
	No.	%	No.	%	No.	%	No.	%	No.	%
Sparse hair	8	0.8	8	0.7	3	0.3	4	0.4	23	0.5
Discoloured hair	38	3.8	52	4.3	42	3.6	12	1.1	144	3.2
Night Blindness	20	2.0	19	1.6	5	0.4	22	2.1	66	1.5
Bitot's Spot	7	0.7	18	1.5	7	0.6	13	1.2	45	1.0
Angular Stomatities	215	21.8	142	11.6	69	5.9	105	9.9	531	12.0
Cheilosis	8	0.8	9	0.7	0	0.0	3	0.3	20	0.5
Swollen Red Gums	1	0.1	14	1.1	6	0.5	0	0.0	21	0.5
Bleeding Gums	6	0.6	4	0.3	10	0.9	2	0.2	22	0.5
Dental Caries	151	15.3	218	17.9	299	25.7	252	23.8	920	20.8
Swollen Red Papillae	29	2.9	11	0.9	2	0.2	3	0.3	45	1.0
Enlarged Thyroid Gland	192	19.4	49	4.0	15	1.3	320	30.2	576	13.0
Dermatosis	40	4.0	14	1.1	10	0.9	11	1.0	75	1.7
Population Examined	988		1220		1164		1060		4432	

Table 3.6.2: Distribution of marginal farm household members suffering from different nutritional deficiency symptoms by rounds

Nutritional Deficiency Symptoms	First Round		Second Round		Third Round		Fourth Round		All Rounds	
	No.	%	No.	%	No.	%	No.	%	No.	%
Sparse hair	8	0.7	7	0.6	3	0.3	5	0.5	23	0.5
Discoloured hair	35	3.2	34	3.1	35	3.2	40	3.6	144	3.2
Night Blindness	23	2.1	20	1.8	12	1.1	11	1.0	66	1.5
Bitot's Spot	19	1.7	16	1.4	6	0.5	4	0.4	45	1.0
Angular Stomatities	184	16.6	68	6.1	122	11.0	157	14.2	531	12.0
Cheilosis	8	0.7	2	0.2	0	0.0	10	0.9	20	0.5
Swollen Red Gums	13	1.2	4	0.4	2	0.2	2	0.2	21	0.5
Bleeding Gums	10	0.9	6	0.5	3	0.3	3	0.3	22	0.5
Dental Caries	246	22.2	223	20.1	228	20.6	223	20.1	920	20.8
Swollen Red Papillae	24	2.2	6	0.5	6	0.5	9	0.8	45	1.0
Enlarged Thyroid Gland	151	13.6	143	12.9	145	13.1	137	12.4	576	13.0
Dermatosis	33	3.0	18	1.6	15	1.4	9	0.8	75	1.7
Population Examined	1108		1108		1108		1108		4432	

Table 3.6.3: Distribution of household members suffering from different nutritional deficiency symptoms by sex

Nutritional Deficiency Symptoms	Sex Groups		
	Male	Female	Both
Sparse hair	0.5	0.6	0.5
	(11)	(12)	(23)
Discoloured hair	2.3	4.2	3.2
	(53)	(89)	(142)
Night Blindness	1.2	1.8	1.5
	(28)	(38)	(66)
Bitot's Spot	1.0	1.0	1.0
	(23)	(23)	(46)
Angular Stomatites	13.0	10.9	12.0
	(299)	(232)	(531)
Cheilosis	0.3	0.7	0.5
	(7)	(15)	(22)
Swollen Red Gum	0.7	0.2	0.5
	(16)	(4)	(20)
Bleeding Gums	0.4	0.6	0.5
	(9)	(13)	(22)
Dental Caries	19.2	22.4	20.8
	(442)	(477)	(919)
Swollen Red Papillae	0.9	1.1	1.0
	(21)	(23)	(44)
Enlarged Thyroid Gland	9.0	17.3	13.0
	(207)	(368)	(575)
Dermatosis	1.8	1.6	1.7
	(41)	(34)	(75)
Population Examined	2303	2129	4432
No.of Diseased Persons	1157 (50.2%)	1328 (62.4%)	2488 (56.1%)

Table 3.6.4: Distribution of marginal farm household members suffering from various diseases by rounds

Disease Name	First Round		Second Round		Third Round		Fourth Round		All Rounds		Prevalence rate/1000
	No.	%	No.	%	No.	%	No.	%	No.	%	
Fever/cold	349	53.3	287	56.3	325	58.2	199	52.5	1160	55.3	262.1
ARI/Pneumonia	1	0.1	-	-	-	-	-	-	1	0.1	-
Measles	18	2.8	3	0.6	-	-	1	0.3	22	1.1	5.0
Dysentery	75	11.5	125	24.6	123	22.0	80	21.2	403	19.2	91.1
Diarrhoea	95	14.5	35	6.9	53	9.5	55	14.6	238	11.3	53.8
Jaundice	6	0.9	3	0.6	3	0.6	3	0.8	15	0.7	3.4
Typhoid	1	0.1	3	0.6	-	-	-	-	4	0.2	0.9
Scabies	24	3.7	21	4.1	6	1.1	-	-	51	2.4	11.5
Heart-Disease	3	0.5	1	0.2	-	-	-	-	4	0.2	0.9
Gastric Ulcer	24	3.7	9	1.8	20	3.6	15	4.0	68	3.2	15.4
Others	58	8.9	22	4.3	28	5.0	25	6.6	133	6.3	30.0
Total	654	100.0	509	100.0	558	100.0	378	100.0	1861	100.0	474.2
% of diseased Population	59.1		46.0		50.4		34.2		47.4		

Table 3.6.5: Distribution of diseased persons by type of treatment received by disease

Disease Name	Type of treatment received									
	Allopathic		Homeopathic		Kobiraji		No treatment		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Fever/cold	916	78.9	33	2.8	5	0.5	206	17.8	1160	100.0
ARI/Pneumonia	1	100.0	-	-	-	-	-	-	1	100.0
Measles	5	22.8	3	13.6	-	-	14	63.6	22	100.0
Dysentery	342	84.9	5	1.2	9	2.2	47	11.7	403	100.0
Diarrhoea	199	83.6	6	2.5	4	1.6	29	12.3	238	100.0
Jaundice	10	66.7	-	-	3	20.0	2	13.3	15	100.0
Typhoid	4	100.0	-	-	-	-	-	-	4	100.0
Scabies	37	72.5	-	-	-	-	14	27.5	51	100.0
Heart-Disease	4	100.0	-	-	-	-	-	-	4	100.0
Gestric Ulcer	58	85.3	-	-	-	-	10	14.7	68	100.0
Others	77	57.8	20	15.0	15	11.3	21	15.9	133	100.0
All disease	1653	78.6	67	3.2	36	1.7	343	16.3	2099	100.0

Figure 3.6.1: Distribution of diseased persons who did not receive treatment by reasons of non-treatment (N=343)

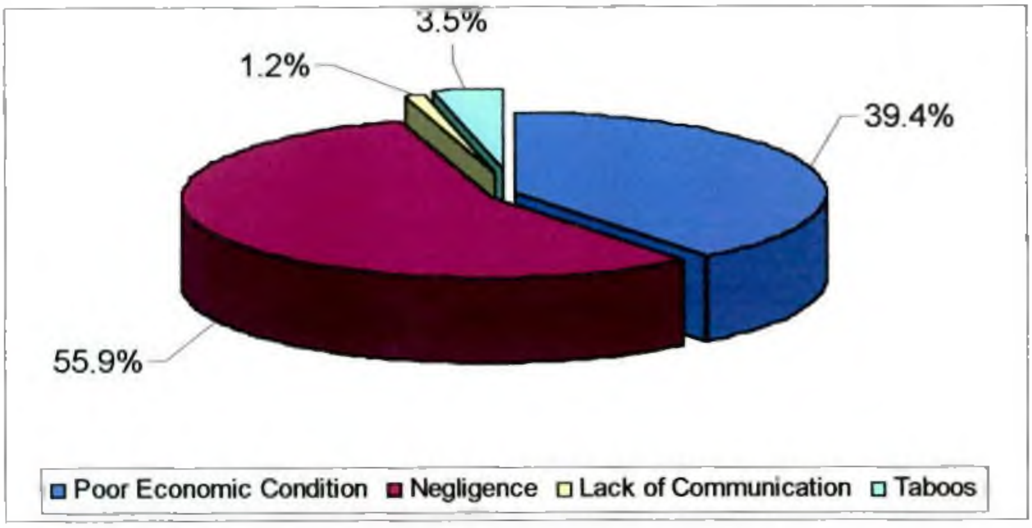


Figure 3.6.2: Distribution of 0-6 years old children by receipt of vitamin A capsule

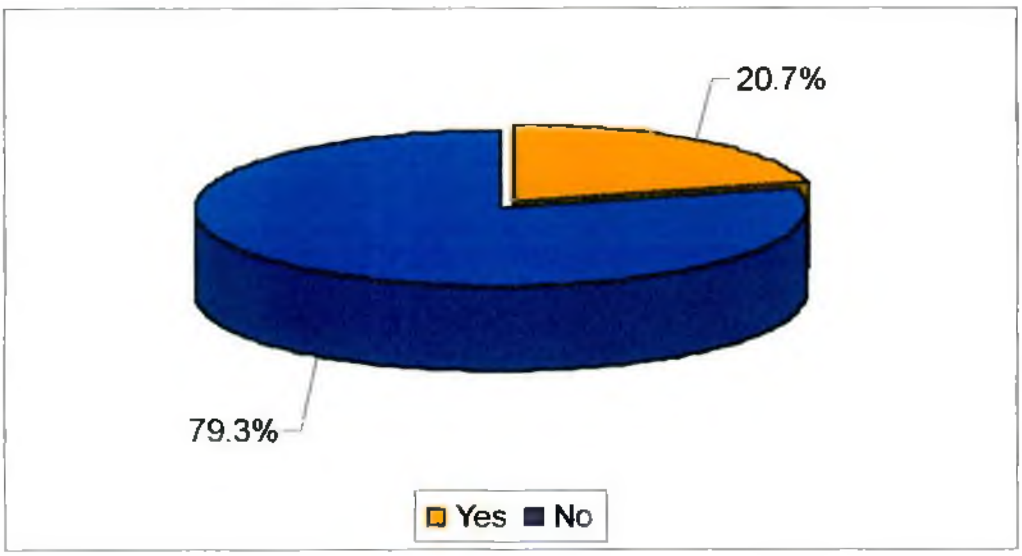


Table 3.6.6: Distribution of under five children by Immunization status (N=853)

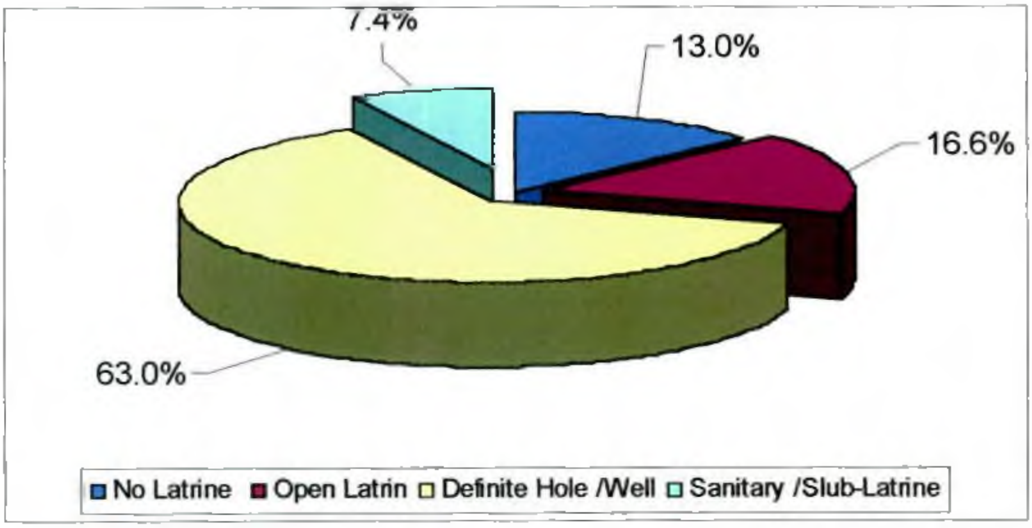
Immunization Status	BCG	DPT	Polio	Measles
All doses completed	90.4 (771)	73.2 (624)	72.9 (622)	72.2 (616)
Timely being given	0.2 (2)	1.4 (12)	1.4 (12)	- -
Incomplete doses	-	15.8 (135)	15.7 (134)	0.6 (5)
Time yet not come	2.1 (18)	2.7 (23)	2.7 (23)	12.1 (103)
No Immunization given	7.3 (62)	6.9 (59)	7.3 (62)	15.1 (129)
Total	100.0 (853)	100.0 (853)	100.0 (853)	100.0 (853)

(Figures in the Parentheses indicate number of children)

Table-3.6.7: Distribution of marginal farm households by use of water by sources

Sources of water	Use of water			
	Drinking		Cooking and Washing	
	Number	Percentage	Number	Percentage
Tube-well	205	94.9	146	67.6
Pond /Ditch	2	0.9	43	19.9
River /Canal	9	4.2	27	12.5
Total	216	100.0	216	100.0

Figure 3.6.3: Distribution of marginal farm households by type of latrine



Figur 3.6.4: Distribution of households by mode of hand cleaning by the family members after defecation

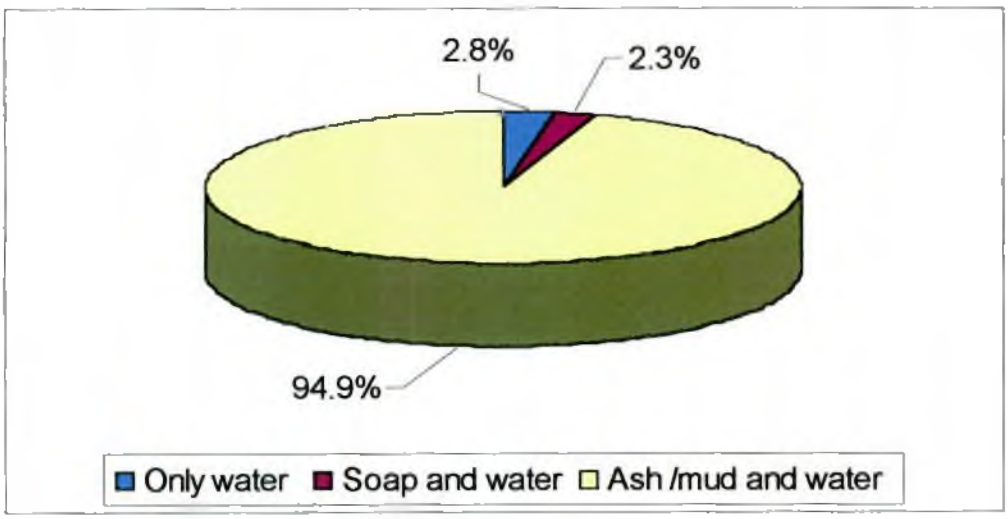
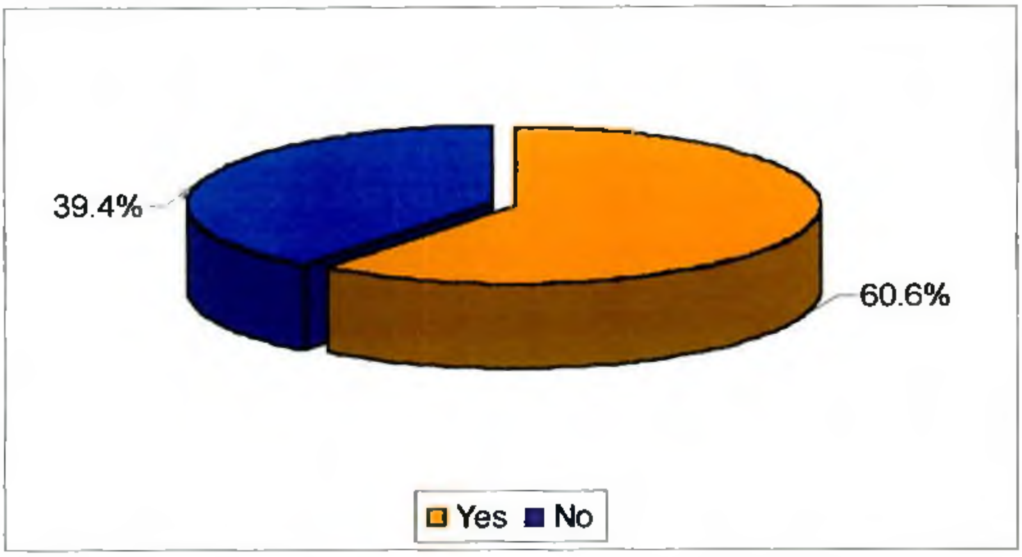


Figure 3.6.5: Distribution on of households by use of sandal / shoe by the family members while going to latrine



3.7: Socio-economic Issues of Marginal Farm Households:

Figure 3.7.1 shows that all the family members of 64.4 per cent households were dependent on only one earning member. The marginal farm households depending on 2 and 3 & above earning members were 22.2 and 13.4 per cent respectively.

Regarding ownership of house, 196 marginal farmers (90.7%) had own house to reside, while 6.5 per cent had no own house who used to live in other people's house without any rent (Figure 3.7.2). Six marginal farmers (2.8%) were found to live in their parent's house.

Table 3.7.1 presents the land holding of the marginal farm households. It was found that in 25.5 per cent households the holding size was between 81 and 100 decimal of land, as against 24.0 per cent households who had upto 15 decimal of land. The proportion of households decreased with the increase in holding size with an exception in highest holding size of 81-100 decimal of land. So, 50.5 per cent households were found to have 16 to 80 decimal of land. But in respect of land under cultivation, 24.5 per cent households cultivated 16 to 30 decimal of land and the proportion of households decreased with the increase in land size under cultivation (Table 3.7.2). Land size up to 15 and 81 to 100 decimal was found to have cultivated by 18.5 and 15.3 per cent households respectively.

Regarding per capita monthly income, in 90 households (41.6%) per capita monthly income was between Tk.500 and Tk.999, while in 34.3 per cent households per capita income was between Tk.250 and Tk.499 (Table 3.7.3). The mean per capita monthly income of the marginal farm households was Tk.754.1 ±733.6. In 14 and 17 households per capita monthly income was Tk. < 250 and Tk.1500 & above respectively.

Table 3.7.4 shows the round-wise monthly household income by sources. It shows that at the beginning average household monthly income was Tk.2924.1 ±1833.9, which increased to Tk.4303.3 ±2587.9 by second round. Monthly income again decreased to Tk.3018.7 ±3587.2 during third round i.e. in typical lean period, which again increased to Tk.3807.6 ±3536.2 in fourth round. By sources of income, highest average income

(Tk.895.2 ±918.1) was obtained from salary and wages (from secondary occupation) followed by income of Tk.718.3±1266.8 from other non-specific sources (such as part time small business; gift/donation/jakat/begging; rent of house/shop/ rickshaw/van/boat/agricultural equipments etc). In the first round highest income (Tk.1145.6) was obtained from salary and wages, while in the second round highest income (Tk.1421.7) was obtained from household production. But highest income in the third round (Tk.812.9) and fourth round (Tk.882.2) round was obtained from other non-specific sources. Household income from farm production was Tk.630.5 with highest income of Tk.1421.7 during second round. Income obtained from homestead food production was also the highest (Tk.258.0) during second round. Highest income from salary and wages (Tk.1145.6) was obtained in first round and that was the lowest in lean period during third round (Tk.592.3) indicating seasonal unemployment. Per capita monthly income by round and source also followed the similar trend as found in round-wise household monthly income by sources (Table 3.7.5).

Table 3.7.6 presents the round-wise household monthly income, monthly expenditure on different heads of expenditure by the marginal farm households together with monthly expenditure on food as per cent of monthly income and total expenditure. It shows that monthly household expenditure increased and decreased with corresponding increase and decrease of total income over the study period. On the contrary, monthly household expenditure on food decreased during second round, although monthly income increased, which might be due to low prices of foods followed by increased other household expenses. In the third round the situation was found vice-versa, where expenditure on food increased although monthly income and expenditure decreased, which then increased with corresponding increase in income and total household expenditure in the fourth round. It reveals from the Table that household expenditure on food did not proportionately increased with increased income particularly during second and fourth round, but household expenditure was higher compared to income during fourth round which might be due to increased cost of other household expenses including successive cultivation. The Table also shows that about 45 per cent of total income was spent for household expenditure on food, while about 52 per cent of household total expenditure was spent for food.

Table 3.7.7 shows that per capita monthly income, expenditure and expenditure on food followed the similar trend as household monthly income, total expenditure and expenditure on food. About 43 and 51 per cent of per capita income and total expenditure respectively were spent for meeting expenditure on food. In the third round, though per capita expenditure on food increased to some extent compared to that of second round, food intake was drastically decreased to 588.3 gm, which might be due to higher prices of food items during this lean period.

Daily labour wage in the study locations by rounds showed that the average daily labour wage without any food in all the locations was Tk.49.00 (Table 3.7.8). Mean daily labour wages in Nokla, Laksham, Uzirpur and Raygonj were Tk.50.00, 65.00, 30.00 and 50.00 respectively. The daily labour wage was the highest in Laksham as the cropping pattern of this area was triple cropping which demanded much labour force resulting high labour wage. During dull season in October & November labour wage in all the locations was the lowest compared to other seasons, which might be due to lack of employment opportunities causing surplus labour force with simultaneous decreased demand of labour in this period.

Market prices of essential food commodities during different rounds showed that average prices of wheat flour (ata), potato, mash kalai, egg, duck, mustard oil, leafy vegetables, onion, garlic, banana and lemon were found higher during October- November in third round due to increased demand and simultaneous food scarcity compared to other seasons. On the contrary, prices of khesari dal, chicken, small fish, medium size fish were lower during this period (Table 3.7.9). The prices of different food items were found to fluctuate in different seasons according to supply in the market as well as pick harvest season of specific food items. The seasonal fluctuations in market prices of food commoditis as well as in labour wages greatly contributed in the per capita food and nutrient intake by the marginal farm households in different rounds, particularly in the dull/lean season in October & November months.

Figure 3.7.1: Distribution of marginal farm households by earning members

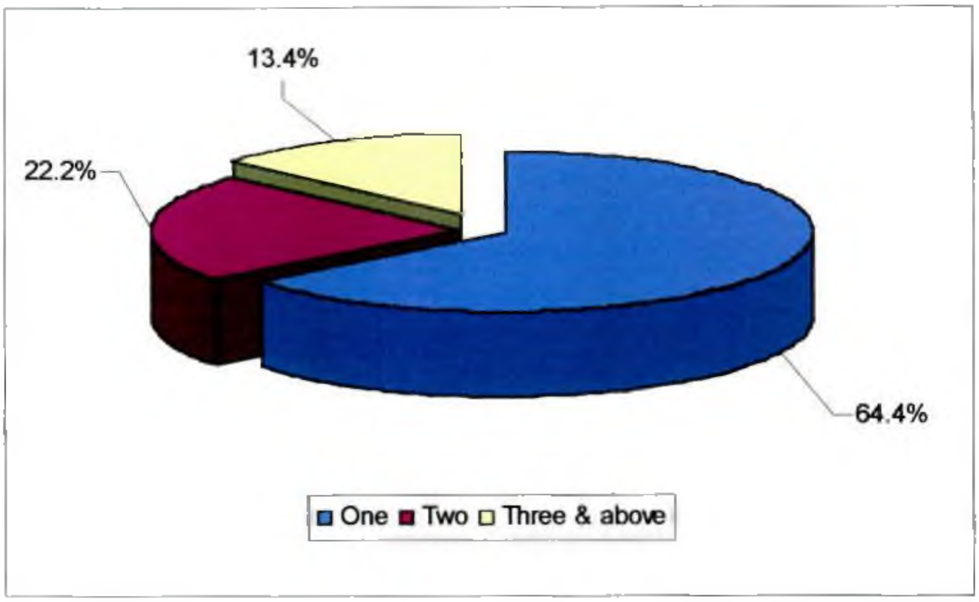


Figure 3.7.2: Distribution of marginal farm households by ownership of house

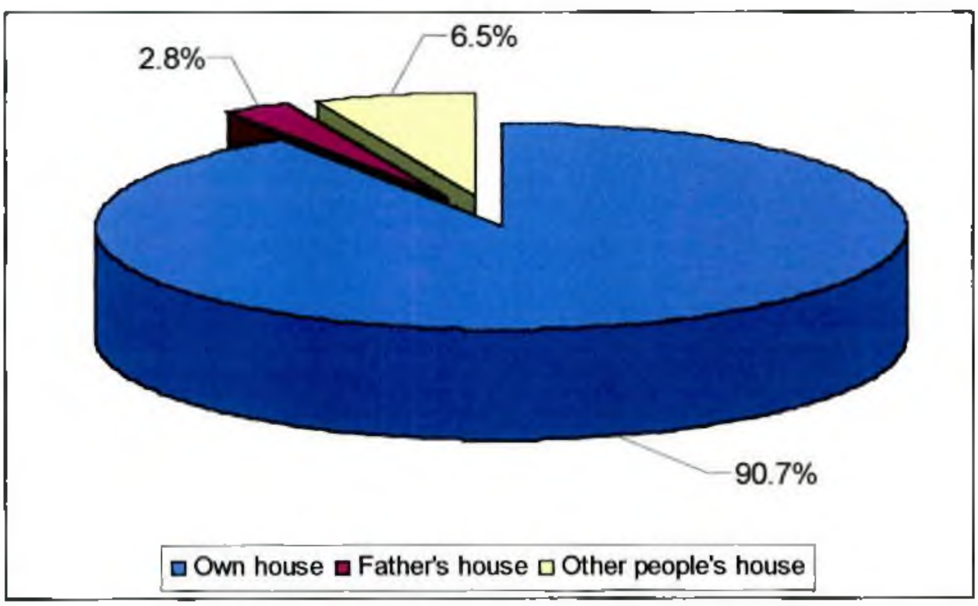


Table 3.7.1: Distribution of marginal farm households by land holding

Total Land size (in decimals)	No. of Households	Percentage
Up to 15 decimals	52	24.0
16– 30 "	34	15.7
31–45 "	31	14.4
46 –60 "	28	13.0
61 –80 "	16	7.4
81 –100 "	55	25.5
Total	216	100.0

Table 3.7.2: Distribution of households by land under cultivation

Size of cultivated land	No. of Households	Percentage
Up to 15 decimals	40	18.5
16– 30 "	53	24.5
31–45 "	35	16.2
46 –60 "	33	15.3
61 –80 "	22	10.2
81 –100 "	33	15.3
Total	216	100.0

Table 3.7.3: Distribution of households by per capita monthly income

Per Capita Monthly Income (Tk)	No. of Households	Percentage
< 250.00	14	6.5
250.00 – 499.00	74	34.3
500.00 – 999.00	90	41.6
1000.00 – 1499.00	21	9.7
1500.00 and above	17	7.9
Total	216	100.0

Mean Per Capita Monthly Income = Tk.754.1 (± 733.6)

Table 3.7.4: Monthly household income by sources and rounds

Rounds	Sources of Income						
	Farm land Production (Tk.)	Homestead production (Tk.)	Salary & wages (Tk.)	Other sources (Tk.)	Selling H/H materials (Tk.)	Taking debt/loan (Tk.)	Total H/H Monthly Income (Tk.)
First Round	225.2	192.2	1145.6	462.1	396.1	503.0	2924.1
	(±423.5)	(±354.9)	(±941.8)	(±813.9)	(±1073.8)	(±971.2)	(±1833.9)
Second Round	1421.7	258.0	977.3	716.1	454.3	475.9	4303.3
	(±1363.9)	(±878.7)	(±840.5)	(±1175.5)	(±943.1)	(±1001.9)	(±2587.9)
Third Round	195.4	154.6	592.3	812.9	718.2	545.3	3018.7
	(±434.2)	(±273.6)	(±766.8)	(±1612.6)	(±1812.7)	(±1830.2)	(±3587.2)
Fourth Round	679.8	154.3	865.7	882.2	649.2	576.4	3807.6
	(±800.5)	(±445.3)	(±1019.3)	(±1301.8)	(±2538.5)	(±1666.8)	(±3536.2)
Average	630.5	189.8	895.2	718.3	554.4	525.1	3513.4
	(±981.1)	(±541.8)	(±918.1)	(±1266.8)	(±1717.7)	(±1418.9)	(±3025.5)

Table 3.7.5: Per capita monthly income by sources of income and rounds

Rounds	Sources of Income						Total Per Capita Monthly Income (Tk)
	Farm land Production (Tk)	Homestead production (Tk)	Salary /wages (Tk)	Other sources (Tk)	Selling H/H goods (Tk)	Taking debt /low (Tk)	
First Round	48.4	38.0	244.7	93.4	81.6	101.5	607.5
	(±90.3)	(±70.1)	(±216.7)	(±165.6)	(±218.9)	(±164.5)	(±346.5)
Second Round	327.7	54.3	213.4	146.3	101.3	108.8	951.8
	(±348.2)	(±205.4)	(±218.6)	(±239.7)	(±221.2)	(±340.9)	(±721.8)
Third Round	35.5	30.9	121.0	188.2	159.2	102.1	636.8
	(±77.3)	(±44.6)	(±157.9)	(±509.4)	(±397.9)	(±327.2)	(±806.1)
Fourth Round	143.3	29.8	191.5	206.6	129.0	119.1	819.5
	(±170.4)	(±83.9)	(±361.9)	(±447.3)	(±450.8)	(±356.1)	(±889.1)
Average	138.9	38.3	192.7	158.6	117.8	107.9	754.1
	(±233.9)	(±118.8)	(±253.9)	(±370.7)	(±339.1)	(±306.6)	(±733.6)

Table 3.7.6: Household income, expenditure, expenditure on food by round

Round	H/H monthly income (Tk)	H/H monthly expenditure (Tk)	H/H monthly expenditure on food (Tk)	H/H monthly expenditure on cultivation (Tk)	H/H monthly other expenses (Tk.)	H/H expenditure on food as % of total income	H/H expenditure on food as %of total expenditure
First	2924.1	2863.6	1670.9	574.7	618.0	57.1	58.3
Round	(±1833.9)	(±2134.2)	(±1463.9)	(±496.2)	(±424.3)		
Second	4303.3	3097.2	1459.8	341.5	1295.9	33.9	47.1
Round	(±2587.9)	(±2207.7)	(±1406.1)	(±359.7)	(+669.1)		
Third	3018.7	2816.1	1543.9	241.9	1030.3	51.1	54.8
Round	(±3587.2)	(±1660.5)	(±1102.9)	(±349.7)	(±674.7)		
Fourth	3807.6	3416.5	1657.9	274.0	1484.6	43.5	48.5
Round	(±3536.2)	(±3323.5)	(±518.9)	(+357.4)	(±774.4)		
Total	3513.4	3048.3	1583.1	358.0	1107.2	45.1	51.9
	(±3025.5)	(±1575.3)	(±739.4)	(±415.7)	(±689.9)		

Table 3.7.7: Per capita monthly income, expenditure, expenditure on food, food & nutrients intake by the marginal farm households

Round of survey	P/C/M Income (Tk.)	P/C/M Expenditure (Tk.)	P/C/M Expenditure on food (Tk)	P/C/M Expnd. on food as % of P/C/M income(Tk.)	P/C/M Expd. on food as %of P/C/M Expend.(Tk.)	P/C/D food intake (gm)	P/C/D calorie intake (kcal)	P/C/D protein intake (gm)
First	607.5	594.0	347.3	57.2	58.5	678.2	1710.2	41.4
Second	951.8	642.4	302.8	31.8	47.1	672.9	1759.8	41.0
Third	636.8	584.2	320.9	50.4	54.9	588.3	1719.1	41.4
Fourth	819.5	708.7	344.5	42.0	48.6	774.3	1884.5	44.9
All	754.1	640.2	323.7	42.9	50.5	678.3	1768.3	42.2

Table 3.7.8: Daily labour wage in taka in the study locations by round

Rounds	Locations				
	Dhonakusha, Nokla	Selunia, Laksham	West Satla, Uzirpur	Bashuria, Raygonj	All Locatons
First Round	50.00	60.00	30.00	50.00	47.50
Second Round	50.00	70.00	35.00	55.00	52.50
Third Round	40.00	60.00	20.00	40.00	40.00
Fourth Round	60.00	70.00	35.00	55.00	55.00
All Rounds	50.00	65.00	30.00	50.00	49.00

Table 3.7.9: Market prices of the important food items in the local markets of the study area (Tk. per kg /No.) by rounds

Food Items	First Round	Second Round	Third Round	Fourth Round	Average
Rice (course)	15.50	13.50	15.50	15.50	15.00
Atta	12.00	12.00	13.00	13.00	12.50
Gur (Jagory)	24.00	26.00	24.00	22.00	24.00
Sugar	33.00	32.00	33.00	32.00	32.50
Potato	5.00	8.50	9.00	5.50	7.00
Lentil	42.00	34.00	37.00	39.00	38.00
Khesari	21.00	16.00	15.00	18.00	17.50
Mash Kalai	20.00	20.00	24.00	22.00	21.50
Egg (Hen)/ 4 pieces	10.75	11.00	12.75	12.50	11.75
Egg (Duck)/ 4 piece	10.75	10.50	13.00	11.75	11.50
Chicken (Medium)/ 1 piece	70.00	58.00	53.00	51.00	58.00
Duck (Medium)/ 1 piece	62.00	60.00	62.00	60.00	61.00
Small Fish	45.00	42.00	24.00	35.00	36.50
Medium size Fish	70.00	50.00	40.00	40.00	50.00
Milk	14.00	13.00	14.00	15.00	14.00
Beef	60.00	65.00	65.00	58.00	62.00
Soybean Oil	55.00	54.00	54.00	55.00	54.50
Mustard Oil	63.00	53.00	58.00	58.00	58.00
Coconut Oil	85.00	70.00	70.00	75.00	75.00
Leafy Vegetables	3.50	3.50	5.00	3.00	3.75
Other Vegetables	5.00	5.00	5.00	4.00	4.75
Onion	13.00	19.50	41.50	23.50	24.38
Garlic	35.00	37.00	43.00	41.00	39.00
Salt (Open)	7.00	6.00	5.00	5.75	6.00
Salt (Packet)	10.00	10.00	10.00	10.00	10.00
Banana/ 4 pieces	7.00	8.00	9.00	8.00	8.00
Jack-fruit (medium)/ piece	-	23.00	-	-	23.00
Pine-apple/ piece	-	6.00	-	-	6.00
Lemon/ 4 piece	4.00	6.00	8.00	-	6.00
Jambura/ piece	-	-	7.00	-	7.00
Guava/4 piece	8.00	4.00	6.00	-	6.00

3.8. Socio-economic Determinants of Nutritional Deficiencies:

In this section we have considered socio-economic variables such as household total income, total expenditure, expenditure on food, family size, number of earning members and size of cultivated land in order to find out relationships with intake of foods and nutrients. Tables 3.8.1 through 3.8.5 present the relationship as measured by correlation coefficient between different socio-economic variables and food intake by the marginal farm households. Per capita per day intakes of cereals, pulses, vegetables, fruits, meat, fish, egg and milk were increased, while that of roots & tubers and other non-specific foods decreased with the increase in household monthly income. Household monthly income did not have any significant relationship with cereals, roots & tubers, vegetables, fruits, meat, egg and fat intakes, but there was positive significant correlation with the intakes of pulse, fish and milk (Table 3.8.1). Per capita intakes of pulses, fruits, meat, fish, egg and milk were found to increase, while that of roots & tubers, vegetables and other non-specific foods decreased with the increase in household monthly total expenditure (Table 3.8.2). Only pulses intake was found to have significant positive, while that of other non-specific foods have negative correlation with monthly total expenditure.

Roots & tubers, vegetables, egg, fats & oils and other non-specific foods intakes decreased, but only milk intake increased with increase in household monthly expenditure on food, while cereals, pulses, fruits, meat and fish intakes did not show any regular trend. Monthly expenditure on food was found to have significant negative relationship with the levels of fat & oils and other non-specific foods intakes, but no significant relationship was found with other food groups (Table 3.8.3). Per capita household income had positive correlation with pulses, vegetables, fish, egg, milk and fats & oils; while per capita expenditure had positive correlation with cereals, pulses, vegetables, meat, fish, egg, milk and fats & oils; but only cereals, milk and fat & oils intakes were found to be positively correlated with per capita expenditure on food and there found no relationship with size of cultivated land. (Appendex Tables D-1 to D-4).

Per capita per day intakes of different food groups decreased, while only pulses intake increased with increase in family size. Family size had a negative relationship with level of cereal, roots & tubers, vegetables, egg, fat & oils and other non-specific food intakes, while the relationship of other food groups intakes was negative and insignificant (Table 3.8.4). Per capita intakes of cereals and fish increased, while fruits, meat, egg and fat & oils decreased with the increase in number earning members in the household; but intakes of pulses, roots and vegetables did not show any regular trend. Number of earning members had a significant positive and negative correlation with only cereal and egg intakes respectively (Table 3.8.5).

Tables 3.8.6 to 3.8.8 indicate that there was no close relationship between household monthly income, total expenditure & expenditure on food and different nutrients intakes with an exception of fat intake, where there was a highly significant negative correlation with household monthly expenditure on food. Calorie, protein, fat, carbohydrate, thiamine, niacin, vitamin C and zinc intakes were negatively correlated with family size (Table 3.8.9). But calorie, carbohydrate and niacin intakes were significantly positively correlated with the number of earning members (Table 3.8.10). While in respect of per capita income, expenditure and expenditure on food, there were highly significant positive relationships with the intakes of calorie, protein, fat, carbohydrate, calcium, niacin and vitamin C and there found no relationship between the size of cultivated land and intake of different nutrients (Appendix Tables D-5 to D-8).

Results as obtained from multiple regression analysis for calorie intake with different socio-economic variables are presented in Table 3.8.11. It was seen that family size, total number of earring members and monthly expenditure were significantly related to per capita calorie intake.

Table 3.8.1: Household monthly income and per capita per day food intake

Household Monthly Income(Tk)	No. of H/H	Food Groups										
		Cereals (gm)	Roots & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk & milk prod. (gm)	Fats & oils (gm)	Other Foods(gm)
<2000	37	439.8	52.6	4.5	109.8	6.2	2.0	22.8	0.4	2.0	2.6	[illegible].8
2000-4999	147	447.9	50.7	6.7	116.8	7.9	3.8	21.6	0.5	4.3	2.3	[illegible].7
≥ 5000	32	468.1	46.5	8.9	128.4	7.0	3.9	31.5	1.1	6.5	2.6	[illegible].1
Correlation co-efficient	216	.056	-.056	220**	.033	-.013	-.057	.256**	.110	.138*	.092	-[illegible]25

Level of Significance: *=0.01,**=0.001

Table 3.8.2: Monthly household total expenditure and per capita per day food intake

Monthly H/H Total Expenditure(Tk)	No. of H/Hs	Foods Groups										
		Cereal (gm)	Root & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruit (gm)	Meat (gm)	Fish (gm)	Egg (gm)	Milk & milk prod. (gm)	Fats & oils (gm)	Other Foods (gm)
<2000	51	447.9	53.4	4.3	119.5	6.7	2.5	23.9	0.5	1.6	2.6	1[illegible]7
2000-2999	77	443.9	51.4	5.6	123.0	6.5	3.3	21.8	0.5	4.9	2 2	82
3000-3999	53	461.2	50.9	6.9	117.2	9.1	3.9	21.9	0.5	4.8	2.5	88
≥4000	35	446.5	47.0	9.7	109.9	7.4	4.5	27.9	0.9	6.5	2.4	61
Correlation Co-efficient	216	.061	-.055	.243**	-.047	.014	.119	.132	.073	.128	.000	-.155*

Level of Significance: * = 0.01, **=0.001

Table 3.8.3: Monthly household expenditure on food and per capita per day food intake.

Household Monthly Expenditure on Food (Tk)	No. of H/Hs	Foods Groups										
		Cereals (gm)	Roots & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk & milk prod.(gm)	Fats & oils(gm)	Other Foods (gm)
<1000	34	451.9	69.5	5.1	122.0	10.1	3.3	21.5	0.7	2.8	3.1	12.7
1000-1499	79	445.9	52.0	4.8	123.9	6.5	3.4	23.5	0.6	4.6	2,4	9.1
1500-1999	74	448.5	44.3	8.3	115.5	6.0	4.0	24.4	0.5	4.4	2.3	7.5
2000 & above	29	459.2	44.0	6.4	108.1	9.5	2.3	21.9	0.4	5.2	2.0	5.0
Correlation co-efficient	216	.086	-.116	.073	-.093	-.029	-.083	-.021	-.081	.007	-.233**	-.200**

Level of Significance: * = 0.01, **= 0.001

Table 3.8.4: Family size and per capita per day food intake

Family Size	No. of H/Hs	Foods Groups										
		Cereals (gm)	Roots & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk & milk prod. (gm)	Fats &oils (gm)	Other Foods (gm)
1-2	10	483.0	65.2	5.0	129.1	8.2	5.0	25.8	0.9	0.0	3.4	14.6
3-4	80	461.3	59.3	6.9	127.8	8.8	4.3	23.2	0.9	6.4	2.9	9.1
5-6	81	443.4	46.9	5.4	116.6	7.3	2.4	23.3	0.3	3.6	2.1	9.1
7 and above	47	434.0	41.9	7.1	104.4	4.8	3.3	22.9	0.3	3.1	1.8	5.8
Mean	216	449.7	51.2	6.3	118.6	7.3	3.4	23.3	0.6	4.4	2.4	8.6
Correlation Co-efficient		-.148*	-.202*	-.004	-.156*	-.107	-.101	-.038	-.183**	-.115	-.448**	-.173*

Level of Significance: * = 0.01, **= 0.001

Table 3.8.5: Number of earning members and per capita per day food intake.

Number of Earning Members	No. of H/Hs	Foods Groups										
		Cereals (gm)	Roots & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk & milk prod. (gm)	Fats & oils (gm)	Other Foods (gm)
One	139	438.9	51.2	5.9	117.4	8.3	3.8	22.8	0.7	5.4	2.5	[illegible].5
Two	50	462.2	56.3	7.4	115.8	6.6	3.2	24.0	0.2	2.1	2.4	[illegible].7
Three & above	27	497.6	41.7	6.4	129.0	3.6	2.1	24.6	0.3	3.0	2.1	[illegible].3
Mean	216	449.5	51.2	6.3	118.6	7.3	3.4	23.3	0.6	4.4	2.4	[illegible].6
Correlation Co-efficient		.231**	-.059	.047	.077	-.103	-.111	.040	-.139*	-.133	-.104	-.105

Level of Significance: * = 0.01, **= 0.001

Table 3.8.1: Household monthly income and per capita per day food intake

Household Monthly Income(Tk)	No. of H/H	Food Groups										
		Cereals (gm)	Roots & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk & milk prod. (gm)	Fats & oils (gm)	Other Foods(gm)
<2000	37	439.8	52.6	4.5	109.8	6.2	2.0	22.8	0.4	2.0	2.6	[illegible].8
2000-4999	147	447.9	50.7	6.7	116.8	7.9	3.8	21.6	0.5	4.3	2.3	[illegible].7
≥ 5000	32	468.1	46.5	8.9	128.4	7.0	3.9	31.5	1.1	6.5	2.6	[illegible].1
Correlation co-efficient	216	.056	-.056	220**	.033	-.013	-.057	.256**	.110	.138*	.092	-[illegible]25

Level of Significance: *=0.01, **=0.001

Table 3.8.2: Monthly household total expenditure and per capita per day food intake

Monthly H/H Total Expenditure(Tk)	No. of H/Hs	Foods Groups										
		Cereal (gm)	Root & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruit (gm)	Meat (gm)	Fish (gm)	Egg (gm)	Milk & milk prod. (gm)	Fats & oils (gm)	Other Foods (gm)
<2000	51	447.9	53.4	4.3	119.5	6.7	2.5	23.9	0.5	1.6	2.6	[illegible]
2000-2999	77	443.9	51.4	5.6	123.0	6.5	3.3	21.8	0.5	4.9	2.2	8.2
3000-3999	53	461.2	50.9	6.9	117.2	9.1	3.9	21.9	0.5	4.8	2.5	8.8
≥4000	35	446.5	47.0	9.7	109.9	7.4	4.5	27.9	0.9	6.5	2.4	6.1
Correlation Co-efficient	216	.061	-.055	.243**	-.047	.014	.119	.132	.073	.128	.000	-.155*

Level of Significance: * = 0.01, **=0.001

Table 3.8.3: Monthly household expenditure on food and per capita per day food intake.

Household Monthly Expenditure on Food (Tk)	No. of H/Hs	Foods Groups										
		Cereals (gm)	Roots & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk & milk prod.(gm)	Fats & oils(gm)	Other Foods (gm)
<1000	34	451.9	69.5	5.1	122.0	10.1	3.3	21.5	0.7	2.8	3.1	12.7
1000-1499	79	445.9	52.0	4.8	123.9	6.5	3.4	23.5	0.6	4.6	2,4	9.[illegible]
1500-1999	74	448.5	44.3	8.3	115.5	6.0	4.0	24.4	0.5	4.4	2.3	7.5
2000 & above	29	459.2	44.0	6.4	108.1	9.5	2.3	21.9	0.4	5.2	2.0	5.0
Correlation co-efficient	216	.086	-.116	.073	-.093	-.029	-.083	-.021	-.081	.007	-.233**	-.200**

Level of Significance: * = 0.01, **= 0.001

Table 3.8.4: Family size and per capita per day food intake

Family Size	No. of H/Hs	Foods Groups										
		Cereals (gm)	Roots & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk & milk prod. (gm)	Fats &oils (gm)	Other Foods (gm)
1-2	10	483.0	65.2	5.0	129.1	8.2	5.0	25.8	0.9	0.0	3.4	14.6
3-4	80	461.3	59.3	6.9	127.8	8.8	4.3	23.2	0.9	6.4	2.9	9.1
5-6	81	443.4	46.9	5.4	116.6	7.3	2.4	23.3	0.3	3.6	2.1	9.1
7 and above	47	434.0	41.9	7.1	104.4	4.8	3.3	22.9	0.3	3.1	1.8	5.8
Mean	216	449.7	51.2	6.3	118.6	7.3	3.4	23.3	0.6	4.4	2.4	8.6
Correlation Co-efficient		-.148*	-.202*	-.004	-.156*	-.107	-.101	-.038	-.183**	-.115	-.448**	-.173*

Level of Significance: * = 0.01, **= 0.001

Table 3.8.5: Number of earning members and per capita per day food intake.

Number of Earning Members	No. of H/Hs	Foods Groups										
		Cereals (gm)	Roots & tubers (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk & milk prod. (gm)	Fats & oils (gm)	Other Foods (gm)
One	139	438.9	51.2	5.9	117.4	8.3	3.8	22.8	0.7	5.4	2.5	[illegible].5
Two	50	462.2	56.3	7.4	115.8	6.6	3.2	24.0	0.2	2.1	2.4	[illegible].7
Three & above	27	497.6	41.7	6.4	129.0	3.6	2.1	24.6	0.3	3.0	2.1	[illegible].3
Mean	216	449.5	51.2	6.3	118.6	7.3	3.4	23.3	0.6	4.4	2.4	[illegible].6
Correlation Co-efficient		.231**	-.059	.047	.077	-.103	-.111	.040	-.139*	-.133	-.104	-.105

Level of Significance: * = 0.01, **= 0.001

Table 3.8.6: Household monthly income and per capita per day nutrient intake

Household Monthly Income (Tk)	No. of H/Hs	Nutrients												
		Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbohydrate (gm)	Calcium (mg)	Iron (mg)	Vit.A (I.U.)	Carotene (µg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vit. C (mg)	Zinc (mg)
<2000	37	1716.4	40.7	7.7	368.6	234.6	13.6	41.2	3201.3	1.2	0.5	18.4	24.4	6.7
2000-2999	66	1739.5	41.5	7.4	373.9	240.6	13.7	23.8	3088.3	1.3	0.5	18.6	23.6	6.8
3000-3999	56	1781.1	42.8	7.9	382.3	261.6	13.3	35.0	3540.6	1.3	0.5	19.4	26.5	6.8
4000-4999	25	1753.9	41.1	7.1	378.4	243.0	11.5	32.7	3035.4	1.2	0.4	18.9	22.6	6.4
5000&above	32	1848.7	44.4	8.3	397.6	277.6	11.6	54.7	2807.3	1.3	0.5	19.8	25.1	7.0
Correlation Co-efficient	216	.091	.132	.105	.088	.125	-.131	.035	-041	-.009	-.077	.084	.054	.043

Level of Significance: * = 0.01, ** = 0.001

Table 3.8.6: Household monthly income and per capita per day nutrient intake

Household Monthly Income (Tk)	No. of H/Hs	Nutrients												
		Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbohydrate (gm)	Calcium (mg)	Iron (mg)	Vit.A (I.U.)	Carotene (µg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vit. C (mg)	Zinc (mg)
<2000	37	1716.4	40.7	7.7	368.6	234.6	13.6	41.2	3201.3	1.2	0.5	18.4	24.4	6.7
2000-2999	66	1739.5	41.5	7.4	373.9	240.6	13.7	23.8	3088.3	1.3	0.5	18.6	23.6	6.8
3000-3999	56	1781.1	42.8	7.9	382.3	261.6	13.3	35.0	3540.6	1.3	0.5	19.4	26.5	6.8
4000-4999	25	1753.9	41.1	7.1	378.4	243.0	11.5	32.7	3035.4	1.2	0.4	18.9	22.6	6.4
5000&above	32	1848.7	44.4	8.3	397.6	277.6	11.6	54.7	2807.3	1.3	0.5	19.8	25.1	7.0
Correlation Co-efficient	216	.091	.132	.105	.088	.125	-.131	.035	-041	-.009	-.077	.084	.054	.043

Level of Significance: * = 0.01, ** = 0.001

Table 3.8.7: Household monthly total expenditure and per capita per day nutrient intake

Household Monthly Total Expenditure	No. of H/Hs	Nutrients												
		Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbo-hydraie (gm)	Calcium (mg)	Iron (gm)	Vit. A (I.U.)	Carotene (µg)	Thia-mine (mg)	Ribof-lavinn (mg)	Niacin (mg)	Vit. C (mg)	Zinc (mg)
<2000	51	1769.1	42.2	8.0	379.2	242.2	14.2	34.6	3117.8	1.3	0.5	19.0	26.9	7.0
2000-2999	77	1724.5	41.2	7.4	370.8	259.7	12.8	30.3	3571.3	1.3	0.5	18.6	23.8	6.7
3000-3999	53	1818.4	43.0	7.7	391.8	242.6	13.4	29.3	2961.6	1.3	0.5	19.6	25.2	6.9
4000&above	35	1762.1	42.4	7.6	378.6	256.1	11.4	56.2	2723.0	1.2	0.5	18.8	22.0	6.5
Correlation Co-efficient	216	.074	.094	.012	.078	.055	-.122	.047	-.077	-.010	-.098	.068	-.059	.001

Level of Significance: * = 0.01, ** = 0.001

Table 3.8.8: Household monthly expenditure on food and per capita per capita nutrient intake

Household Monthly Total Expenditure on food (Tk)	No. Of H/Hs	Nutrients												
		Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Iron (mg)	Vit. A (I.U.)	Carotene (µg)	Thia-mine (mg)	Ribo-flavin (mg)	Niacin (mg)	Vit. C (mg)	Zinc (mg)
<1000	34	1803.1	42.3	8.5	386.1	246.9	12.7	24.7	3112.7	1.3	0.5	19.1	27.6	6.8
1000-1499	79	1754.8	42.1	7.8	376.4	250.9	13.6	42.8	3331.7	1.3	0.5	18.9	25.0	6.8
1500-1999	74	1747.6	42.1	7.4	375.7	256.2	12.9	36.8	3163.7	1.3	0.5	18.9	23.4	6.8
2000&above	29	1786 2	41.7	6.9	387.6	241.4	12.2	23.2	2866.3	1.3	0.5	19.3	23.0	6.7
Correlation Co-efficient	216	.033	.012	-.182**	.058	-.033	-.028	-.037	-.051	.001	-.073	.029	-.115	-.041

Level of Significance: * = 0.01, ** = 0.001

Table 3.8.9: Family size and per capita per day nutrient intake

Family Size	No. of H/Hs	Total Food Intake (gm)	Nutrients												
			Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Iron (mg)	Vit. A (I.U)	Carotene (µg)	Thia-mine (mg)	Ribo-flavin (mg)	Niacin (mg)	Vit C (mg)	Zinc (mg)
1-2	10	741.5	1939.6	46.7	9.0	414.6	293.3	14.5	25.0	4098.6	1.4	0.5	21.0	31.7	7.[illegible]
3-4	80	708.1	1830.4	43.4	8.4	392.7	257.1	13.0	35.9	3564.2	1.3	0.5	19.6	28..8	6.[illegible]
5-6	81	653.8	1724.5	41.3	7.4	370.4	254.0	13.4	22.7	2977.5	1.3	0.5	18.6	21.9	6.[illegible]
7& above	45	625.4	1676.9	40.0	6.4	362.7	223.9	12.1	59.2	2632.4	1.2	0.4	18.1	20.0	6.4
Mean	216	672.0	1764.2	42.1	7.7	379.2	250.8	13.0	35.2	3177.1	1.3	0.5	19.0	24.5	6.8
Correlation Co-efficient		-.235**	-.195**	-.190**	-.337**	-.173*	-.100	-.032	-.064	-.039	-.143*	-.118	-.185**	-.186**	-.149

Level of Significance: * = 0.01, ** = 0.001

Table 3.8.10: Number of earning members and per capita per day nutrient intake

Number of Earning members	No. of H/Hs	Total Food Intake (gm)	Nutrients												
			Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbo-hydrate (gm)	calcium (mg)	Iron (gm)	Vit. A (I.U.)	Carotene (µg)	Thia-mine (mg)	Ribo-flavin (mg)	Niacin (mg)	Vit C (mg)	Zinc (mg)
One	139	663.8	1731.8	41.7	7.9	371.1	251.0	13.2	38.8	3294.5	1.2	0.5	18.7	25.3	6.7
Two	50	685.4	181.8	42.7	7.7	390.9	247.5	12.8	3208	2663.4	1.3	0.5	19.3	23.7	6.9
Three above	27	690.0	1838.3	42.9	6.8	399.6	255.7	12.6	20.9	3526.1	1.3	0.5	20.0	22.0	6.9
Mean	216	672.0	1764.2	42.1	7.7	379.2	250.8	13.0	35.2	3177.1	1.3	0.5	19.0	24.5	6.8
Correlation Co-efficient		.102	.187**	.091	-.126	.218**	-.006	-.020	-.022	-.050	.119	-.025	.176**	-.080	.098

Level of Significance: * =0.01, ** = 0.001

Table 3.8.11: Multiple Regression Analysis for Calorie intake

Multiple R= 0.46

R Square =0.21

Adjusted R Square =0.194

F =13.87; (df=4), Significance of F=0.000

Variable in the equation:

Variable	β	S.Eβ	Beta	T	Sig T.
Family Size	-6 0.68	12.11	-0.41	-5.0	0.000
Total No. of earring members	132.16	24.83	0.38	5.3	0.000
Per capita Total Monthly expenditure on foods (Tk)	0.43	0.16	0.18	2.65	0.009
Per capita monthly H/H Total Expenditure	0.02	0.012	0.12	1.69	0.093

Dependent Variable: Per capita calorie intake.

Independent Variables:

Family Size

Total No. of earning members

Land under cultivation/ operation (dec.)

Per capita Total monthly income (Tk.)

Per capita Total monthly expenditure on foods (Tk.)

Per capita Total monthly expenditure (Tk)

Monthly H/H income (Tk)

Monthly H/H Total expenditure on foods (Tk.)

Monthly H/H total expenditure (Tk.)

3.9: Sources of Money for Household Expenditure and Measures for Attaining Household Food Security:

Regarding earning money for meeting the cost of food production and purchase, Table 3.9.1 shows that 82.9 per cent of the marginal farm households were often depended on extra income form secondary or minor occupation and 19.0 per cent used to take loan/debt from available sources. Twenty seven (12.5 %) households reported that they used to sell produced food grains and other cash crops to meet food purchase and production costs. Six and three households were also reported to sell domestic animals such as duck / chicken / egg / milk and cows /goats respectively.

Regarding adopted measures by the marginal farmers on their own for attaining household food security during food scarsity, it was found that 137 (63.5%) marginal farmers stated that they usually used to take loan/debt from relatives and/or neighbours, while 17.6 per cent stated that they went for selling extra labour to earn more income (Table-3.9.2). Measures like - part-time rickshaw / van pulling, selling domestic animals & poultry were reported by 3.7, and 3.2 per cent marginal farmers respectively. Nine respondents (4.2%) reported that they used to spend their previous savings. Nine marginal farmers (4.2%) also mentioned that at time of severe food shortages their family used to go and stay at the relative's house for some days as guest.

In respect of the opinion of the marginal farmers about appropriate measures to be adopted to ensure round the year food security in the households, Table 3.9.3 shows that easy loan without interest for investing in income generating activities was mentioned by 34.3 per cent marginal farmers. Augmenting employment opportunities to increase income and there by purchasing power capacity was mentioned by 7.9 per cent. Measures like – more food production using modern agricultural practices, reduction of prices of farm equipments & ensuring reasonable prices of agricultural products, and fixation of wage rate according to market prices of food commodities were respectively mentioned by 3.7, 3.8 and 2.8 per cent marginal farmers. However, majority of the farmers (64.4%) advocated all possible measures as a package programme to be adopted to ensure household food security round the year instead of citing any single measure for this purpose.

Table 3.9.1: Distribution of marginal farm households by sources of money to meet food purchasing / production cost
(Sources are not mutually exclusive)

Sources of money	No. of Households	Percentage
By selling food grains and other cash crops	27	12.5
By taking debt / loan	41	19.0
By selling duck /chicken /egg /milk etc.	6	2.8
By selling domestic animals (cows /goats)	3	1.4
By earning money from secondary or minor occupations	179	82.9
Other sources	27	12.5

Table 3.9.2: Distribution of marginal farm households by measures usually adopted to maintain food supply while the household faces food scarsity (Multiple responses)

Measured usually adopted to maintain food supply	No. of Households	Percentage
1. Selling extra labour for more income	38	17.6
2. Part-time Rickshaw /Van pulling	8	3.7
3. Taking debt /loan from relatives and /or neighbours	137	63.5
4. Residing in relative's home as guest for some days	9	4.2
5. Go to the nearest town for search of work	2	0.9
6. Temporary business(vegetables, fruit & fish)	2	0.9
7. Spending previous savings	9	4.2
8. Selling domestic animals and poultry	7	3.2
9. Selling household goods(furniture / house / tin/ tree/ bamboo etc.)	3	1.4
10. Other non – specific measures	41	19.0

Table 3.9.3: Distribution of respondents by their opinion about appropriate measures to be adopted for ensuring round the year household food security (Multiple responses)

Opinion about measures to be adopted	No. of Respondents	Percentage
1. Producing more food using modern agricultural practices, HYV of seeds, appropriate fertilizers, irrigation and multiple food cropping by maximum utilization of farm land and homestead.	8	3.7
2. Reducing prices of farm equipments & materials and ensuring reasonable market prices of agricultural products	8	3.8
3. keeping the market prices of essential food commodities within the reach of the poor through adequate supply of foods in the market and establishment of open market sale during food shortages	5	2.3
4. Augmenting easy employment opportunities in order to increase purchasing power capacity	17	7.9
5. Taking necessary attempts to fix wage rate according to market prices of food commodities	6	2.8
6. Arrangement of easy loan without interest for income generating activities (IGA)	74	34.3
7. All the above measures	140	64.9

CHAPTER – FOUR

DISCUSSION

DISCUSSION

4.1. Discussion:

For food supply the marginal farmers can not solely depend on household food production, rather other other sources are needed. Because about 98 per cent of marginal farm households usually got their food supply from both household production and food purchased from market (Figure 3.2.1). Annual food production in the marginal farm households was 1193.8 kg, of which 971.1 kg (including 843.2 kg staple) was produced in the cultivated farm land and 222.7 kg (including about 100 kg of leafy & non-leafy vegetables) was produced in the homestead. About 81% of total food production was obtained from cultivated farm land, while the rest amount was obtained from homestead (Table 3.2.1). Per capita per annum food production was 238.8 kg (including 168.7kg cereals and 29.3 kg vegetables) which is lower than the average figure of of total crop production in Bangladesh, as stated by an UNICEF report[193] that per capita crop production in Bangladesh is 0.24 metric ton i.e. 240 kg. Lowest farm land production was obtained in third round during October-November, while lowest homestead production was obtained in fourth round during January-February (Table 3.2.2). About 49 per cent households produced less than 300 kg of food annually, while 21.3 per cent produced 1000 kg & more food (Table 3.2.3). Since food production in a household is considered as a measure of household food security and is regarded as an important source of household food supply, the food production situation indicates that the marginal farmers could have produced about half of their household food requirement, which might be considered as a strong indicator of perpetual food insecurity in their households.

Since different kinds of vegetables cultivation, fruit trees plantation and rearing of poultry and domestic animals in the homestead are considered as the indicator of future food security of the household, it was expected that all the marginal farme households would have cultivated varieties of vegetables & fruits trees in their homestead. But the results showed that only 27, 15.2 and 11.2 per cent households respectively were found to cultivate data sak, kachu sak, lal sak and pui sak respectively, while about 52, 38, 34 and 21 per cent were found to cultivate sweet pumpkin & broad beans, water pumpkin, gourd and chichinga respectively (Table 3.2.4). Similarly, more than 90 per cent of the marginal farm households did not have planted citrus fruit trees in their homestead, on the other hand about 35, 32, 21, 18 and 12 per cent households respectively have planted mango, jackfruit, coconut, guava and papya trees permanently (Table 3.2.5). About 54 and 80 per cent households did not have any cow and goat respectively and about 85 per cent households had different number of poultry, while in only 12.5 per cent households there were milky cows (Table 3.2.6). These homestead production trend might be due to unavailability of excess land/space in the homestead for cultivating vegetables & fruits and rearing of poultry & domestic animals indicating that the marginal farm households were run short of animal foods and protecting foods at present as well as in the future indicating their present and future food insecurity.

Food availability in a households depends on the utilization pattern of produced foods, because, people usually use food in different ways beyod household consumption. And as such about half of the produced foods are left available for consumption. In this study it was found that out of 971.1 kg of total food produced in the marginal farm households from cultivated farm land, only 41.5 per cent was utilized for household consumption, while 52.1 per cent was used for sale (Table 3.2.7). The corresponding figures for homestead food production were 55.4 and 43.1 per cent respectively (Table 3.2.8). However, about 44 per cent of total annual food production was left available for consumption by the marginal farm household members, where as more than half (50.4%) of the produced food was utilized for sale in order to meet the cost of other household needs (Figure 3.2.2). As a result per capita per annum and per capita per day availability of food obtained for consumption from household production amounted to only 105.4 kg and 290 gm respectively of which about 93% was staples and about 14% was vegetables (Table 3.2.9). Per capita availability of food grains of Indian population was 531 gm in 2000, which was 395 gm in 1951 although about 40% of Indian population live below poverty line [135,232], which is much higher than that obtained in the marginal farm households. Food availability for consumption was also much lower than that found in Saotal households of Bangladesh, which was 631 gm per capita per day[230]. Food availability status of the marginal farm households, however, indicates that a few more than 40 per cent of per capita food intake could be provided by household production and the rest amount of food would be obtained from other sources, such as purchasing from market.

The marginal farmers usually, getting no other alternative, are bound to sell a major portion of the produced food items for meeting the cost of other household needs and successive cultivation, which hampers in attaining household food security. As such it was mentioned by about 36 per cent marginal farm households that food would be available for attaining household food security throughout the year if produced foods were not at all sold for other purposes. But if produced food were partly sold, the expected level of food security was found to be more or less opposite, where the proportion of households mentioning food would be available throughout the year came down to only 4.2 per cent (Figure 3.2.3). A study in 1996 by CCDB in Bangladesh indicated that 79.8% of 828 beneficiary rural marginal and landless households under People's Participatory Rural Development Programme were food insecure before entry into the programme, characterized by unavailability of food throughout the year, which reduced to about 44% after completion of the programme[218]. The results of the present study reveal that selling of produced foods caused food insecurity in the marginal farm households and if these people could manage the cost of successive cultivation and other household needs from earned income by secondary occupations or other income generating activities, they could be able to attain household food security from own production for the maximum period of the year.

Income is an indicator to assess the household food security and food intake of a family. Since 64.4 per cent of marginal farm households were dependent on only one earning member in the household (Figure 3.7.1) and due to low wage rate (Table 3.7.8), the average monthly income of the marginal farm households was also low and only Tk.3513.4 (±3025.5) (Table 3.7.4). And per capita monthly income was Tk. 754.1 (± 733.6) and in 14 and 17 households per capita monthly income was Tk. <250 and Tk.1500 & above respectively (Table 3.7.3). Highest income (Tk.895.2) was obtained by the marginal farmers from salary and wages which was 25.5 per cent of the total household income, while income from household production was 23.4 per cent of the total income (Table 3.7.4). Household expenditure was found to be increased and decreased with the level of income, but expenditure on food was not found as such (Table 3.7.6), which might be due to fluctuation of prices of food commodities in different seasons (Table 3.7.9).

Household expenditure on food is also considered as an important indicator of household food security. In this study it was found that about 45 per cent of total income was spent by the marginal farm households for household expenditure on food, while about 52 per cent of total household expenditure was spent for food (Table 3.7.6), which is lower than that reported by third report of World Nutritional Situation which showed that more than 60% of the total household expenditure in Bangladesh is allocated to foods indicating food insecurity at the household level [217].

As the marginal farmers are the key people of food production for the entire population, their sound health and good nutritional status is essential to work hard for increasing food production. So, for the sake of increasing food production and its continuty there is a need to keep them healthy for hard working. And which is dependent on adequate food and nutrient intake throughout the year. Household food security or in other words food availability in the household mostly ensures adequate food and nutrient intake. Although nutrition security of all the family members is the ultimate goal of household food security, it alone is not sufficient enough to bring about good nutritional situation. Because, nutritional improvement is related to different factors that determine the consumption and utilization of food by a person. Good environmental sanitation and hygienic practices ensure proper utilization of consumed foods. But the marginal farm household members most often fail to have adequate and safe food intake throughout the year due to low food production, low food availability for consumption, low household income and poor sanitation as well. As a result they become malnourished and unhealthy to work efficiently. This view has been fairly reflected in the results obtained of this study.

The findings regarding food production, utilization and availability for consumption indicate perpetual food insecurity in the marginal farm households. Lower food and nutrient intake by the members of marginal farm households also support this view. It was found that mean per capita per day food intake of the marginal farm households was 678.3 gm including 450.5 and 118.9 and 31.8 gm cereals, vegetables and animal foods respectively (Table 3.2.13), which was 52.2gm lower than the mean per capita food intake of rural population (730.8gm) as found in 1995-96 national nutrition survey[30]. Intakes of all food groups except vegetables were found to be lower among marginal farm households compared to 1995-96 survey intakes. Besides, households having monthly household income <Tk. 3000/- per capita per day food intake was 713 gm including cereals-452 gm, and households having per capita monthly income <Tk.400/- food intake was 694 gm including cereals-448 gm, while households with < 100 decimals operated land mean food intake was 725.4 gm including 458.5 gm cereals [30], all of which were higher than the intake of marginal farmers. Food intake in the small farm households (marginal) estimated in 1981-82 national nutrition survey was also much higher (745gm including 470gm cereals) [29]. Average intake of cereal was also much higher (548gm) among the population of West Bengal, India than that found in this study[249]. Higher vegetables intake by marginal farm households might be due to the fact that these people are the rural poor who usually cook and eat more vegetables of different kinds in order to increase the bulk of their diets and as such vegetables intakes became higher in them compared to 1995-96 intake of rural population (Table 3.2.15). The findings indicate that the members of the marginal farm households are low fed compared to other rural population and hence more food insecure.

The marginal farmers aged between 20 and 59 years, who are the main work force for food production, were also found to consume much less amount of foods (about 202 gm) of all groups compared to rural adult population (Table 3.2.16). So, it reveals that the consumption of major food items by the hard working marginal farmers might have caused lower intake of macronutrients, as it has been found that except iron intake of all the nutrients of adult marginal farmers was low compared to the intake of rural adult population[30] (Table 3.2.21). About 464 kcal, 13.0 gm protein and 147.5 mg calcium were less consumed by the marginal farmers than the rural adult population. It reveals that although the marginal farmers belong to one section of rural adult population, their lower nutrients intake is indicative of chronic food insecurity resulting higher proportion of chronic energy deficiency and thereby poor nutritional status.

Similarly, intakes of most of the nutrients by the marginal farm households were lower than the rural population as well as than the requirement, as it has been found that per capita calorie intake was 1768.3 kcal, while protein, fat, carbohydrate, calcium, iron and vitamin C intakes were 42.2gm, 7.7gm, 380.1gm, 251.4mg, 13.1mg and 24.6 mg per capita respectively. The intakes of only vitamin A, thiamine and niacin could meet the requirement (Table 3.2.19). Calorie intake of small farm households as found in 1981-82 was 1873 kcal [29], and calorie intakes in households with monthly income < Tk. 3000/-, per capita monthly income < Tk. 400/- and with <100 decimal of operated land were 1862, 1827 and 1889 kcal respectively as found in 1995-96 survey [30]. CCDB in 1996 found that per capita food intake of marginal & landless families was 788gm including 513.2gm cereals providing 2126 kcal energy [218], and calorie intake of the Indian population as found in 1995 was 2172 kcal[135]. All the mentioned calorie intakes were much higher than the intakes of marginal farm households in this study indicating more food insecurity.

Nutritional status is the reflection of food and nutrient intake and thereby food security of the marginal farm households. It was found that 58.1 per cent of adult marginal farmers were chronic energy deficient (Table 3.5.1) which is about 10 per cent more than the rural adult population as found in national nutrition survey in 1995 – 96 [30]. Chronic energy deficiency was found to increase with the increase in age of adults and the prevalence was more than 83 per cent in elderly people (Table 3.5.2b). It rteveals that the adult marginal farmers were more food insecure than the rural adults, although they were given priority of eating meals first of all, eating good quality foods in more amount, and not suffering from less eating when the household faced food scarcity compared to other members of the households (Tables 3.4.1 to 3.4.3). This was the situation of food security of the adult marginal farmers upon whom the other household members depended, who were usually deprived in all aspects and given less priority in food intake indicating that there would be more food insecurity in them. Thus the household as a whole became food insecure. The nutritional situation of other members of the marginal farm household also confirms this view, as about 65 and 63.0 per cent adolescents were stunted and underweighth respectively and about 46 per cent were chronic energy deficient (CED) (Table 3.5.3 and 3.5.4). About 72 per cent of 6-9 years old children were malnourished in respect of both stunting and underweight and 65.3 per cent were malnourished in respect of both stunting and wasting and on an average 59.3, 12.0 and 62.0 per cent children were stunted, wasted and underweight respectively (Table 3.5.6). When compared with the findings of national nutrition survey in 1995-96, stunting and underweight rates were found to be higher among 6-9 years old children of marginal farmers than the rural children[30] (Table 3.5.8). It indicates that both height and weight of these children were low for age which is indicative of chronic low food intake by the marginal farm households due to perpetual food insecurity. Similarly, 78.5 per cent of children aged 6-71 months were malnourished in respect of both stunting and underweight, while 73.0 per cent were malnourished in respect of both stunting and wasting and overall 69.4, 12.9 and 64.8 per cent were stunted, wasted and underweight respectively (Table-3.5.10), and according to Gomez classification 94.5 per cent (including 4.0% severe) were malnourished (Figure 3.5.8 & 3.5.9). Stunting rate was higher, while wasting and underweight rates were lower among farmer's children than those found for rural children in 1995-96 national nutrition survey (Table 3.5.17). Nutritional status of marginally poor Indian rural children (0-4 years) excluding 5 States showed that stunting was 53.6 per cent[292]. Therefore, it reveals that chronic malnutrition is more prevalent among the children of marginal farmers than acute form of malnutrition indicating chronic food insecurity.

Besides nutritional status, among the study population 20.8, 13.0 and 12.0 per cent were also found to have been suffering from dental caries, enlarged thyroid gland and angular stomatitis. Some 1.5, 1.0 per cent was found to suffering from nightblindness, bitot's spot due to vitamin A deficiency and 1.7 per cent was found suffering from dermatosis (Table 3.6.1). Nightblindness was much higher in marginal farm household members, while angular stomatitis was found to be lower than that of rural population as found in 1995-96 survey[30]. The prevalence of nightblindness and angular stomatitis is the reflection of low intake of vitamin A and riboflavin per capita. Although carotene intake was higher and hence total vitamin A intake was also higher, but due to very low intake of fats & oils, vitamin A could not be utilized as was expected causing higher incidence of nightblindness.

Morbidity pattern shows that 47.4 per cent of the study people were well suffering from various diseases: 55.3 per cent suffereng from fever/cold followed by dysentery (19.2%), while morbidity of diarrhoea was found 11.3 per cent (Table 3.6.4). And 16.3 per cent of the diseased persons did not have received any sort of treatment mostly because of poor economic condition and negligence due to high level of illiteracy (Table 3.6.5, Figure 3.6.1 and Table 3.1.2); and due to these reasons vitamin A capsule distribution coverage among 0-6 months old children of these households was only 20.7 per cent (Figure 3.6.2).

Since sources of drinking and cooking water in the household and personal and environmental sanitation indicate the situation of utilization of consumed food, morbidity and thus state of health and nutritional status; it was found that although about 95 per cent households were using tube-well water for drinking, yet about 33 per cent households were not using tube well water for cooking and washing (Table 3.6.7). Again in 13 per cent households there was no latrine, while sanitary /water sealed latrine was found in 7.4 per cent households (Figure 3.6.3) and the members of about 95 and 2.3 per cent households were found to use ash /mud & water and soap & water for cleaning of hands after defecation (Figure 3.6.4). The findings regarding sources of water and sanitation support the high incidence of dysentery and diarrhoea among the members of marginal farm households which were much higher than the overall prevalence rate of Bangladeshi population[43].

The study also confirms the prevalence of the practice of giving more quality foods to the male, specially the household head and /or male earning members of the family. Nutritional need of individuals has always been ignored. In this study the food preferences data among the members of marginal farm households reveals that females, irrespective of age groups and physiological state, were given less preferences in respect of eating meals first, adequate amount of food intake and eating more good quality foods as well. On the other hand, male members, specially the household heads were the first eater and given more preference in eating good quality foods in more amounts (Tables 3.4.1, 3.4.2 and 3.4.3). It seems that these mal-practice of food allocation among the family members are principally due to taboos, superstitions, ignorance and lack of nutritional knowledge as well.

Therefore, if we consider and examine the results obtained in respect of household food production, utilization of produced food and food availability for consumption, household income, food and nutrient intake, food preferences, prevalence of chronic energy deficiency (CED) among adult farmers and malnutrition among adolescents & young children, morbidity and personal & environmental sanitation, then without any hasitation it can undoubtedly be inferred that the marginal farm households were food insecure and the pattern of their food insecurity was mostly perpetual in nature.

The status of household food security and food intake is not the same in all seasons rather it varies depending on the food scarcity/shortages in the household, food short supply in the local markets and situation of employment. It is thought that seasonality influnces and aggravates household food insecurity. In this study it was found that about 85 per cent marginal farm households faced food shortages during Falgun & Choitra (mid February to mid April) – the usual food shortage period which is now widely considered as critical lean period before boro paddy harvest. And another 45.4 per cent households faced food shortages during Kartik & Agrahayan (mid October to mid December) – the period which is also considered as another critical lean period of Bangladesh before aman paddy harvest (Table 3.2.10). And as such about 79 per cent of the marginal farm households had to purchase rice for different periods from 1 to 5 months to meet the food short supply in their households (Table 3.2.11), and about 42 per cent households had to purchase rice ranging from 100 to 300 kg during the mentioned period (Table 3.2.12). In a study it has been estimated that the marginal farm households of Bangladesh purchased on an average 62 to 80 per cent of the rice they consume [213].

Moreover, food intake of the marginal farm households was also found different in different seasons. Highest intake (774.3gm) was observed in abundant period during January & February (4^{th} round) after aman harvest, while lowest (588.3gm) intake was found in the typical lean period during October and November (3rd round) before aman harvest (Table 3.2.14). The consumption of all group of foods were less in third round compared to fourth round and the differences in intakes of almost all food groups except roots, meat, milk, egg and fruits between third and fourth round were statistically highly significant ($p<0.001$).The lowest intake of vegetables and fruits during lean period indicates low production and scarcity of vegetables in autumn season (October – November), which caused drastic low intake of these food items in the marginal farm households in that period.

It was also found that majority of the nutritents were found to be consumed in leser amounts in the third round compared to other rounds. At the beginning calorie intake was 1710.2 kcal, which increased to 1759.8 kcal in second round, then slightly decreased to 1719.1 kcal in third round and then again increased by 164.4 kcal to 1884.5 kcal in the fourth round (Jan.- Feb.), which might be due to the increased intake of foods, particularly, cereal foods after aman harvest (Table 3.5.20). The differences in intakes of calorie, protein, fat, carbohydrate, iron, carotene, thiamine, riboflavin, niacin and zinc between lean (3^{rd} round) and abundant period (4^{th} round) were statistically significant ($p<.001$). Corresponding nutritional situation in different rounds showed that highest stunting was observed among adolescents (67.0%) and 6-9 years children (62.3%) during third round indicating chronic malnutrition (Table 3.5.3 and Figure 3.5.1). Highest prevalence of stunting (71.6%) and underweight (70.0%) was also observed among 6-71 months old children during third round in October-November (Figure 3.5.4). The observed nutritional situation fairly corresponds with the lowest food intake in third round (Table 3.1.2). The findings indicate that seasonality had an influence on the food security status of the marginal farm households as the existing food insecurity aggravated during lean season (third round), which again reduced in abundant period after aman harvest during December & January.

Male-female difference in food intake in the marginal farm households was also remarkable and hence food insecurity was more prevalent among female members. Intake of all the food items with an exception of milk & milk products and other non-specific food item were found significantly higher ($p<.001$) in males than female members (Table 3.2.17.) indicating that females of marginal farm households were deprived of adequate food intake like all other females of rural communities. Moreover, the females were found to consume other non-specific food beyond the known food groups in more amounts in order to satisfy their hunger which is a common practice among rural women. Similarly all the nutrients were consumed by the females in lesser amount compared to their male counterparts and the differences were highly significant ($p<.001$) (Table 3.2.22). Females, irrespective of age groups and physiological state, are given less preferences in respect of eating meals first, adequate amount of food intake and eating more good quality foods compared to the male members. This mal-practice of intra-family food distribution has influenced in the intake of food and nutrients by the male and female members of different age groups.

Nutritional status showed that CED was higher among adult males than females, specially higher in more active males than females of 18-39 years age group (Table 3.5.2a and Table 3.5.2b) indicating that because of increased demand male marginal farmers needed more energy to do hard work in agricultural activities, which due to inadequate food intake made them more chronic energy deficient. The prevalances of stunting, underweight and CED were higher in male adolescents than females, which might be due to the fact that the adolescent boys are more active and engaged in more energy expensive activities compared to the girls. This over activities leading the boys towards higher proportions of underweight (68.9%) and CED (51.7%) (Tables 3.5.3 and 3.5.4), indicating acute food insecurity among male adolescents of marginal farm households.

In respect of both stunting & underweight and both stunting & wasting, 6-9 years old male children were more malnourished (75.2% & 66.7% respectively) than female children (68.6% & 64.0% respectively). Girls were more stunted compared to boys, while boys were more underweight and wasted than girls (Table 3.5.6), and according to Gomez classification females were found more malnourished than males (Table 3.5.7). Among 6-71 months old children stunting (72.4%) and underweight (69.8%) rates were higher, whereas wasting (10.9%) rate was lower in females than male children (Table 3.5.10). Male children were found to suffer from wasting in higher proportion in all rounds than girls (Figure 3.5.6). This situation might be due to the fact that male children are usually more active and spending more time in energy expensive playing than girls leading them towards acute energy deffeciency giving rise to acute weight loss and ultimately they become wasted. But the proportion of simultaneously stunted and underweight children reveals that females were the worst sufferer and the situation was comperatively better in males than females in respect of Gomez classification (Table 3.5.14). The food and nutrients intake and nutritional status of both sexes indicate that none among male and female members of marginal farm households were food secure, rather both groups were the victims of household food insecurity.

Regarding relationship as measured by correlation co-efficient between different socio-economic variables and food and nutrient intakes, it was found that positive significant correlation was found between the intakes of pulse, fish and milk and household monthly income, but no significant relationship was found with the intakes of other food groups. Among the known food groups only pulses intake was found to have significant positive correlation with monthly total expenditure. Monthly expenditure on food was found to have significant negative relationship with the levels of fat & oils and other non-specific foods intakes, but no significant relationship was found with other food groups (Tables 3.8.1, 3.8.2 & 3.8.3). Family size had a negative relationship with level of cereal, roots & tubers, vegetables, egg, fat & oils and other non-specific food intakes (Table 3.8.4), while number of earning members had a significant positive correlation with cereal intake and a negative correlation with egg intake, but no significant correlation was found with the intakes of other food groups (Table 3.8.5).

There was no close relationship between household monthly income, total expenditure & expenditure on food and intakes of different nutrients with an exception of fat intake, where there was a highly significant negative correlation with household monthly expenditure on food (Tables 3.8.6 to 3.8.8). Calorie, protein, fat, carbohydrate, thiamine, niacin, vitamin C and zinc intakes were negatively correlated with family size (Table 3.8.9). But calorie, carbohydrate and niacin intakes were significantly positively correlated with the number of earning members in the household (Table 3.8.10). Multiple regression analysis also showed that family size, number of total earning members and household monthly expenditure was found significantly related to per capita calorie intake (Table 3.8.11).

To meet the food production and food purchasing costs majority of the marginal farmers (82.9%) were found to depend on income earned by the principal and secondary occupations (Table 3.9.1). Falgun-Chaitra and Kartik – Agrahayan months were the two lean periods, as stated earlier, faced by the majority of marginal farm households before aus and aman paddy harvest respectively (Table 3.2.10). So, during these periods the marginal farmers adopted multiple measures to maintain food supply in their households. A loan for food procurement is a good indicator of household food insecurity. In this study it was found that 63.5 per cent marginal farm households took debt/loan from relatives and/or neighbours to maintain food supply in their household during the period of food scarcity (Table 3.9.2). A study by HKI carried out among Char households in Bangladesh showed that 17 % Char households took loan to purchase foods during previous two months compared with only 11 % of rural households [228] and almost one third (30%) of households in Chittagong Hill Tracts were found to have taken a loan for food in the previous month that was much higher than rural Bangladesh[219]. These figures are much lower than that obtained by the marginal farm households indicating more food insecurity. Similarly, the marginal farmers passed their opinion about multiple measures to be adopted in order to ensure round the year food security in their households. Among the mentioned measures 34.3 and 7.9 per cent marginal farmers advocated easy loan without interest for adopting income generating activities and augmenting easy employment opporunities respectively. Of course, majority of the marginal farmers

(64.4%) advocated all the possible measures to be adopted as a package programme in order to maintain round the year household food security (Table 3.9.3).

As the income from household production was too low in the marginal farm households, they are to depend on earned income from different sources (Table 3.7.4) to meet the food production and purchasing cost as well as to meet the cost of other unavoidable household needs. So, if the earned income can be increased at least to some extent by increasing salary and wages and by adoption of income generating activities, the marginal farmers could be able to spend more money for food purchasing. Thus household food food security and thereby adequate food intake could be achieved.

The findings also indicate that the marginal farmers used to adopt different measures within their reach to ensure food supply during food shortages. Moreover, they have pointed out different measures which, according to them, would be able to bring about household food security round the year. Of course, they do not possess such capacity to adopt most of the mentioned measures on their own such as-- available easy loan for undertaking income generating activities; reasonable market price of agricultural products; control of food prices; available supply of HYV seeds, fertilizers & irrigation and augmenting employment opportunities during dull seasons etc. The marginal farmers and the villagers were trying to obtain financial support from the Government and other developing agencies of the country in order to undertake appropriate income generating activities for meeting their household expenditure.

4.2. Limitation of the Study:

1. There is paucity of literature relating to household food security of marginal farm households in Bangladesh and elsewhere in the world faced during the study period.

2. Under reporting about food production and food intake by the marginal farm household members with the hope that they would get some help either in cash or credit in future.

3. Due to country-wide devasting flood in the country during the study period, data collection during third round had to conduct about one month later than the schedule.

4. For convienience 24 hours recall method was used to collect food intake data and hence direct weighing method was not considred.

5. Inclusion of all nutritional parameters was not feasible for this study.

6. The marginal farm households from all the divisions were included in the study but drought and flood prone areas were not considered.

CHAPTER – FIVE

CONCLUSION

AND

RECOMMENDATION

CONCLUSION AND RECOMMENDATION

Inadequate and imbalanced food and nutrient intake by the marginal farm household members, particularly during lean season, were due to low household food production and in turn low food availability for consumption lead higher prevalence of chronic malnutrition (stunting) in children and adolescents. Higher proportion of chronic energy deficiency was also seen among both male and female adults. Total food intake of the marginal farm households was lower than intakes of rural population of Bangladesh. Moreover, about 44 per cent of produced foods were available for household consumption and more than 50 per cent was sold to meet the cost of other household needs and successive cultivation. And as such about 36 per cent marginal framers could have food security round the year if produced foods were not at all sold. While only 4.2 per cent households expressed to have food security if partly sold. Similarly, household monthly income, total expenditure and expenditure on food in these households were also low and about 45 and 52 per cent of total income and total expenditure respectively were spent for household expenditure on food. Besides, about 64 per cent marginal farmers used to take loan from available sources to maintain food security in the households during scarcity. Therefore, food and nutrients intake, nutritional status and morbidity of the marginal farm households and the differences thereof between male & female members and lean & abundant seasons as well as food preferences indicate that the marginal farm households were food insecure and their food insecurity was perpetual in nature. And these findings obviously reveal that the marginal farmers have no ability to lead a socially useful and economically productive life. This is a common picture of the marginal farm households prevailing all over Bangladesh.

However, low food & nutrient intake and resultant poor nutritional status was due to multiple causative factors, which directly or indirectly contributed to food insecurity. So, factors contributing food insecurity are needed to be prevented aiming at the gradual improvement of health and nutritional status of the marginal farm household members, specially the adult farmers, so that they could be able to do work regularly for sustainable increasing food production. This requires adoption of appropriate preventive measures mostly on self-help basis. Hence, it is concluded with the following recommendations:

i. For increasing household food production and thereby increasing food and nutrient intake maximum utilization of crop land & homestead of the marginal farmers must be ensured by using HYV and improved techniques of cultivation. For this purpose, use of power tiller, high yielding varietis of seeds, organic manure, irrigation, multiple cropping, mixed cropping, crop-rotation and crop diversification are needed to be encouraged among the marginal farmers.

ii. For increasing consumption and meeting micronutrient requirement establishment of kitchen garden and plantation of permanent fruit trees in the homestead to be encouraged for round the year vegetable and fruit production. Similarly, poultry and cattle/goat rearing are also to be encouraged to supply animal protein in the family diet as well as to earn extra income.

iii. Selling of foods produced should be strongly discouraged and adoption of IGA should be incouraged in order to increase food availability for household consumption.

iv. For increasing household income, appropriate income generating activities other than farm activities are needed to be introduced with small scale investment by providing credit without or with minimum interest, so that the marginal farmers do not think it necessary to sell a portion of the produced food to meet the cost of other household needs.

v. For uniform supply of food during all seasons through out the country as well as for controlling the prices of essential food items open market sale of staples should be introduced on a regular basis by the Government.

vi. Market prices of essential food stuffs to be kept within the purchasing capacity of the marginal farmers.

vii. Appropriate measures needed to be adopted by the responsible authority for fixiation of labour wage based on the market prices of common food stuffs.

viii. Labour-intensive public works or food for works, labour-intensive agriculture based employment opportunities are to be created and augmented during dull/ lean seasons by the government.

ix. Take away food aid or feeding centres for feeding the vulnerable groups are to be established in the rural areas during emergencies with treatment facilities for common diseases.

All the mentioned strategies are needed to be introduced and adopted as and when feasible. But the marginal farmers do not posses such capacity to adopt most of the measures on their own. Hence, an intergated approach must be undertaken with the help of local leaders, upazilla level agriculture and other government officials along with financial support in order to increase food production, availability & intake and there by to improve health and nutritional status of the marginal farmers of the country. Further indepth study may show the most appropriate path.

CHAPTER – SIX

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CHAPTER – SEVEN

APPENDIX
TABLES

APPENDIX TABLES

Appendix Table- A-1: Food intake (gm per capita per day) of marginal farmers by different age and sex groups

Age Group in years	Cereals (gm)			Roots & Tubers (gm)			Sugar (gm)			Pulses (gm)			Vegetables (gm)			Fruits (gm)			Meats (gm)		
	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B
Children																					
1-3	117.7	124.4	126.5	11.6	12.6	12.1	2.0	1.6	1.8	1.9	1.5	1.7	31.5	30.3	30.9	7.0	7.3	7.1	0.7	0.6	0.6
4-6	300.1	265.4	283.7	29.0	29.4	29.2	1.3	0.6	1.0	3.5	4.5	4.0	73.0	72.7	72.9	10.2	10.7	10.4	2.3	1.4	1.9
7-9	394.6	351.7	374.3	39.0	34.1	36.7	1.1	0.4	0.8	6.8	2.9	5.0	88.2	99.2	93.4	9.7	4.2	7.1	1.1	2.6	1.8
Adolescent																					
10-12	438.7	363.4	405.0	41.6	40.5	41.1	1.3	0.2	0.8	5.1	4.8	5.0	107.8	84.9	97.5	10.5	6.0	8.5	2.0	1.3	1.7
13-15	491.0	393.5	459.3	52.6	25.5	43.8	1.7	1.2	1.5	6.3	10.0	7.5	117.8	99.7	111.9	8.9	15.7	11.1	3.0	0.1	2.1
16-19	440.3	391.7	411.1	35.9	45.1	41.4	0.5	0.9	0.8	4.7	7.1	6.1	109.9	90.7	98.4	1.4	4.1	3.0	1.9	3.6	2.9
Adults																					
20-39	471.7	451.7	461.4	56.5	49.4	52.8	1.9	1.0	1.5	8.9	5.3	7.0	126.4	122.9	124.6	8.6	9.7	9.1	2.9	2.2	2.5
40-49	521.1	441.2	483.1	51.6	50.3	51.0	1.7	0.8	1.3	6.9	4.6	5.8	128.1	115.8	122.2	15.2	1.7	8.8	3.1	2.3	2.7
50-59	516.0	395.3	470.8	49.1	37.7	44.8	0.4	1.5	0.8	7.0	9.7	8.0	148.3	103.7	131.6	4.6	4.6	4.6	3.0	3.5	3.2
60-69	517.1	375.1	469.4	43.7	36.2	41.2	1.1	1.6	1.3	9.3	11.4	10.0	126.2	95.5	115.9	4.8	0.7	3.4	1.9	1.2	1.7
70 & above	418.4	317.0	352.2	27.7	39.0	35.1	2.2	0.3	1.0	23.7	3..9	10.8	100.4	78.9	85.34	2.7	0	0.9	10.6	1.3	4.5
Pregnant Woman		406.2			43.7			2.7			5.1			103.0			22.3			5.0	
Lactating mother		440.5			48.7			1.1			4.9			118.6			6.8			2.3	
All age & Sex		450.8			51.2			1.2			6.3			118.9			7.3			3.4	

Appendix Table A-1: (Continued)

Age Group in years	Eggs (gm)			Fish (gm)			Milk & milk product (gm)			Fats & Oils (gm)			Other foods (gm)			Total food consumed (Both sex)
	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B	
Children																
1-3	0.6	0.2	0.4	5.8	7.0	6.4	7.8	13.1	10.6	0.7	0.7	0.7	3.1	3.1	3.1	201.9
4-6	0.3	0.2	0.3	14.0	14.2	14.1	5.0	2.2	3.7	1.4	1.4	1.4	4.7	29.0	16.2	438.7
7-9	0.6	0.3	0.4	22.0	16.3	19.3	2.4	2.9	2.6	1.8	1.7	1.8	7.9	8.3	8.1	551.2
Adolescent																
10-12	0.3	0.1	0.2	20.8	19.2	20.1	5.2	3.6	4.4	2.1	1.7	1.9	8.8	6.9	7.9	594.2
13-15	0.5	0.9	0.6	23.9	23.5	23.8	4.5	4.5	4.5	2.3	1.8	2.2	7.7	9.0	8.1	676.4
16-19	0.1	0.6	0.4	22.8	20.8	21.6	0.1	6.8	4.1	2.0	2.2	2.1	8.7	5.9	7.0	598.8
Adults																
20-39	1.4	0.7	1.1	25.7	23.9	24.8	6.5	3.9	5.1	2.9	2.8	2.9	11.1	17.9	14.6	707.7
40-49	1.0	0.2	0.6	30.2	20.0	25.3	5.4	1.3	3.4	2.8	2.3	2.6	12.0	8.0	10.1	716.9
50-59	0.1	0.2	0.1	26.2	19.8	23.8	0.7	7.1	3.1	2.7	2.6	2.7	9.3	6.4	8.2	701.7
60-69	1.0	1.0	1.0	29.5	20.9	25.6	2.5	12.1	5.7	2.7	2.4	2.6	7.5	4.6	6.5	685.2
70 & above	2.7	0.1	1.0	8.9	28.4	21.7	15.9	5.6	9.2	2.0	2.1	2.0	7.5	5.3	6.0	520.8
Pregnant Woman		0.6			27.3			8.4			3.6			10.2		638.2
Lactating Mother		1.0			21.2			2.9			2.5			7.6		657.9
All age & Sex		0.6			23.4			4.4			2.4			8.6		678.3

Appendix Table A-2: Nutrient intake (per capita per day) of marginal farm household members by age and sex groups

Age Group in years	Calorie (kcal)			Protein (gm)			Fat (gm)			Carbohydrate (gm)			Calcium (mg)			Iron (mg)		
	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B
1-3	485.5	543.2	515.8	11.5	12.9	12.3	2.7	2.7	2.7	102.9	115.8	109.7	75.1	86.4	81.0	4.2	3.9	4.0
4-5	1174.6	1132.6	1154.7	27.5	26.8	27.2	4.9	6.0	5.5	253.3	241.8	247.9	158.3	186.7	171.7	9.0	11.9	10.4
7-9	1540.8	1366.2	1458.4	36.8	32.4	34.7	6.5	5.5	6.0	332.2	294.3	314.3	219.3	185.9	203.5	11.0	11.0	11.[illegible]
10-12	1707.1	1415.6	1576.7	40.5	33.6	37.4	7.3	6.0	6.7	367.5	305.3	339.7	234.9	202.7	220.5	14.0	10.7	12.[illegible]
13-15	1919.3	1548.1	1798.8	45.0	37.9	42.7	7.9	6.4	7.4	414.7	333.6	388.4	240.1	261.7	247.1	13.8	11.5	13.[illegible]
16-19	1688.1	1547.9	1603.9	39.0	36.9	37.8	6.1	6.8	6.5	367.8	331.8	346.2	235.3	227.8	230.8	9.8	11.4	10.[illegible]
20-39	1879.4	1795.7	1836.2	45.0	42.4	43.7	8.7	8.0	8.4	402.9	385.7	394.1	277.0	255.4	265.9	13.7	12.8	13[illegible]
40-49	2056.0	1714.4	1893.5	50.8	39.6	45.5	9.2	7.1	8.2	439.6	371.4	407.2	308.4	222.7	267.6	17.6	12.3	15.[illegible]
50-59	2010.9	1569.1	1845.4	47.1	38.3	43.8	8.3	7.9	8.1	433.9	335.3	397.0	271.8	248.0	262.9	14.6	11.4	13.4
60-69	2004.4	1497.9	1834.3	48.7	36.7	44.7	8.3	7.4	8.0	432.2	320.0	394.5	292.0	247.1	276.9	14.7	12.0	13.8
70 & above	1718.6	1250.1	1412.7	42.1	30.9	34.8	8.9	5.1	6.7	363.1	267.4	300.6	186.2	211.6	202.8	10.6	7.7	8.7
Pregnant Women		1652.1			39.7			8.1			350.8			258.3			11.8	
Lactating Mother		1723.5			40.2			7.4			372.4			229.2			12.9	

Appendix Table A-2: (Continued)

Age Group in years	Vitamin A (I.U.)			Carotene (μg)			Thaimine (mg)			Riboflavin (mg)			Niacin (mg)			Vitamin C (mg)			Zinc (mg)		
	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B
1-3	25.1	30.3	27.8	1000.4	756.8	872.3	0.35	0.38	0.37	0.15	0.17	0.16	5.0	5.6	5.3	7.1	6.7	6.9	1.9	2.1	[illegible]
4-6	19.8	13.5	16.8	2074.2	2150.0	2110.0	0.85	0.79	0.82	0.33	0.31	0.32	12.6	11.8	12.2	16.6	16.2	16.4	4.4	4.1	[illegible]
7-9	16.8	19.5	18.1	2771.5	2646.1	2712.3	1.12	1.00	1.06	0.42	0.40	0.41	16.5	14.7	15.7	20.7	18.3	19.5	5.8	5.3	[illegible]
10-12	25.8	12.6	19.9	2733.4	2351.0	2562.3	1.26	1.04	1.16	0.50	0.40	0.46	18.4	15.3	17.0	19.7	18.9	19.4	6.6	5.4	[illegible]
13-15	68.4	120.9	86.4	3146.4	3293.8	3194.2	1.37	1.12	1.29	0.52	0.44	0.49	20.6	16.4	19.2	24.7	18.4	22.7	7.3	5.9	[illegible]
16-19	16.1	33.7	26.7	3299.8	2836.3	3021.4	1.15	1.09	1.11	0.40	0.43	0.42	18.3	16.6	17.3	21.1	17.6	19.0	6.1	5.9	[illegible]
20-39	55.1	28.6	41.4	3296.4	3227.7	3251.0	1.34	1.29	1.32	0.52	0.50	0.51	20.1	19.0	19.5	26.7	26.6	26.6	7.2	6.7	[illegible]
40-49	34.9	14.8	25.3	3434.3	2970.0	3213.4	1.50	1.24	1.37	0.58	0.47	0.53	22.0	18.5	20.3	27.4	23.2	25.4	7.9	6.4	[illegible]
50-59	18.9	125.5	58.8	3606.7	2894.2	3339.9	1.45	1.12	1.32	0.54	0.45	0.51	21.8	16.9	19.9	27.3	20.8	24.9	7.5	6.0	6.9
60-69	23.4	45.5	30.8	2812.0	2944.0	2856.3	1.45	1.08	1.33	0.56	0.45	0.52	21.8	15.7	19.8	21.9	19.3	21.0	7.8	5.8	7.1
70 & above	18.5	16.5	17.2	3018.5	1522.3	2041.4	1.22	0.88	1.00	0.48	0.33	0.38	18.0	13.4	15.0	11.7	26.9	21.7	6.0	4.8	5.2
Pregnant		27.6			3550.9			1.14			0.46			17.3			22.2			5.9	
Lactating		33.19			3025.1			1.24			0.48			18.6			23.4			6.6	

Appendix Table B-1: Energy and protein requirement by age group

Age Group	Energy Requirement (kcal/person/day)		Protein Requirement (gm / person /day	
	Male	Female	Male	Female
< 1 Year	803	742	26.6	24.6
1-3 Years +	1330	1260	32.0	30.4
4-6 Years +	1709	1551	39.1	36.9
7-9 Years +	1949	1728	44.8	44.5
10-12 Years +	1969	1775	41.5	42.7
13-15 Years +	2150	1848	44.2	42.7
16-17 Years +	2317	1855	53.3	46.1
18-29 Years +	2763	1943	53.7	43.2
30-59 Years +	2807	2027	53.7	43.2
60 Years and above	1910	1683	53.7	43.2
Pregnant Women	(1985+285) 2270			
Lactating Women	(1985+500) 2485		(43.2+7.3) 50.5	
1st 6 months			(43.2+21.4) 64.6	
2nd 6 months			(43.2+15.9) 59.1	
Average	2264	1814	47.4	41.8
Average (All age & sex)	2039		44.6	

Appendix Table C-1: Percentiles for cut-off points of BMI-for age for adolescents (10-17 years).

Age (years)	Percentiles			
	5^{th}		85^{th}	
	Male	Female	Male	Female
10	14.42	14.23	19.60	20.19
11	14.83	14.60	20.35	21.18
12	15.25	14.98	21.12	22.17
13	15.73	15.36	21.93	23.08
14	16.18	15.67	22.77	23.88
15	16.59	16.01	23.63	24.29
16	17.01	16.37	24.45	24.74
17	17.31	16.59	25.28	25.23

Fifth percentiles indicate the lowest and 85th percentiles indicate the highest cut-off values for normal range of BMI for age.
Reference data are based on the first National Health and Nutrition Examination Survey (NHAESI) in the United States of America.

Appendix Table D-1: Per capita monthly income and per capita per day food intake

Per Capita Monthly Income (Tk)	No. of H/Hs	Foods Groups										
		Cereals (gm)	Roots (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meat (gm)	Fish (gm)	Egg (gm)	Milk (gm)	Fats (gm)	Other Food (gm)
<500	68	421.5	44.6	4.9	106.6	4.9	1.7	21.1	0.3	2.1	2.0	8.0
500-749	69	456.2	50.3	5.3	128.4	8.7	3.7	22.7	0.4	3.5	2.2	9.6
≥750	78	468.4	57.6	8.3	120.4	8.3	4.8	25.8	0.9	7.1	2.9	8.3
Mean	215	449.7	51.2	6.3	118.6	7.3	3.4	23.3	0.6	4.4	2.4	8.6
Correlation Co-efficient		.114	.040	.155*	.170*	.035	.090	.285**	.238**	.163*	.352**	-.004

Level of Significance: * = 0.01, **= 0.001

Appendix Table D-2: Per capita monthly expenditure and per capita per day food intake.

Per capita Monthly Expenditure (Tk.)	No. of H/Hs	Food Groups										
		Cereals (gm)	Roots (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk (gm)	Fats (gm)	Other Foods (gm)
<300	38	414.7	42.0	3.6	101.8	4.3	2.8	20.5	0.2	1.4	1.9	8.1
300-499	42	438.4	46.1	6.0	129.1	4.0	2.9	21.8	0.2	2.1	2.2	10.4
500-699	79	464.7	52.0	5.9	122.1	8.7	2.9	24.4	0.6	5.3	2.4	8.1
700&above	56	460.7	60.0	8.8	117.2	10.0	5.1	24.8	1.0	6.8	2.9	8.3
Mean	215	449.7	51.2	6.3	118.6	7.3	3.4	23.3	0.6	4.4	2.4	8.6
Correlation Co-efficient		.158**	.089	.221**	.155*	.091	.205**	.157*	.288**	.222**	.377**	.006

Level of Significance: * = 0.01, **= 0.001

Appendix Table D-3: Per capita monthly expenditure on food and per capita per day food intake.

Per Capita Monthly Expenditure on Food (Tk)	No. of H/Hs	Foods Groups										
		Cereals (gm)	Roots (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk (gm)	Fats (gm)	Other Foods (gm)
<250	35	416.4	44.0	3.7	113.6	5.7	3.0	22.3	0.3	1.1	1.9	9.4
250-299	65	436.0	50.8	6.3	110.2	5.5	3.3	22.1	0.3	3.1	2.3	9.4
300-349	61	461.0	51.6	5.3	128.1	7.1	3.1	23.2	0.6	5.2	2.4	7.6
350 & above	54	476.1	55.7	9.1	121.2	10.9	4.3	25.5	1.0	7.0	2.9	8.3
Mean	215	449.7	51.2	6.3	118.6	7.3	3.4	23.3	0.6	4.4	2.4	8.6
Correlation Co-efficient		.274**	.059	.107	.072	.091	.047	.017	.115	.145*	.262**	-.042

Level of Significance: * = 0.01, **= 0.001

Appendix Table D-4: Size of cultivated land and per capita per day food intake.

Size of Cultivated Land (Decimals)	No. of H/Hs	Foods Groups										
		Cereals (gm)	Roots (gm)	Pulses (gm)	Vegetables (gm)	Fruits (gm)	Meats (gm)	Fish (gm)	Egg (gm)	Milk (gm	Fats (gm)	Other Foods (gm)
Up to- 15	40	449.8	44.7	6.2	112.8	5.1	2.1	22.1	0.7	4.7	2.5	8.3
16-30	53	459.1	47.6	5.9	131.0	6.9	3.5	24.5	0.6	2.8	2.4	9.3
31-45	35	444.1	59.1	6.2	101.5	3.6	2.0	21.9	0.6	4.8	2.0	5.8
46-60	33	441.3	45.3	8.4	115.7	9.3	3.3	24.8	0.6	4.4	2.2	9.0
61-80	22	440.0	62.3	4.3	120.4	6.7	7.9	26.0	0.4	6.2	3.1	11.0
81-100	33	454.2	53.9	6.4	125.6	13.1	3.6	21.2	0.4	4.7	2.5	8.6
Mean	216	449.5	51.2	6.3	118.6	7.3	3.4	23.3	0.6	4.4	2.4	8.6
Correlation Co-efficient		-.036	.053	-.063	-.017	.023	.046	.043	-.054	-.047	.023	-.002

Level of Significance: * = 0.01, **= 0.001

Appendix Table D-5: Per capita monthly income and per capita per day nutrient intake

Per capita Monthly Income (Tk)	No. of H/Hs	Nutrients												
		Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Iron (mg)	Vit.A (I.U.)	Carotene (µg)	Thia-mine (mg)	Ribof-lavinn (mg)	Niacin (mg)	Vit. C (mg)	Zinc (mg)
<500	68	1645.8	39.4	7.0	353.7	229.8	13.5	30.6	3209.3	1.2	0.5	17.7	22.0	6.5
500-749	69	1775.7	42.0	7.4	382.7	252.3	13.2	21.5	3565.3	1.3	0.5	19.2	24.9	6.8
750&above	78	1858.8	44.5	8.5	398.6	268.5	12.5	51.4	2831.2	1.3	0.5	20.0	26.7	7.0
Mean	215	1764.8	42.1	7.7	379.3	251.1	13.0	35.2	3183.2	1.3	0.5	19.0	24.6	6.8
Correlation Co-efficient		.168*	.217**	.273**	.151*	.204**	-.067	.041	-.004	.060	-.013	.161*	.140*	.122

Level of Significance: * = 0.01, ** = 0.001

Appendix Table D-6: Per capita monthly expenditure and per capita per day nutrient intake

Per capita Monthly Expenditure (Tk)	No. of H/Hs	Nutrients												
		Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Iron (mg)	Vit. A (I.U.)	Carotene (µg)	Thia-mine (mg)	Ribo-flavin (mg)	Niacin (mg)	Vit. C (mg)	Zinc (mg)
<300	38	1618.5	38.5	6.8	348.2	215.3	13.1	36.6	3181.1	1.2	0.5	17.5	21.1	6.3
300-499	42	1708.6	40.8	7.4	367.6	244.8	13.3	16.7	3282.0	1.3	0.5	18.4	25.3	6.7
500-699	79	1821.3	43.5	7.6	391.7	269.0	13.6	32.5	3263.5	1.3	0.5	19.6	24.7	7.0
700 & above	56	1826.4	43.5	8.5	391.8	254.6	12.1	52.0	2997.2	1.3	0.5	19.6	26.5	6.8
Mean	215	1764.8	42.1	7.7	379.3	251.1	13.0	35.2	3183.2	1.3	0.5	19.0	24.6	6.8
Correlation Co-efficient		.209**	.227**	.260**	.197**	.148*	-.079	.071	-.035	.090	-.025	.201**	.072	.111

Level of Significance: * = 0.01, ** = 0.001

Appendix Table D-7: Per capita monthly expenditure on food and per capita per day nutrient intake

Per capita Monthly Expenditure on food (Tk)	No. of H/Hs	Nutrients												
		Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Iron (mg)	Vit. A (I.U.)	Carotene (µg)	Thia-mine (mg)	Ribo-flavin (mg)	Niacin (mg)	Vit. C (mg)	Zinc (mg)
<250	35	1628.8	39.9	6.7	350.2	240.6	13.0	19.3	3241.1	1.2	0.5	17.4	21.3	6.4
250-299	65	1719.2	40.6	7.5	369.6	232.1	12.8	42.5	2967.2	1.2	0.5	18.5	22.9	6.6
300-349	61	1785.8	42.8	7.8	383.8	265.4	13.5	34.1	3461.5	1.3	0.5	19.3	25.6	6.9
350&above	54	1884.0	45.0	8.4	404.8	264.5	12.8	38.8	3091.3	1.3	0.5	20.2	27.7	7.1
Mean	215	1764.8	42.1	7.7	379.3	251.1	13.0	35.2	3183.2	1.3	0.5	19.0	24.6	6.8
Correlation Co-efficient		.262**	.218**	.150*	.268**	.076	.049	.014	-.013	.180**	.056	.256**	.075	.144*

Level of Significance: * = 0.01, ** = 0.001

Appendix Table D-8: Size of cultivated land and per capita per day nutrient intake

Size of Cultivated Land (Decimal)	No. of H/Hs	Total Food Intake (gm)	Nutrients												
			Calorie (Kcal)	Protein (gm)	Fat (gm)	Carbo-hydrate (gm)	Calcium (mg)	Iron (mg)	Vit. A (I.U)	Carotene (µg)	Thia-mine (mg)	Ribo-flavin (mg)	Niacin (mg)	Vit C (mg)	Zinc (mg)
Upto-15	41	648.6	1739.5	41.5	7.2	374.9	238.1	14.3	20.2	3094.9	1.3	0.5	18.7	21.6	6.8
16-30	51	682.2	1775.0	42.0	7.6	382.1	260.2	11.8	29.2	3442.2	1.3	0.5	19.1	26.7	6.7
31-45	33	664.2	1757.0	42.1	7.6	377.5	250.8	12.5	27.6	2814.9	1.3	0.5	18.9	24.0	6.7
46-60	34	664.8	1768.4	42.3	7.9	378.9	236.9	12.9	29.9	3409.5	1.3	0.5	19.1	21.0	6.8
61-80	24	668.1	1740.4	42.7	8.1	372.2	284.4	14.0	29.3	2638.9	1.3	0.5	18.8	25.2	6.9
81-100	33	703.2	1798.0	42.1	7.8	387.0	240.9	13.2	80.6	3387.9	1.3	0.5	19.2	28.3	6.9
Mean	216	672.0	1764.2	42.1	7.7	379.2	250.8	13.0	35.2	3177.1	1.3	0.5	19.0	24.5	6.8
Correlation Co-efficient		-.072	-.098	-.106	-.093	-.093	-.100	-.021	-.051	-.047	-.069	-.048	-.097	-.028	-.039

Level of Significance: * = 0.01, ** = 0.001

CHAPTER – EIGHT

ANNEXURES

Annexure-1

Study on Food Security and Nutritional Status of Marginal Farm Households of Bangladesh

Institute of Nutrition and Food Science
University of Dhaka

Village Description Form

Name of the Interviewer ________________ Date __________ Round ______ ☐

Name of the village _______________ Union_____________ Area code ________
Upazilla _________________ District ___________ Division_______________ ☐

General Information of the Village:

1.Total area of the village ☐☐☐ sq. kilometer (approx.)

2.Total number of different households of the village:

Land less H/Hs	Marginal farm H/Hs	Medium & large farm H/Hs	Other H/Hs	Total H/Hs

3.Total population of the village: Male ☐☐☐☐ Female ☐☐☐☐ Total ☐☐☐☐☐

4.Number of Educational Institutions of the village:

Moktab	Primary school	High school	Madrasa	College	Total

5. Market / Hat ☐1 Health center ☐2 Post office ☐3
Mosque ☐4 Mondir ☐5 Bank ☐6

6.Main Sources of Water: Drinking water________ Cooking water_______ ☐☐

7.Distance of the village from Upazilla headquarter ☐☐ Km.

Road: Pacca road ☐☐ km, Kacha road ☐☐ km, Main Transport_______________ ☐

8.Total area of the village:

a) Cultivated land__________ acre ☐☐☐☐☐

b) Fellow land __________ acre ☐☐☐☐☐

c) Pond __________ acre ☐☐☐☐☐

9. Cropping Pattern: 1. Single cropping 2. double cropping, 3. triple cropping ☐

10.Production of main crops: a) Food crops: 1. Paddy/rice 2. Wheat 3.Maize 4.Vegetables 5. Pulse 6.Fruits ☐☐

b) Cash crops: 1. Jute 2. Tobacco 3.Sugarcane 4. Others (Spacify__________) ☐☐

11. Is the village situated in food shortage area? 1. Yes 2. No

12. Irrigation facilities: 1. Power pump 2. Shallow tube well 3. Deep tube well 4. Hand tube well 5.Others

13. Which fertilizer is mostly used by the village farmers?
1. Chemical fertilizer 2.Green manure 3.Compost 4.Cow dung

14. No.of agril cooperative societies_____, No. of Block supervisors________
No. of Health workers ______, No. of F.W.V.__________

15.What is the main occupation of H/H heads of the village? _______________

16.Daily Wage rate:

Wage without food Tk. Wage with one main meal Tk

Wage with 2 main meals Tk. Wage with 3 main meals Tk.

17. Situation of staple food supply in the local markets:
1. Adequate 2. Inadequate 3. scarce

18. Present market prices of common food stuffs in the local markets:

Food Items	**Price / kg or Nos.(Tk.)**	**Food Items**	**Price / kg or Nos.(Tk.)**
01 Coarse rice		34 Leafy veget. (Diff. varit)	
02 Fine rice		35 Non-leafy veget. (Diff. varit)	
03 Wheat		36 Onion	
04 Wheat flour (Ata)		37 Garlic	
05 Moida		38 Zinger	
06 Gegory		39 Open salt	
07 Sugar		40 Packet salt	
08 Potato		41 Lemon	
09 Sweet potato		42 Orange	
10 Lentil (Mushur)		43 Jambura	
11 Mung dal		44 Banana (Sabri / Sagar)	
12 Motor dal		45 Banana (Kabari/ champa)	
13 Chola dal		46 Pineapple	
14 Khesari dal		47 Guava	
15 Mash kolai dal		48 Amra	
16 Egg (Hen, Deshi)		49 Kul (Boroi)	
17 Egg (Hen, Farm)		50 Apple	
18 Egg (Duck)		51 Graphs	
19 Medium chicken/ piece		52 Date	
20 Medium duck /piece		53 Black Berry	
21 Small fish (Gura mas)		54 Lichi	
22 Medium size fish		55 Water melon (Tarmuj)	
23 Large fish		56 Bangi	
24 Cat fish		57 Khira	
25 Milk (Cow/Bufallow)		58 Cucumber (Shosha)	
26 Beef		59 Jolpai	
27 Mutton		60 Mango	
28 Soybean oil		61 Jack fruit (medium)	
29 Mustard oil		62 Banana Green	
30 Sesame oil		63	
31 Coconut oil		64	
32 Ghee / Butter		65	
33 Dalda		66	

Annexure-2

Study on Food Security and Nutritional Status of Marginal Farm Households of Bangladesh

Institute of Nutrition and Food Science
University of Dhaka

Household Dietary Survey Form

Name of the Interviewer ________________ Date __________ Round ☐

1. Identification:
Name of the village ________________ Union ______________ Area code ________ ☐
Upazilla ________________ District ____________ Division ________________

2. Household / Family Information:
a. Household number ☐☐☐

b. Name of the H/H Head ______________ Father/ Husband's name ________________
(Respondent)

c. Religion: 1 Muslim 2 Hindu 3. Christian 4. Buddhist 5. Others ☐

d. No. of H/H Members: ____________________ ☐☐

Member No.	Name	Relation with H/H head	Age				Sex 1. Male 2. Female 3.Pregnant 4.Lactating	Marital status 1.Unmarried 2.Married 3.Widow 4.divorced	Education level 88 Illiterate 00 Put Signature __ Class passed 77 < 6yr. child	Main Occupation (Code)
			Year		Mon					
01										
02										
03										
04										
05										
06										
07										
08										
09										
10										

Relation code:

1. Self
2. Wife / husband
3. Son
4. Daughter
5. Daughter-in-law
6. Grand son / Daughter
7. Brother / Sister
8. Father / Mother
9. Others

Occupation code:

01. Farmer (only own land)
02. Farmer (only share cultivation)
03. Farmer (own land + share cult.)
04. Agriculture/ Day labourer
05. Industrial/ construction labourer
06. Transport labourer
07. Rickshaw/ Van puller / Boatman
08. Driver (Motor Vehicle)
09. Small shop keeper/Grocer/ hawker
10. Medium Businessman
11. Service
12. Student
13. Professionals
14. Skilled Labourer
15. Housewife / Household activities
16. Household servent / Maid
17. Fisherman/fishing
18. Unemployed

e. Has anybody in your household died during last three months ? 1. Yes 2. No.
If yes, record the following information:

Name of the dead person	Sex Male =1, Female =2	Age at death (Yr)	Cause of death (code)

Cause of death code:

01 Unknown sicknes	05 Measles	09 Hooping cough	13 Diabetes
02 Fever/cold	06 Joundice	10 Polio	14 Heart disease/ high BP
03 Pneumonia	07 Tubercolusis	11 Dyphtheria	15 Canser
04 Diarrhoea/ dysentery	08 Titanus	12 Peptic ulcer	16 Others

3. Information about sources of water, sanitation and personal cleanliness:
   a. Water uses by household members by sources:

Mode of use	Water source (code)	Ownership (code)
For drinking		
For cooking and washing (utensils)		

Source code: 1. Tubewell /Tap
2. Well
3. Pond /ditch
4. River /canal
5. Pond /river water on boiling

Ownership code : 1. Personal /own
2. Public /NGO
3. Others

b. Type of latrine in the household:
1. No latrine 2. Open /hanging latrine 3. Definite hole /well
4. Sanitary /slub latrine 5. Others

c. Where the faces of the children is thrown away who can't use latrine ?
1. Ditch 2. Open place 3. Definite hole /well 4. Sanitary latrine
5. No child under 5 years

d. Where the household garbage is discarded ?
1. Definite hole out side the homestead 2. Definite hole inside homestead
3. Through away scattered 4. Hither & thither 5. Others

e. With which the family members clean their hands after defecations?
1. Only water 2. Soap & water 3. Ash /Mud & water 4. Others

f. Do all the family members always use shoe /sandal? 1. Yes 2. No.
If no, do they use shoe /sandal while going to latrine /nasty place ?
1. Yes 2. No.

g. How is the environment of the residence, kitchen, and surrounding places?
1. Neat & clean 2. Clean to some extent 3. Unclean /nasty /dirty

4. Information about household food consumption:
   a. What is the source of food supply in your household?
   1. Food produced from cultivated land 2. Purchased from marked
   3. Received from charity /donation /jakat 4. (1+2) 5. (1+3) 6. (1+2+3)

b. Do all the members of your household eat meals together? 1. Yes 2. No.

If no, who are those eat first? (Yes= 1, No=2)

a	Household head	
b	Other adult males	
c	Young children	
d	Old man /Old woman	
e	Housewife	
f	Other adult females	
g	Adolescent male	
h	Adolescent female	
i	Others	

and who eats last of all members?

1. Household head 2. Housewife 3. Young children 4. Adolescent male
5. Adolescent female 6. Old men /women 7. Household servants 8. Others

c. Who are given less amount of food when the household faces food scarcity? (Yes = 1, No = 2)

a	Household head /adult male	
b	Housewife / adult female	
c	Young children < 10years	
d	Old man /Old woman	
e	Pregnant women	
f	Lactating mother	
g	Adolescent male	
h	Adolescent female	
i	Servant / maid	
j	Others	

d. Whom in the family is given comparatively more fish /meat /egg /milk /fruits ?

01. Equal to everybody
02. Old man /woman
03. Male child
04. Female child
05. Male adolescent
06. Female adolescent
07. Pregnant woman
08. Lactating woman
09. Male earning member
10. Female earning member
11. Both male /female earning member
12. Others

e. What is the pattern of meal time in your family per day ? ____________________ times

f. How many times most of your family members took meals yesterday ? __________ times

5. Household food intake in last 24 hours (Recall method) for day before yesterday (1), yesterday (2), day of survey (3),

Meal time	Menu and description	Cooked / uncooked				Food code	Raw weight of edible portion
		Ingredients	Family measures	Total weight (gm)	Conversion factor to raw weight		
Left over food from previous day (Cooked)							
Breakfast Number eaten ☐ Number not eaten ☐ Member code ☐☐☐ Guest ☐☐☐☐ ☐☐☐☐							
Lunch Number eaten ☐ Number not eaten ☐ Member code ☐☐☐ Guest ☐☐☐☐ ☐☐☐☐							

Meal time	Menu and description	Cooked / uncooked				Food code	Raw weight of edible portion
		Ingredients	Family measures	Total weight (gm)	Conversion factor to raw weight		
Afternoon Snack							
Supper Number eaten ☐ Number not eaten ☐ Member code ☐☐☐ Guest ☐☐☐☐ ☐☐☐☐							

6. Intra family food consumption during last 24 hours (recall method):

Household No. ☐☐☐ Area code ☐ Round ☐ Member code ☐☐

Member name__________________ Sex ☐ Age ☐☐☐☐ Occupation ☐

Meal time	Menu and description	Cooked / uncooked				Food code	Raw weight of edible portion
		Ingredients	Family measures	Total weight (gm)	Conversion factor to raw weight		
Breakfast							
Mid day snack							
Lunch							

Meal time	Menu and description	Cooked / uncooked				Food code	Raw weight of edible portion
		Ingredients	Family measures	Total weight (gm)	Conversion factor to raw weight		
Afternoon snack							
Supper							

Annexure-3

Study on Food Security and Nutritional Status of Marginal Farm Households of Bangladesh

Institute of Nutrition and Food Science

University of Dhaka

Household Socio-economic Data Collection Form

Name of the Interviewer ____________ Date [| | | | |] Round [ ]

1. Identification:

Name of the village ____________ Union ____________ Area code ________ [ ]

Upazilla ____________ District ____________ Division ____________

2.Household / Family Information:

a. Household number [| |]

b. Name of the H/H Head ____________ Father/ Husband's name ____________
(Respondent)

c. Sex: 1 Male 2 Female Age: ________ years [ ]

d. No. of H/H Members: [|]

e. Information about H/H earning members:

Member No.	Name	Relation with H/H head	Age (Years)	Sex 1. Male 2. Female 3.Pregnant 4.Lactating	Marital status 1.Unmarried 2.Married 3.Widow 4.divorced	Education level 88 Illiterate __ Class passed 00 Put Signature	Main Occupation (Code)	Secondary Occupation (Code)

Relation code:
1.Self
2.Wife / husband
3. Son
4. Daughter
5. Daughter-in-law
6.Grand son / Daughter
7. Brother / Sister
8. Father / Mother
9.Others

Occupation code;
01. Farmer (only own land)
02. Farmer (only share cultivation)
03. Farmer (own land + share cult.)
04. Agriculture/ Day labourer
05. Industrial/ construction labourer
06. Transport labourer
07. Rickshaw/ Van puller / Boatman
08. Driver (Motor Vehicle)
09 Small shop keeper/Grocer/ hawker
10. Medium Businessman
11. Service
12. Student
13. Professionals
14. Skilled Labourer
15. Housewife / Household activities
16. Household servent / Maid
17.Unemployed
18. Others

3. Information about House and other Household assets:

A. Description of House:

1. Own house 2. Father's house 3. Reside in other people's house without rent 4. Others [ ]

B. Number of Houses: ____________ [ ]

C. Pattern of House:
1. Building
2. Tin-shed building
3. All tin + Pacca floor
4. All tin + kacha floor
5. Tin roof + Earthen wall
6. Thest roof + Earthen wall
7. Thest roof + thest/bamboo wall
8. Others (Spacify________)

D. H/H Lightening Facilities: 1. Kerosine lamp 2. Electric light

E. Types of Utensils:
1. All Alluminium
2. All Earthen ware
3. Alluminium + Earthen ware
4. Others

F. Does the H/H possess the following materials? (Yes=1 , No = 2)

a. Cot	c. Radio	e. Rickshaw/ Van	g. Boat
b. Chair/Table	d. Almira	f. Bicycle	h.Hand-barrow / cart

4. Information about other Assets:

a. Household land holding (decimals)

Homestead	Cultivable land	Fellow land	Pond	Garden	Other	Total land

b. Present land under cultivation (decimals):

Own cultivated land	Land share cropping in +	Land Leased in +	Land mortgage in +	Land share cropping out –	Land Leased out –	Land mortgage out –	Total land

c. Size of cultivated land by cropping intensity:

Single cropping ________________ decimal

Double cropping ________________ decimal

Triple cropping ________________ decimal

d. No. of trees presently giving fruits in the households:

Mango	Coconut	Lemon
Jackfruit	Banana	Jambura
Black berry	Amlaki	Papaya
Lichi	Guava	Amra
Kamranga	Jolpai	Others

e. Number of domestic animals presently rearing in the households:

Total No. of Cow & Bufallow	Milky Cow
Total goat + sheep	Milky Goat
Total Duck + Hen + Cock	Peagon

f. What kind of vegetables presently been cultivated in the homestead? (Yes = 1 , No = 2)

Lal sak		Kolocasia sak		Lau		Borboti	
Pui sak		Kowliflower		Chal Kumra		Gajor	
Danta sak		Cabbage		Bean (Seam)		Tomato	
Kalmi sak		Sajna		Brinjal (Begun)		Chichinga	
Radish sak		Sweet Kukumber		Bitter gourd (Korolla)		Others	

5. Information on Household Food Production and Household Income:

a. Agricultural production, utilization and income from production during last three (3) months:

Agricultural production	Total Production Kg/No.	Present Market Price	Total Market value /Total income	Utilization of produced food crops (Kg / No.)				
				Food Consumed	Used as Seed	Jakat/ Gift/ Donation/	Used for Sale	Other uses
Rice (paddy)								
Wheat								
Pulses								
Potato								
Sweet potato								
Oil seeds								
Ground nut								
Leafy vegetable								
Non-leafy veget.								
Green piper								
Dried Chillies								
Banana								
Mango								
Jack fruit								
Sugar cane								
Jute								
Tobacco								
Cotton								
Betel leaf								
Other foods								
Total								

b. Food Production from homestead & garden, Utilization and Income during last three (3) months:

Type of Food Produced	Total Production Kg/No.	Present Market Price	Total Market value /Total income	Utilization of produced foods (Kg / No.)				
				Food Consumed	Used as Seed	Jakat/ Gift/ Donation/	Used for Sale	Other uses
Leafy vegetable								
Sweet Pumpkin								
Bottle gourd								
Ash gourd								
Other vegetables								
Banana								
Mango								
Jack fruit								
Guava								
Coconut								
Other fruits								
Areca nuts								
Palm /Date Juice								
Palm gur								
Date gur								
Milk								
Egg								
Fish from Pond								
Other foods								
Total								

c. Income from Wage / Salary during last three (3) months:

Sources of Income	Mean working days per month	Daily / monthly Wage rate (Tk.)	Own monthly Income (Tk.)	Othre's monthly income	Total Income during last 3 months
Day/ Agril. labour					
Rickshaw/ Van pulling					
Driver					
Helper (Transport labor)					
Service (Industrial labor)					
Others					
Total					

d. Income from other sources during last three (3) months;

Income Sources	Monthly Income (Tk.)	Total Income (Tk.) in last 3 months
Business: Shop keeper/ Hawker		
Contractor		
Physician		
Private Tutor		
Gift received		
Sadkah		
Fetrah		
Jakat		
Begging		
Loan refunded		
Rent of House		
Rent of Shop		
Rent of Vehicle		
Rent of Rickshaw/ Van / Boat		
Rent of Machinaries		
Other sources		
Total		

e. Income from Selling Household Materials during last three (3) months;

Description of Household Materials	Income from Sale during last three months (Tk.)
Homestead / House / Farm land	
Land leased out / Mortgage out	
Furniture / Utensils	
Ornaments	
Clock / Radio / T.V. / Fan	
Cycle / Rickshaw / Van / Boat	
Tree / Bamboo / Jute stalk / Straw	
Cow / Bufallow / Goat / Sheep	
Duck / Hen / Peigon	
Selling of Plough	
Others	
Total	

f. Income from taking Debt / Loan during last three (3) months:

Sources of Debt / Loan	Period / date	Total amount of debt/ loan (Tk.)
Friend / Relatives / Neighbours		
Commercial Bank / BRDB		
NGO		
Others		
Total		

g. Total income earned during last three months: a + b + c + d + e + f =

6. Household expenditure during last three (3) months:

Head of Expenditure	Monthly Food Consumed						Mean Monthly Expenditure	Mean Expenditure in last 3 months
	H/H Production		Purchased		Total			
	Kg	No.	Kg	No.	Kg	No.		
a. Food cost:								
Rice								
Wheat/ wheat flour								
Pulses								
Fish								
Meat								
Egg								
Milk								
Sugar / Gegory								
Oil / Ghee								
Potato								
Leafy vegetables								
Non-leafy vegetables								
Salt								
Onion								
Other spices								
Biscuit/Tea / Betel leaf								
Fruits (Banana, Mongo, Jackfruit, Bangi, Water melon, Pineapple)								
Cigarettes								
Others								
Total expenditure on food								

b. Household Purchase:			
Clothes			
Sendle / Shoe			
Furniture / Utensils			
Ornaments			
Cow / Goat			
Land purchased /leased in / mortgage in			
Others			
c. Miscellaneous Expenses:			
Education (Book/ paper/ pen/tution fee etc)			
House rent / repairing			
Fuel (Electricity/kerosene/fire wood)			
Loan repayment			
Donation / Sadkah			
Jakat			
Fetrah / Sacrifice (Korbani)			
Gift			
Tax payment			
Others			
d. Expenditure on Farming:			
Ploughing			
Seed / Seedling			
Fertilizer			
Irrigation			
Insecticides			
Wages (Sawing/weeding/harvesting)			
Rent (agricultural equipments)			
Others			
e. Total Expenditure			

Net Income during last 3 months (5g – 6e) =

7. For how many months of the year agricultur[illegible]ated farm land can provide food supply in your household?

Food crops if not sold ____________________ months

Food crops partly sold ____________________ months

8. Have you bought paddy /rice during last year? 1. Yes 2. No.

If yes, then for how many months? ________________ months

How much bought ?

	Food items	Amount (kg)	Total expenditure (Tk.)
a.	Paddy		
b.	Rice		

9. When your family faces food shortages in the year ?
1. Baishakh /Jaista 2. Ashar /Sraban 3. Bhadra /Ashin
4. Kartic /Agrahayan 5. Poush /Magh 6. Falgun /Choitra

10. How you manage /gather food purchase and production cost of your household ? (1. Yes 2. No.)

a. Selling food and other cash crops

b. Taking loan from Bank /NGO

c. Taking Borow /debt from relatives /neighbors

d. Selling duck /chicken /milk /egg etc.

e. Selling cow /goat /other domestic animals

f. Income earned from secondary /minor occupation

g. Selling plough (rent for ploughing)

h. Others (Specify ---------------------------)

11. What are the measures do you usually adopt for food supply when the household faces food shortages? (Yes = 1, No. = 2)

a	Sale extra labour		k	Go to relative's home as guest	
b	Driving boat		l	Going to town for search of work	
c	Catching fish		m	Selling vegetables and fruits	
d	Selling fish		n	Flying business in the market	
e	Pulling and carrying baggage		o	Spend previous savings	
f	Rickshaw / Van driving		p	Sale chicken / duck / cow/ goat	
g	Helping in construction activities		q	Sale furniture /tin of roof /house	
h	Taking loan from relatives / neighbours		r	Sale tree / bamboo	
i	Begging		s	Taking debt from Bank/NGO	
j	Tax collector in the market		t	Others (Specify________________)	

12. What are the measures do you think necessary to be adopted for meeting round the year food supply in the household? (Yes = 1, No. = 2)

a	By producing more food in the farm land through cultivating high yielding varieties of seeds	
b	By producing more food through cultivating high yielding varieties of seeds appropriate fertilizers and irrigation	
c	By cultivating multiple food crops in the same land instead of a single crop	
d	By producing diversified food crops for meeting nutritious food shortages	
e	By ensuring reasonable market prices of agricultural products	
f	By reducing prices of farm equipments and materials in order to produce more food	
g	By adopting appropriate measures to keep the market prices of essential foods within the reach of the poor	
h	By augmenting easy employment opportunities in order to increase purchasing power capacities of the poor	
i	By taking necessary attempts to fix wage rate according to market prices of food commodities	
j	By taking necessary steps to make adequate supply of foods in the local markets and establishment of open market sale during the period of food shortages	
k	By taking steps for providing easy loan without interest for adopting income generating activities	
l	By ensuring balanced distribution of food in the household according to the need of individual member of the household	
m	By receiving appropriate training on income generating activities and food and nutritional aspects	
n	By undertaking all the above measures	
o	Others (Specify ___________________)	

Annexure-4

"Study on food Intake and Nutritional Status of the Marginal Farm Household of Bangladesh"
Institue of Nutrition and Food Science
University of Dhaka

"ANTHROPOMETRICE AND CLINICAL FORM"

(For all individual member of the family)

Indentification : Area code

Village ________ Union ________ Thana ________

District ________ Household Number ________

Respondant Name ________ Father/Husbands Name ________ Member code

Birth order Sex (code) Occupation ________

Particular Informations in rounds :

Particulars :	Rounds of Survey with date			
	1st Round	2nd Round	3rd Round	4th Round
1. Age on survey date (for all)	Yr m	Yr m	Yr m	Yr m
2. Nutritional deficiency sysmlomps :				
Hair :				
01 Sparse (Yes = 1, No = 2)				
02 Discoloured (Yes = 1, No = 2)				
Eye :				
03 Night blindness (Yes = 1, No = 2)				
04 Bitot's spot (Yes = 1, No = 2)				
05 Blind (Yes =1, No = 2)				
cause : (1=From birth, 2=Nutritional blindness, 3 = Accidental, 9 = not applicable)				
Lips :				
06 Angular Stomatities (Yes = 1, No = 2)				
07 Cheilosis (Yes = 1, No = 2)				
Gums :				
08 Swallen red gum (Yes = 1, No = 2)				
09 Bleeding gums (Yes = 1, No= 2)				
Teeth :				
10 Dental Caries (Yes = 1, No = 2)				
Tongue :				
11 Swallen and red papillee (Yes = 1, No = 2)				
Gland :				
12 Enlarged Thyroid gland (Yes = 1, No = 2)				
Skin :				
13 Dermatosis (Yes = 1, No = 2)				

Sex code : 1 = male, 2 = Famale, 3 = Pregnant, 4 = Lactating, 5 = Preg. + Lact.

	Particulars	1st Round	2nd Round	3rd Round	4th Round
14	Height (cm) (for all members)				
15	Weight (kg) (for all members),				
16	MUAC (cm) (Upto 18 Years & Preg.)				
17	Morbidity Status : (all members) If sufferd from any disease other than diarrhoea during last three months (Yes = 1, No = 2)				
	If yes, Pl mention Disease name*,				
	Duration (days) of the disease,				
	Mode of treatment*,				
	Place of treatement*				
	Cause of non-treatment*				
18	Diarrhoea (all members) :				
	If suffered from diarrhoea during last three months (Yes = 1, No = 2)				
	If Yes, pl. mention How may times				
	How many days in each time				
	Mode of treatment*				
19	If fed Vit. A capsule during last three months (for upto 6 yrs. children) (Yes = 1, No = 2, capsule received but not fed=3)				
	Source (EPI card = 1, Family reprot = 2)				
20	Please mention immunization status : BCG, DPT, Polio, Measles **				
	Source (EPI card = 1, Family rdoprt = 2)				
	Name of Investigator with date				

*** Disease code :**

01 Fever/cold
02 ARI/Pneumonia
03 Measles
04 Dysentry
05 Jaundice
06 Malaria
07 Typhoid
08 Scabies
09 Joint pain
10 Heart disease
11 Diabetes
12 Ulcer
13 Others (Specify______________)

*** Mode of treatment**

1 Alopathic
2 Homeopathic
3 Kabiraji
4 Peer/Fakir
5 Quack
6 Others (Specify ______________)
7 No treatment

*** Place of treatment**

1 Hospital
2 Private clinic
3 Union Health Centre
4 Local pharmacy
5 Cheritable dispensory
6 Others (specify______________)
9 Not applicable in case of non-tratment)

*** Cause of non-treatment**

1 Poor economic condition
2 Negligence
3 Don't think necessary
4 Lack of communication
5 Taboos
6 Others (Specify______________)
9 Not applicable

**** Immunization code**

1 All dose completed
2 Timely being given
3 Incomplete dose
4 Time yet not come
5 No immunization given