FOOD AND NUTRITIONAL SECURITY SCENARIO OF BPL FAMILIES OF CENTRAL ZONE OF KERALA

By

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THESIS

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DECLERATION

I hereby declare that this thesis entitled "**Food and Nutritional Security Scenario of BPL Families of Central Zone of Kerala**" is a bonafide record of research work done by me during the course of research and that it has not been previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

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CERTIFICATE

Certified that this thesis, entitled " **Food and Nutritional Security Scenario of BPL Families of Central Zone of Kerala**" is a record of research work done independently by Mrs. Blossom K. L. under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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ABBREVIATIONS

ACU	Adult Consumption Unit
A/G	Albumin/Globulin
AIIMS	All India Institute of Medical Sciences
BPL	Below Poverty Line
BMI	Body Mass Index
CED	Chronic Energy Deficiency
CU	Consumption Unit
Exp	Exponential
FAO	Food and Agricultural Organisation
Hb	Haemoglobin
ICDS	Integrated Child Development Services
ICMR	Indian Council of Medical Research
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
INSA	Indian National Science Academy
Kcal	Kilocalorie
MSSRF	M.S. Swaminathan Research Foundation
MUAC	Mid Upper Arm Circumference
NFHS	National Family Health Survey
NFI	Nutrition Foundation of India
NIN	National Institute of Nutrition
NIRD	National Institute of Rural Development
NS	Non Significant
NNMB	National Nutrition Monitoring Bureau
OPV	Oral Polio Vaccine
PDS	Public Distribution System
PHC	Primary Health Centre
Ph.D	Doctor of Philosophy
POST	Parliament Office of Science and Technology
PRA	Participatory Rural Appraisal
RDA	Recommended Dietary Allowances
SD	Standard Deviation
SE	Standard Error
SPSS	Statistical Package for Social Sciences

TB	Tuberculosis
UN	United Nations
USCB	United States Census Bureau
USDA	United States of Department of Agriculture
WHO	World Health Organisation
%	Per cent
mg	Milli gram
µg	Micro gram
g	Gram
g/dl	Gram per decilitre

INTRODUCTION

1. INTRODUCTION

Food is vital for the health and well being of an individual. Right to food is the fundamental right with equal footing to that of right to life. We find a whole hymn in praise of food in the *Rig-Veda* and food was regarded as the source of all life. Our nutritional status, health, physical and mental wellbeing depend on the food we eat and how we eat it.

Though, India has achieved self sufficiency in food production and there is 'food for all', the biggest challenge facing the nation is to ensure 'food to all' for achieving food and nutrition security. It has been estimated that in India, one person out of four goes to bed hungry indicating a high Global Hunger Index value. In the report published by International Food Policy Research Institute in 2012, India was ranked 65 out of 79 countries in the Global Hunger Index (IFPRI, 2012_a). The deprivation of the basic need represented by food insecurity and hunger are undesirable in their own right and also are possible precursors to nutritional, health and developmental problems.

According to FAO (1996) food security implies a situation that exists when all people at all times have sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Food security of a nation is ensured if all of its citizens have enough nutritious food available, all persons have the capacity to buy food of acceptable quality and there is no barrier on access to food (Hazra, 2011). Sustainable food security depends on availability of food grains in the market, accessibility of the public in procuring these from the market and the absorption of food in the body. Households that are food secure are the ones capable of providing an adequate supply of nutritious safe food on sustainable basis to each member of the family. Food security is in fact the imperative pre requisite for the economic and social stability of the family, community and nation.

The issue of food security has been with us since time immemorial. It's importance has recently gained both domestic and global focus because the concept of food security and its implementation encompasses implied strategies beyond food

production. Physical and economic access to food at the household level, at all times to ensure healthy and active life is the crux of food security.

Food security of a population in general has been considered at global, regional, state, household and individual levels. In spite of the substantial progress made in India's food production, serious nutritional challenges threaten the progress of our country. Food security at the household level remains a challenge mainly due to low purchasing power and lack of accessibility to a variety of foods by most of the people. Nutritionally inadequate diet among the households coupled with male biased intra household food distribution and lack of care for the nutritionally vulnerable members especially women and children lead to nutritional insecurity and nutritional disorders. Thus, food security is one of the several conditions necessary for the attainment of a healthy and well nourished population.

Nutrition is a fundamental pillar of human life, health and development across the entire life span. The fundamental WHO goals of 'Health for All' mean that people everywhere throughout their lives have the opportunity to reach and maintain the highest attainable level of health. This is impossible to attain in the presence of food insecurity and malnutrition problems. Nutrition security implies physical, economic and social access to balanced diet, clean drinking water, safe environment and health care INSA (2009) and Bamji (2009).

The problem of food and nutrition insecurity still remains a great threat to a large section of poor and vulnerable people in India. Though, there is progress in reducing hunger during the past 20 years, the number of people suffering from undernourishment is unacceptably high in different countries. In India, as per FAO statistics (FAO, 2012) though the percentage of undernourished people declined from 27 per cent in 1990-1992 to 18 per cent in 2010-2012, the double burden of malnutrition with chronic undernourishment and micronutrient malnutrition coexist with obesity, overweight and related non communicable diseases. Thus, ensuring food and nutrition security ought to be an issue of great importance for a country like India where more than one third of the population is estimated to be absolutely poor and one half of all children malnourished in one way or another. In a report published by IFPRI (2012_b), the severity of hunger and malnutrition in Kerala is the second lowest

in India and is considered to be 'serious'. The Comptroller and Auditor General report published during March 2013, it was indicated that 27 to 39 per cent of children below six years in Kerala are malnourished (Anon, 2013).

Even though, the poverty rate in Kerala is low among the Indian states, numerically the size of BPL families still holds a serious attention as there are 40 lakh BPL households in Kerala including manual labourers and those engaged in the unorganised sector (Anon, 2011). The Central and State governments are trying to achieve food and nutritional security of the population especially the poor and underprivileged through various household oriented programmes and supply of food at subsidised rates through Public Distribution System (PDS). In this back drop, a 'multimethodical' study entitled "Food and Nutritional Security Scenario of BPL Families of Central Zone of Kerala" was conducted with the following objectives.

1. To assess the extent and determinants of food and nutritional security among the BPL families of Central Kerala
2. To study the impact of food security on the nutritional status with special reference to women and preschool children.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The review of literature pertaining to the study entitled **"Food and Nutritional Security Scenario of BPL Families of Central Zone of Kerala"** is presented in this chapter under the following headings

2.1. Dimensions of food security
2.2. Food and nutritional security among low socioeconomic groups
2.3. Nutritional problems among different age groups
2.4. Factors influencing food and nutritional security

2.1. Dimensions of food security

Food and nutritional security has more than 69 years of history after the historic Hot Spring Conference of Food and Agriculture in 1943, in which the concept of a "secure, adequate, and suitable supply of food for every one'' was accepted internationally. The definition of food and nutritional security has evolved considerably over time. The starting point of food security was food availability to balance unequal food distribution regionally and nationally (Gross *et al.,* 2000). The term food security originated in International development literature in the 1960s and 1970s. Early definitions focused almost exclusively on the ability of a region or a nation to assure an adequate food supply for its current and projected population. The concept evolved since then and used at global, regional, national, community, household or individual levels. The focus on community, household and individual levels of food security were considered relevant to public health approaches (Cook, 2008). According to Gupta *et al.* (2011) the concept of food security was evolved after the first World Food Conference in 1974, which was accepted globally, and related to the access by all people at all times to enough food for an active and healthy life.

World Bank (1986) defined food security as adequate access to food for all people for an active and healthy life. Anderson (1990), Campbell (1991), Hamilton *et al*. *(*1997) and Kennedy (2002) indicated food security as the access to enough food for an active, healthy life and includes at a minimum the ready availability of nutritionally adequate, safe foods and the assured ability to acquire acceptable foods in socially acceptable ways.

Campbell (1991) indicated that food insecurity exists whenever food security is limited or uncertain. According to Christensen (1991), food security is obtained when there is an adequate supply to which all members of the population have full access. Hubbard *et al*. (1992) described food security as an organizing principle that cut across sectors and disciplines, levels of analysis, from the household to the international economy.

According to FAO (1996) food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Klein (1996) indicated that food security consisted mainly of anxiety about having enough food to eat or running out of food and having no money to purchase more. Annes and Manfred (1997) viewed food security as the ability of a household to produce a stable and sustainable basket of adequate food.

National food security requires both the production and the ability to import food from global markets to meet a nation's consumption needs (IFAD, 2000). According to Young *et al*. (2001) food security is the heart of food crisis and food related emergencies. The authors defined food security as when everyone has at all times access to and control over sufficient quantities of good quality food for an active healthy life. Planning Commission viewed food security as the eradication of hunger and starvation by ensuring availability, accessibility and affordability of balanced food and nutrition to all people of the country especially the underprivileged (NNMB, 2002).

Sustainable food security involves strengthening the livelihood security of all members within a household by ensuring both physical and economic access to balanced diet including the needed micronutrients, safe drinking water, environmental sanitation, basic health care and primary education (MSSRF, 2003 and Razi, 2012).

Mishra *et al.* (2008) indicated that the concept of food security is related to a condition when each and every individual is able to get a nutritionally adequate diet in good quality and in sufficient quantity and food consumed is efficiently being utilized biologically for a healthy productive living. According to the authors food security also implies livelihood security at the level of each household and all members within

and involves ensuring both physical and economic access to balanced diet, safe drinking water, environmental sanitation, primary education and basic health care.

The term food security was used to describe whether a country has access to enough food to meet dietary energy requirements (Andersen, 2009). Swaminathan (2010_a) defined food security as physical, economic and social access to balanced diet, clean drinking water, environmental hygiene and primary health care. Food security at national level refers mainly to the availability of sufficient stocks of food in the country to meet domestic demand either through domestic supply or through imports (Dev and Sharma, 2010). Modi (2012) defined food security as economic access to food along with food production and food availability.

Food security is the right of every person to have regular access to sufficient nutritionally adequate and culturally acceptable food for an active and healthy life (Gautam and Kumar, 2012). According to Baoy (2012) food security implies access by all people at all times to sufficient quantities of food to lead an active and healthy life. The author also indicated that food security is not just adequate supply of food at the aggregate level but also enough purchasing capacity with the individual or household to demand adequate level of food.

Household food insecurity occurs when food is not available or cannot be accessed with certainty in terms of quality, quantity, safety and culturally acceptable ways (UN, 1991). USDA (1996) indicated that food security for a household is the access by all members at all times to enough food for an active, healthy life and includes at a minimum the ready availability of nutritionally adequate and safe foods, and an assured ability to acquire acceptable foods in socially acceptable ways that is without resorting to emergency food supplies, scavenging, stealing or other coping strategies.

According to Kennedy and Haddad (1992) household's purchasing power and income are very critical in ensuring household food security. According to Rai and Rai (2007), a household is considered as food secure, if its entitlements for food are greater than its needs and an individual is considered to be food secure, if his or her food consumption is greater than the need.

Nutrition security is the condition when each and every individual is able to get a nutritionally adequate diet in quality as well as quantity and the food consumed is efficiently being utilized biologically for a healthy, productive living (Gupta and Singhal, 2007).

Sen (1981) described the conceptual basis of assessing food security and indicated access and availability of food as the two important elements of food security. The author indicated that food insecurity occurred not only due to inadequate food but also due to lack of access to enough food and the availability of food near to the household. International Fund for Agricultural Development (IFAD, 1997) suggested both long-term and short-term aspects of food security. Food security analysts also classified two general types of food insecurity namely chronic and transitory food insecurity. According to IFAD (1997) when a household is persistently unable to meet the food requirements of its members over a long period of time, chronic food insecurity occur. The short-term problem may afflict any household, regardless of whether it has a chronic problem or not. Crop failure, seasonal scarcities, temporary illness or unemployment among the productive members of the household or perhaps an emergency need for large cash expenditure reduce the household's access to food and results in transitory food insecurity.

Transitory food insecurity could be further divided into temporary and cyclic or seasonal food insecurity (Thomson and Metz, 1996). According to the authors, temporary food insecurity occurs when sudden and unpredictable shocks such as drought, flood, pest attacks or sudden unemployment affect the household's entitlements. Seasonal food security occurs when there is regular pattern of inadequate access to food. Food and Agricultural Organisation (FAO, 1998) indicated that the concept of seasonal food insecurity falls between chronic and transitory food insecurity.

The three major dimensions of food security are food availability, food access and food absorption (Anderson *et al*., 1999, MSSRF, 2001 and Swaminathan, 2010_a). Availability of food is a function of food production and access to food is a function of purchasing power and employment. Absorption of food in the body is influenced by nutritional status, education and health care (Swaminathan, 2010_a).

MSSRF (2001) also indicated two types of food insecurity namely chronic and transitory food insecurity. Chronic insecurity was referred as a situation in which people consistently consumed diets inadequate in calories and essential nutrients due to inability to access food by production, purchase etc. Transitory food insecurity occurred due to a temporary short fall in food availability and consumption.

Gross (2002) suggested four dimensions of food and nutritional security namely categorical dimension, socio organizational dimension, the managerial dimension and the situation related dimension. Categorical dimension had four elements namely, availability, accessibility, utilization and stability. The second dimension was found to be relevant to all levels of the social organization and the third level referred to the managerial aspects of projects and programmes in food and nutrition security. Situation related dimension included programmes provided during very high food and nutrition insecurity.

Alderman and Horold (2005) indicated three pillars of food security namely food availability, food access and food utilization. The authors also indicated that those who never have sufficient quality food are chronically food insecure and those who have access to an adequate diet conditioned by seasonality are termed seasonally food insecure. Those who have enough to eat but insecure by the disasters are termed as transitorily food insecure. FAO (2008) suggested four dimensions of food security namely physical availability of food, economic and physical access to food and food utilization and stability of the three dimensions over time.

According to Athreya *et al.* (2008) food insecurity is a dynamic concept, a household may be food insecure in the present or in the future or both which may be examined in terms of present and potential food insecurity, where potential food insecurity can occur either due to a potential lack of livelihood or a potential threat of disease and lack of absorption. Kumar (2010) suggested four basic components of food security namely availability, accessibility, utilization and stabilization. Availability is a function of production, accessibility is related to purchasing power, utilization is determined by the availability of minimum basic needs ie., safe drinking water, primary health care, primary education, proper housing facilities, environmental hygiene and stabilization influenced by the extent of attention given to

the sustainability of the system. Modi (2012) suggested food security as a complex issue involving a number of dimensions.

According to Tripathy and Mishra (2011), the definitional jurisdiction of food security comprises three inherent and important dimensions namely availability, accessibility and stability of food articles. When availability of food is a production of food grains, the accessibility of food relies on the state's food policy coupled with the purchasing power of the consumer. Stabilization is influenced by the sustainability of the food system which in turn reduces food insecurity by ensuring food consumption at a required level.

2.2. Food and nutritional security among low socioeconomic groups

In the backward areas of Orissa, Vijayaraghavan *et al.* (1998) indicated food security only among eight per cent of households with respect to all food groups. George and Daga (2000) in a study conducted among preschool children in Mumbai observed food security in 42.6 per cent households. The authors also noticed nutritional security in 54 per cent of the households with respect to energy.

Prema (2001) studied the extent of food security in the households below poverty line in Kerala and identified households of labourers, small scale entrepreneurs in informal sector, urban poor and those residing in low potential areas as at risk. A study conducted by Nnakwe and Yegammia (2002) indicated food security among 56 per cent of households without children when compared to 43 per cent households with children in Coimbatore.

Kumra *et al.* (2003) in a study conducted in the poor households of relocated colonies of Delhi on food and nutritional security in relation to food availability, access and absorption indicated food shock mainly due to loss of employment. In a case study conducted in the agricultural labourer families of Kalliyoor Panchayat of Trivandram district of Kerala, Vijayan (2003) noticed food insecurity in all the households. Lawrence *et al*. (2005) indicated food insecurity without hunger and with moderate hunger in the agricultural labour households of unorganized sector. The authors also reported better food security in the households of women agricultural labourers working in the organized sector due to their better purchasing power.

A study conducted in the three backward tribal dominated districts of Orissa, Panda and Sarangi (2010) observed severe food insecurity and hunger among the population. The authors also indicated severe and moderate forms of hunger in 90 per cent of households and the rest 10 per cent of the households had manageable form of hunger. Moyal and Kohli (2011) in a study conducted among elderly in Ajmer city indicated food security among 80 per cent of the households.

Mukhopadhyay and Biswas (2011) observed marginal food security in 46.8 per cent of households in West Bengal. The authors also indicated food insecurity in 53.2 per cent of the families and noticed severe grades of undernourishment in households with lower grades of food security. Subhashree (2012) noticed food security only among 43 per cent families in the coastal areas of Cochin and the rest were food insecure with levels varying from no hunger to severe hunger. Gupta *et al*. (2012) observed food insecurity with and without hunger among 23 to 49 per cent of households in urban slums of Delhi. A study conducted by Prabhat and Begum (2012) in Mysore indicated food security in 64 to 73 per cent of families. The authors also indicated food insecurity with and without hunger among rest of the families.

In a study conducted on nutritional status of preschool children, Jose and Indira (2000) noticed poor intake of foods in terms of quality and quantity. The authors also noticed decreased intake of all food groups except flesh foods among preschool children. Laxmaiah *et al*. (2002) noticed low intake of all food groups except roots and tubers and sugar and jaggery in the diet of children below six years. In the case of nutrients, the deficit was higher with respect to vitamin A (57.7%) followed by iron (32.5%), riboflavin (28.5%) and energy (29.1%). Kumari (2005) noticed decreased intake of all nutrients except energy, vitamin A and iron among school children. Swaminathan *et al*. (2012) indicated problems of inadequate energy and micronutrients in the diet of primary school children of North Karnataka.

A study conducted by Deepa *et al*. (2004) among adolescent girls in Dharwad indicated lower intake of all nutrients when compared to RDA except folic acid and ascorbic acid. The authors also observed higher energy, iron and protein intake among rural and urban adolescents during rainy season due to increased intake of cereals, pulses, fats and oils, nuts and oil seeds and sugar and jaggery.

Sujatha (1990) indicated inadequacy in the diet of women in unorganised sector with respect to all food groups except roots and tubers and fish. Sar *et al*. (1991) indicated calorie inadequacy among 53 per cent of women in the rural households of Maharashtra and 30 per cent had protein inadequacy. Studies conducted by Narayana and Sathiya (2004) indicated lower calorie intake among women textile workers when compared to home makers. Shobha and Sheela (2004) indicated lower intake of most of the food groups and nutrients among women participating in sericulture technologies of Karnataka. Yenagi *et al.* (2007) reported lower energy and protein intake among women entrepreneurs involved in food processing activities in Dharwad district. Vijayakumar *et al*. (2007) reported food insecurity with moderate hunger among Adidravidar women of Salem district of Tamil Nadu.

A study conducted by Soniya and Vijayanchali (2011) among women workers of cashew factories of Kanyakumari district indicated deficit in calories, calcium, iron and vitamin C in their diet. However, the intake of protein and fat was found to be excess. Health and nutritional profile of female workers in a latex industry located at Kanyakumari district conducted by Krishna and Thangaleela (2011) indicated that the diet consumed by the workers were inadequate and lack in protective foods. Padmapriya and Lakshmi (2012) noticed a deficient intake of micronutrients in the diet of Self Help Group women. The authors also indicated a decrease intake of roots and tubers, leafy vegetables, fruits and other vegetables in their diet and the deficit was found to be more than 50 per cent of RDA. A study conducted by Amaravathi *et al.* (2012) among women employed in a sea food processing unit of Tamil Nadu indicated that more than 80 per cent women consumed decreased amount of energy, protein fat and iron.

A study conducted by Rekha *et al.* (2007) on food and nutritional security of tribal expectant mothers of Jharkhand indicated decreased intake of all food groups except cereals and other vegetables. The authors also noticed nutritional insecurity with respect to the intake of calcium, fat, iron, and β carotene among 100 per cent women and with respect to protein and energy only two to nine per cent were found to be insecure. Deepa and Ramaswami (2012) noticed lower intake of all nutrients except fat in the diet of pregnant women. The authors also indicated a deficit of 25 to 72 per cent in the intake of protein, calcium and vitamin A.

A study conducted by Bansal and Mehta (1989) among workers of brick industry in Hissar observed deficit in the intake of various food groups and nutrients. Sreenivasan *et al*. (1991) and Dungarwal and Choudhry (2001) noticed deficient energy intake among the low income groups of Tamil Nadu and the farm labourers of Agriculture Research Station of Rajasthan respectively. In Tamil Nadu, Parameshwaran and Unnikrishnan (2000) observed that 77 per cent of the landless labour households consumed less than 2300 Kcal of energy daily.

2.3. Nutritional problems among different age groups

Aneeja (2001) noticed different grades of undernutrition among 4 to 11 per cent of infants in the urban slum communities of Delhi. Banerjee and Anindita (2002) indicated different grades of malnutrition among 61 per cent of infants in Varanasi.

Sachithananthan and Chandrasekhar (2005) noticed different grades of malnutrition among 88.2 per cent preschool children in Chennai on the basis of weight for age classification. Rao *et al.* (2005) in a study conducted among tribal preschool children of Madhya Pradesh noticed higher prevalence of undernutrition in terms of underweight, stunting and wasting among 32.9 per cent to 61.6 per cent children. The authors indicated slightly higher measurements among boys when compared to girls. In a tribal community of Northern Kerala, Hari (2008) noticed undernourishment among 52 per cent boys and 55 per cent girls in the preschool age group. A study conducted by Bains and Brar (2008) in the farm families of Punjab indicated moderate to severe stunting among 15 to 21 per cent of preschool children. Chandran (2009) indicated moderate stunting among 65.90 per cent preschool children in Kasaragod. The author also observed underweight among 52.27 per cent of children. In Kannur district of Kerala, Gangadharan (2011) noticed severe malnutrition among 25 per cent scheduled caste boys and girls. Among scheduled tribe population, the severe malnourishment was observed to be 2.2 per cent among boys and 30 per cent among girls.

Ramachandran (2012) indicated stunting and wasting among 50 per cent preschool children in India. In Tamil Nadu, Veena and Kowsalya (2012) noticed wasting and stunting among 36 to 50 per cent preschool children. In Karnataka, Nayak *et al.* (2012) also observed stunting, wasting and underweight among 23 to 37

per cent preschool children. Swaminathan *et al*. (2012) noticed underweight among 37 per cent preschool children in North Karnataka.

Laxmaiah *et al.* (2002) observed micronutrient deficiencies particularly the deficiencies of vitamin C and vitamin A among preschool children in Punjab. National Institute of Nutrition (2003) indicated 0.3 per cent night blindness among preschool children. The study also indicated bitot's spot among 1.2 to 1.4 per cent children in the age group of one to five years. Rao *et al.* (2005) observed bitot's spot among 1.6 per cent preschool children in Madhya Pradesh. Sachithananthan and Chandrasekhar (2005) noticed angular stomatitis and fissured or magenta tongue due to the deficiency of B complex vitamins among 21 to 27 per cent preschool children in urban slums of Chennai. Veena and Kowsalya (2012) observed manifestations of vitamin A deficiency like conjuctival xerosis, bitot's spot and keratomalacia among 0.4 to three per cent preschool children in Ramanathapuram district of Tamil Nadu.

Kumar (2007) observed anaemia among 81 per cent urban and 73 per cent rural children in the age group of 6 to 35 months.

Rajasree and Soman (1994) in a study conducted among school children in Kerala indicated decreased body weight and height when compared to reference standards. The authors also observed an increase in the percentage of wasting and stunting among children along with advancement of age. NNMB (2006) indicated higher stunting and underweight among girls when compared to boys in the age group of 10 to 13 years. Dutta *et al.* (2009) reported stunting and wasting among 31.8 per cent and 29.1 per cent of school children in Himalaya regions. The authors indicated normal nutritional status only among 10 to 11 per cent school children on the basis of height for age and weight for age classification.

A study conducted by Chandran (2010) on the health and nutrition profile of school children in rural Kerala indicated normal nutritional status on the basis of weight for age among 59 per cent of children. The author also noticed different grades of malnutrition among 4 to 21 per cent children. In Pune, a study conducted by Kawade and Chandrakala (2012) reported undernourishment among 42.5 per cent boys and 23 per cent girls in the school age group.

In affluent families of Punjab, Sidhu *et al.* (2006) observed overweight and obesity among 6 to 12 per cent boys and 6 to 14 per cent girls. Bose *et al*. (2007) also indicated overweight and obesity among 17.63 per cent and 51 per cent children in Kolkota. Panjikkaran (2013) indicated 3.17 per cent and 6.67 per cent overweight/obesity respectively among boys and girls in the age group of 7 to 12 years.

In Punjab, Verma *et al.* (1988) noticed iron deficiency anaemia among 55 per cent of school children. Balgir *et al.* (1999) reported high prevalence of anaemia in the range of 59 to 81 per cent among tribal school children in Orissa. A study conducted by Leela and Priya (2002) on iron status and morbidity pattern of school children of Coimbatore reported anaemia among 32.39 per cent of children. The authors also noticed three to four times higher morbidity among children who had haemoglobin levels below 6.5 g/dl. In Jammu and Kashmir, Dhingra *et al.* (2011) noticed mild anaemia among 50 per cent of affluent primary school children.

In Kerala, a report published by AllMS (2001) indicated goitre prevalence of 16.6 per cent among 6 to 12 year children with slightly higher prevalence among boys. In Gujarat, Khan and Singh (2005) observed goitre among 10.67 per cent school children and indicated that the percentage prevalence was equal among boys and girls. In Orissa, Sahu (2005) noticed goitre prevalence among 30.18 per cent children in the age group of 6 to 12 years and the prevalence was found to be higher among girls when compared to boys.

NNMB (2006) noticed micronutrient deficiency signs like conjuctival xerosis, bitot's spot and angular stomatitis among school children in rural areas of India.

Patil *et al.* (2009) observed undernourishment among 2/3rd of adolescent girls in Maharashtra. Adilakshmi *et al*. (2012) indicated higher prevalence of undernourishment among adolescent girls during the late adolescent period. Nagamani and Baby (2012) observed low height and weight among adolescent girls in rural India. In Ambedkar Nagar district of Uttar Pradesh, Poonam and Pandey (2012) noticed stunting and thinness among 18 per cent adolescent girls. The authors noticed overweight only among 0.11 per cent girls. However, Sreedevi *et al*. (2012) observed normal nutritional status among all adolescent girls in Kurnool district of Tirupati.

Srilatha *et al*. (2012) in a study on nutritional status and physical activity of rural adolescent girls of Tirupati indicated chronic energy deficiency among girls. Sawant *et al*. (2012) also observed severe and moderate malnourishment among 26 per cent and 46 per cent adolescent girls in Maharashtra. Moradi *et al*. (2012) noticed overweight and obesity respectively among 14.6 per cent and 26.4 per cent college girls in New Delhi. Agarwal and Malhotra (2012) and Sudhakar *et al.* (2012) also noticed overweight among 27 per cent adolescent girls in Gurgaon and Tirupati.

Vasanthi *et al*. (1994) studied the iron status of adolescent girls in the families of agricultural labourers and observed anaemia among 22 per cent girls. NFHS (1999) reported anaemia among 54.9 per cent adolescent girls in the age group of 15 to 19 years in Andhra Pradesh. Studies conducted by Hathura and Kondapur (2002) and Saibaba *et al*. (2002) among adolescent girls of Andhra Pradesh indicated anaemia among 81 to 88 per cent. Deepa *et al*.(2004) studied the iron status of adolescent girls in Dharwad and indicated that 32 per cent had severe anaemia in summer which decreased to 15 per cent in rainy season and 2.5 per cent in winter season. Kotecha *et al*. (2005) indicated anaemia among 75 per cent of adolescent girls of rural Wardha. Dalavi *et al*. (2012) reported mild anaemia among 70 per cent adolescent girls in Dharwad.

Karuna and Prema (1993) reported different grades of energy deficiency among 33 per cent fisherwomen in Thiruvananthapuram. Taneja and Sexena (1998) reported malnutrition among 95 per cent Bhil women of Madhya Pradesh. The authors indicated normal grades of BMI only among 2.72 per cent women. Rajkumar and Premakumari (1999 and 2000) noticed high prevalence of underweight among male workers of different occupational sectors in Coimbatore. Jyothi (2003) observed CED among 43.33 per cent women agricultural labourers of Palakkad. Lawrence (2003) noticed chronic energy deficiency among 21 to 30 per cent women agricultural labourers.

Parvathy and Begum (2007) observed different grades of malnutrition among 11.7 per cent women belonging to the low income families. The authors also indicated obesity among 30 per cent women. A study conducted by Singh *et al.* (2007) on nutritional status of rural population in Rajasthan revealed normal nutritional status among 44.5 per cent and the rest had chronic energy deficiency. Glawe *et al*. (2008)

reported slightly higher BMI among women when compared to men in Vellore district of Tamil Nadu.

Rao *et al.* (2010) observed high prevalence of CED among tribal lactating women when compared to rural counterparts. Latheef (2011) noticed underweight among 50 per cent of women in Thiruvananthapuram. Anal and Subapriya (2012) observed CED among women athletes in Manipur and indicated negative energy balance among all respondents. Prabhavathi *et al.* (2012) observed CED only among nine per cent of Iranian women residing in Mysore.

Naik and Prakash (2012) noticed CED among 21.7 per cent women in Mysore. The authors also observed overweight and obesity among 18.4 per cent and 7.9 per cent women. Amaravathi *et al.* (2012) observed normal nutritional status among 52.9 per cent women in Tamil Nadu. However, Dhipali and Rajeswari (2012) indicated overweight and underweight respectively among 24 per cent and 16 per cent women. Athulya (2012) noticed normal nutritional status among 70 per cent women engaged in vegetable cultivation in Thiruvananthapuram district. The author indicated underweight and overweight among 13 per cent and 16 per cent women. Chakma and Meshram (2012) indicated chronic energy deficiency among 55.8 per cent men and 16.9 per cent women belonging to the Baiga tribe of Bihar.

Bentley and Griffiths (2003) noticed anaemia among 49 per cent of women in Andhra Pradesh. A study conducted by Jyothi (2003) indicated anaemia among 63.3 per cent women labourers involved in rice cultivation. Reddy and Ramakrishna (2004) in a study conducted at Bangalore observed higher percentage of anaemia among teenage women followed by women in the age group of 20 to 24 years. Chandran (2005) noticed anaemia among 66 per cent women in Neyyattinkkara Taluk of Kerala. Parvathy and Begum (2007) observed anaemia among 76.5 per cent of women in Mysore. The authors also indicated clinical symptoms of anaemia such as pale tongue, skin and conjunctiva among women. Vijayakumar *et al*. (2007) indicated anaemia among 83.3 per cent women in Salem area. Jose and Navaneetham (2008) observed anaemia among 47 per cent tribal women in the age group of 15 to 49 years. Deepa (2009) observed anaemia among 70 to 85 per cent women employed in coir industry in Kerala. According to Latheef (2011), 56.66 per cent and 26 per cent women were severely and moderately anaemic in Thiruvananthapuram. A study

conducted by Padmapriya and Lakshmi, (2012) indicated iron deficiency anaemia among 76 per cent of self help group women in Coimbatore. Anusha (2012) noticed anaemia among 89 per cent women agricultural labourers in Kuttanad area of Kerala. Among this, 52 per cent and 8 per cent women respectively had moderate and severe forms of anaemia.

Kapil *et al*. (1999) noticed iron deficiency anaemia among 4.8 per cent pregnant women in urban slums of Delhi. A study conducted by NFI (2005) among pregnant women indicated that more than 90 per cent women in Tamil Nadu, 58 per cent in Kerala, 68 per cent in Himachal Pradesh are anaemic. Among lactating women, the prevalence of anaemia was found to be 90 per cent, 60 per cent and 91 per cent in Tamil Nadu, Kerala and Himachal Pradesh respectively. Agarwal *et al.* (2006) reported moderate anaemia among 51 per cent pregnant and lactating women in India. The authors also observed anaemia among 57.8 per cent pregnant women and 60.7 per cent lactating women in Kerala. Among pregnant women of BPL families of Hissar district of Haryana, 78 per cent women had anaemia (Panghal and Boora, 2010).

Raghuram *et al*. (2012) observed higher prevalence of anaemia among women who had a birth spacing of one to two years when compared to women who had a birth spacing of two to three years. The authors observed 62.9 per cent anaemic women in the first category when compared to 37 per cent in the later category.

Cherian (1992) observed vitamin B complex deficiencies among 29 per cent of agricultural labourers in Thiruvananthapuram. Clinical signs of B complex deficiencies were observed by Devi and Sarojini (2000) among 41 per cent women engaged in dairy and non dairy industries. Lawrence (2003) noticed angular stomatitis among 6 to 18 per cent women agricultural labourers in Thrissur.

Griffiths and Bentley (2001) indicated goitre prevalence among 18 per cent of adult women in Andhra Pradesh. However, Khan and Singh (2005) observed goitre only among three per cent of women in Gujarat.

Kapil *et al.* (1999) reported iodine deficiency disorder among 22.9 per cent of pregnant women in Andhra Pradesh. In North India, Sahu *et al*. (2009) observed vitamin D deficiency among pregnant women.

2.4. Factors influencing food and nutritional security

Among farmers, Kennedy and Haddad, (1992) observed food insecurity due to the increased expenditure incurred for food production. According to Kennedy and Peters (1992), poverty is a major factor influencing food insecurity. Ahmed, (1993) indicated unemployment, low income, inadequate purchasing power and poor economic growth as the factors influencing food security. Vijayaraghavan *et al*. (1998) indicated non ownership of agricultural land, lower agricultural production, low per capita income and illiteracy as the factors influencing household food security. Lupien and Menza (1999) indicated that in addition to problem of food supply, access to basic services like education, health facilities, sanitation, clean water, safe housing and employment affect food security.

The full story of food insecurity is related to poverty, illiteracy, gender discrimination, caste discrimination, neglect, unhygienic living conditions, lack of basic amenities and health care (MSSRF, 2001). Tarasuk, (2001) indicated social isolation, poorer self-rated health, long standing health problems and activity limitation as the factors influencing food insecurity. Nnakwe and Yegammia (2002) considered anxiety, negative feelings about self-worth, hostility towards the outside world as the factors influencing food insecurity. Vozoris and Tarasuk (2002) observed association between household food insecurity and poor health status, food insufficiency in terms of financial difficulty in acquiring food among elderly women.

Gulliford *et al*. (2003) indicated a positive association between food insecurity and low income and physical limitation at household and individual levels. However, the authors indicated a negative association between food insecurity and employment status, type of water supply in the home, age and gender of the head of family. Adhiguru and Ramaswamy (2003) observed that household food security stems from inadequate employment, low income, seasonal migration, high food prices, geographic and seasonal misdistribution of food, poor social organisation and large family size. Vijayan (2003) indicated inadequate cultivable land, expenditure pattern, lack of nutrition education and inability to make use of available resources as the major factors influencing food security. Lawrence (2003) indicated food expenditure, monthly income, family size and type of family as the important factors influencing food security.

Deepa *et al.* (2004) indicated seasonal and climatic changes as the factors that determine the agricultural cropping pattern and availability of local food stuffs and thus the household food and nutritional security. Scholes and Biggs, (2004) cited poverty, lack of education, unavailability of employment, poor market access, increase in food price, failure in poverty right and climate or environment as the seven chronic drivers of household food insecurity. The authors also indicated that the first five drivers acted by restricting access to food and the last two acted via reduction in food production.

As per Parliamentary Office of Science and Technology (POST, 2006) factors such as poverty, health, food production, political stability, infrastructure, access to markets and natural hazards affect food security. Ayinde *et al*. (2006) indicated that the nature of food security worsened by the low level of formal education, income and farm productivity.

Vijayakumar *et al*. (2007) considered low purchasing power and lack of accessibility of a variety of foods as the factors influencing food security. The authors also reported economic status, education and empowerment of women as the factors influencing food security among women at household and individual levels. Sikwela and Mpuzu (2008) indicated a positive effect of per capita aggregate production, cattle ownership, fertiliser application and access to irrigation on household food security.

Rao (2008) described weak access to education, skills, assets and productive livelihoods in a globalizing and liberalizing economy, sanitation and housing conditions as the factors affecting food insecurity. Gupta (2009) indicated a safe environment, prevention of transmission of vector-borne diseases and equitable health care as the elements promoting nutrition security for every individual.

Kumar (2010) indicated low productivity, frequent crop failure, uneven and untimely rainfall due to climate change as the factors influencing food insecurity. According to Chandran (2010) lack of amenities like safe drinking water, acute scarcity of doctors and other public health professionals in rural areas, nutrition education, lack of health services, proper child care affected food insecurity. Shapouri and Rosen (2010) indicated current trends in agricultural production, income, population growth and inflow of foreign capital as the factors affecting food security.

Livelihood security as an essential and inseparable component of a comprehensive strategy for national food security was indicated by Swaminathan (2010_b). Mathur (2011) indicated fewer opportunities for education, great instances of early marriage as the factors affecting food insecurity.

Pal and Jha (2011) indicated that increase in food price leading to lower purchasing power especially among low income groups affect food security. Hazra (2011) also indicated the high cost of food items making the food unaffordable as one of the important factors influencing food and nutrition insecurity. Kumar and Shivay (2011) indicated food shortage and low purchasing power as the factors affecting food security.

Mete and Mondal (2011) reported child labour as a serious problem which hampers the health and growth of children as a factor affecting food security.

According to Tiwari and Tiwari (2011), large scale depletion through crop harvests and low level of replenishments through inadequate nutrient use causes negative nutrient balance in the soil system and thus multinutrient deficiencies affecting food security. Massive use of fertilizers and toxic pesticides which poisons the land and water cause environmental consequences like loss of top soil, decrease in soil fertility, surface and ground water contamination and loss of genetic diversity affecting food production and finally to food security (Singh and Dabas, 2012). Gautam and Kumar (2012) indicated under investment, low productivity, irrigation and post harvest losses as the main factors affecting food security.

Bamji (2009) indicated that apart from physical and economic access to food, access to clean environment and drinking water, increasing incidence of chronic diseases due to sedentary life styles, shift to low fibre, high fat, refined carbohydrate diets, stress, addictions, low physical activity as the factors affecting nutritional insecurity.

Gender discrimination in food distribution was observed as an important factor affecting food and nutritional security in the Indian households (Basu *et al.,* 1993 and MSSRF 2000). Quisumbing *et al*. (1995) considered women as the key to household food security. IFAD (2004) indicated that at any given income level, a household is likely to enjoy more food security when there is control over income for women.

Shukla (2008) indicated gender disparity as an important factor affecting the nutritional security among children. Gender blindness and lack of women empowerment were considered by FAO (2008) and Wanner (2009) as the factors influencing food security.

United States Census Bureau (USCB, 2000) and Bukuluki *et al.* (2008) observed more food insecurity among the elderly and the disabled. However, Croome *et al*. (2007) indicated high food insecurity in the households with young children and in female headed households. Hadley *et al.* (2008) observed more food insecurity among girls when compared to boys. Ramachandran (2008) and Floro and Swain (2010) also indicated more food insecurity among women when compared to men and children due to gender bias.

According to Ajula *et al.* (1993), Selvaraj and Jayaprakashan (2001) and Priscilla *et al*. (2002) poverty is a major determinant of chronic household food insecurity. NIRD (1999) reported that larger the number of poor, lower would be their access to food and higher would be their food insecurity and vulnerability. MSSRF (2001) indicated poverty as an important cause for persistent food insecurity. Among poor families lower consumption of fruits and vegetables due to lack of knowledge and low income affected nutritional security (Kidd and Peters, 2010). Razi (2012) also indicated mass poverty as one of the major critical problems of food insecurity.

Household's real income is an important factor influencing food security as income limits the amount of food which can be obtained (Dewalt *et al*., 1990, VonBraun and Lorch, 1991 and Sheikh, 2007). Bonti-Ankomah (2001) observed higher vulnerability to food security in households with low income. Viswanath (2001) reported that increased income as well as income from diversified sources as important factors to achieve long term food security especially among rural women. According to Tarasuk (2001) household food security is inextricably linked to financial insecurity.

Access to health service and food provision was found to be affected negatively in low income families (Piaseu and Mitchell, 2004). Petersen (2004) and Nyanguru (2005_a and 2005_b) observed improved access to basic human needs in the

households with income security. Sheikh (2007) indicated food prices as an important factor influencing food security.

Basic education among rural people was considered as a key factor for promoting over all food and nutritional security (Swamy *et al*., 2000, Tessio *et al.,* 2005 and Burchi, 2006). According to Rajikabandari and Smith (2000) female education had an impact on the consumption of nutritious and preferred foods that was independent of the effect of income. Hoffmann *et al.* (2009) also indicated the impact of education in reducing poverty, hunger and food insecurity. Haddad (1999), Mukudi (2003) Simister (2003) and Mehrota (2006) stressed the influence of parental education in achieving nutritional security among children.

Large family size would result in improper food distribution among family members due to low purchasing power (Thimmayamma, 1983). Yesoda (1990) reported that family size along with the composition of the family would affect the availability and access to food which directly affect household food security. VonBraun and Lorch (1991) observed larger family size with younger age composition and dependants in food insecure households. Sikwela and Mpuzu (2008) and Anusha (2012) also indicated significant relationship between household food security with the size of the households.

Farm size was considered as an important factor influencing food accessibility through household income (Najafi, 2003). A negative and significant relationship between farm size and household food security was indicated by Sikwela and Mpuzu (2008).

According to Devereux (2000) drought and war are the main triggers of transitory food insecurity. The author also indicated seasonality as a major cause of cyclical food insecurity while structural factors contributing to chronic food insecurity included poverty, fragile natural resource base, weak institutions and unhelpful or inconsistent government policies. Rosegrant and Cline (2003) indicated climate change as a critical factor affecting food security. Gregory *et al*. (2005) observed labour issues and the availability and quality of ground water for irrigation as factors

influencing food security. According to Nolan *et al*. (2006) food security is strongly and independently associated with the capacity to save money.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

The methods and procedures employed for the study are presented in this chapter under the following sections.

3.1. Selection of the area

3.2. Selection of the sample

3.3. Plan of study

3.4. Methods adopted for the study

3.5. Development of tools and conduct of study

3.6. Analysis of the data

3.1. Selection of the area

The study was conducted in the Central Zone of Kerala. All the four districts of Central Zone of Kerala namely Thrissur, Ernakulam, Palakkad and Malappuram were selected for the study. From each district, two blocks and from each block, one panchayat and from each panchayat two wards were selected randomly. Thus, 16 wards from the four districts of Central Zone of Kerala comprised the locale of the study (Fig. 1).

3.2. Selection of the sample

To select the samples for the study, the details regarding the BPL families of the selected wards were collected from the records maintained by the concerned Taluk Rationing Officer of each district. From the details, 25 families were selected randomly from each of the selected wards comprising 100 BPL families from each district. Thus, 400 families from the Central Zone of Kerala were selected for the study. While selecting the samples, families residing in Corporation/Municipal areas were excluded and only families having BPL cards were selected for the study.

To conduct the detailed study, 15 women in the age group of 25 to 35 years and 15 preschool children in the age group of three to five years were selected as subsamples from each of the selected four districts comprising a total number of 60 women and 60 preschool children. While selecting the subsample, women with special physiological conditions and women and children with specific diseases were excluded.

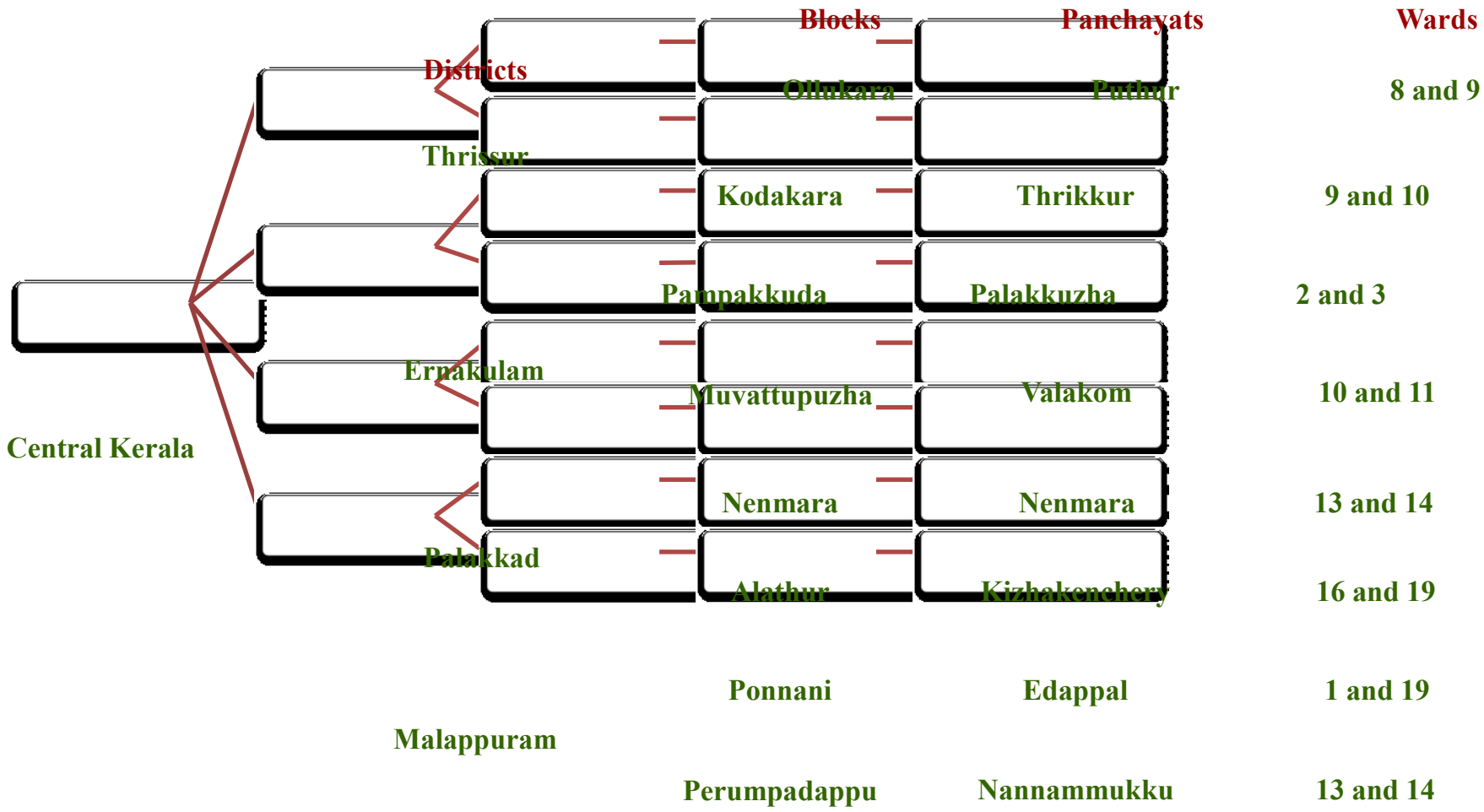


Fig. 1. Sampling process for the study

3.3. Plan of study

The plan of study was designed on the basis of the specific objectives which comprised of:

3.3.1. A baseline survey to collect information on the socioeconomic status of the selected families

3.3.2. A dietary survey to collect details on the food consumption pattern of the selected families

3.3.3. Food purchase inventory of the families for a week which was carried out thrice during March to May (summer), June to August (rainy) and November to January (winter).

3.3.4. A dietary recall survey to collect data on the food and nutritional adequacy of the families by determining the food intake per consumption unit (CU) per day and per capita nutrient intake per day. This was also carried out thrice during March to May (summer), June to August (rainy) and November to January (winter).

3.3.5. Assessment of nutritional status of the family members through

3.3.5.1. Anthropometric measurements

3.3.5.2. One day food weighment survey to assess actual food and nutrient intake of women and preschool children (subsample) replicated thrice during March to May (summer), June to August (rainy) and November to January (winter).

3.3.5.3. Clinical examination of women and preschool children (subsample) to identify specific deficiency symptoms.

3.3.5.4. Biochemical examination of blood of women and preschool children (subsample) for haemoglobin, total protein, albumin/globulin ratio, and creatinine.

3.3.6. Measurement of food and nutritional security of the families.

3.3.7. Conduct of Participatory Rural Appraisal (PRA) sessions among women and preschool children (subsample).

3.3.8. Statistical analysis and interpretation of data using suitable statistical techniques.

3.4. Methods adopted for the study

Determination of suitable methods and procedures are very important to get accurate and reliable data. Interview method with the help of structured and pretested schedules was used to collect the required information about the socioeconomic status and food consumption pattern of the families.

Food purchase inventory for a period of one week was conducted using a food purchase inventory schedule to find out the frequency of purchase of various food items and the quantity of food purchased by the families. From the data collected, adequacy of purchase of different food items was computed.

To assess the food adequacy among family members, one day recall method of diet survey was conducted among the selected families during March to May (summer), June to August (rainy) and November to January (winter). From the data collected, food intake per consumption unit and per capita nutrient intake among family members for a day were computed.

To assess the nutritional status of family members, following methods were employed.

1. Recording of anthropometric measurements.
2. Monitoring actual food and nutrient intake.
3. Conducting clinical examination.
4. Estimating haemoglobin, total protein, albumin/globulin ratio, and creatinine level of blood.

Weight and height of all family members were recorded using standard procedures suggested by Jelliffe (1966). Among preschool children, apart from height and weight, mid upper arm circumference (MUAC), head circumference and chest circumference were also measured using standard procedures suggested by Jelliffe (1966). To assess the actual food and nutrient intake, one day food weighment survey was conducted among women and preschool children selected as subsample.

Clinical examination of the subsample was also conducted to assess the signs and symptoms associated with nutritional deficiencies.

Biochemical estimation of blood for haemoglobin, total protein, albumin, globulin and creatinine was also conducted among women and preschool children (subsample) to find out the prevalence of anemia and protein deficiency.

Food security of the families was assessed using the modified version of USDA (2000) module and the index developed by MSSRF (2008). Food security of all the selected families was assessed by determining the three criteria of food security namely access, availability and absorption of household food resources and nutrition security was determined from the per capita nutrient intake of the family members.

The survey data was triangulated and supplemented with the help of key informants through a series of PRA (Participatory Rural Appraisal) sessions among women and preschool children selected as subsample from each district. One PRA session was conducted at each district. The PRA is a process of learning from a community to investigate, analyse and evaluate specific situations, resources, problems, constraints and opportunities. Information from the above counts are put together to make decisions regarding research, extension and development activities for a region/ locality like a panchayat or village/ ward/ neighborhood in general. The final outcome of the PRA exercises should be the prioritization of problems and identification of intervention points to reduce the reasons/causes responsible for the problems.

3.5. Development of tools and conduct of study

3.5.1. Socioeconomic and food consumption pattern of the families

A tool is defined as an instrument in the hand of researcher to measure what they intent to do in their study. The details regarding socioeconomic and food consumption pattern of the families were collected with the help of two separate interview schedules developed for the study. To find out the socioeconomic conditions of the families information pertaining to religion, caste, type of family, family size, age, education and occupational status of family members, monthly income, possession of land, domestication of animals, savings, indebtedness, monthly expenditure pattern, housing conditions, personal habits, availability of safe drinking water, health facilities available in the locality and details of morbidity and mortality

pattern among family members were collected. The schedule used to collect the socioeconomic details of the families is given in Appendix I.

The schedule to find out the food consumption pattern of the households included queries about the food habits, meal pattern, food expenditure pattern, details of purchasing pattern of different food items like place of purchase, quantity purchased, frequency of purchase, frequency of use of foods, coping strategies adopted during food crisis and preservation and storage practices adopted. This schedule was appended with a questionnaire to collect details on dietary recall for a day to find out the food adequacy of the families. The schedule for food consumption pattern of the families is given in Appendix II.

To find out the details on food purchasing pattern of the families the food purchase inventory schedule was kept in the custody of an educated member of the family for a period of seven days. This nominated member recorded the details of food purchased by the family on a daily basis. Details such as nature of food purchased and quantity purchased were included in the inventory schedule. This was repeated thrice during March to May (summer), June to August (rainy) and November to January (winter). The quantity of food purchased for a week was then converted on per day basis and were categorised under each food group namely cereals, pulses, roots and tubers, other vegetables, green leafy vegetables, fruits, milk and milk products, non vegetarian food items, fats and oils and sugar and jaggery. Then, the total requirement of each food group for each of the selected families were determined separately on the basis of the family composition taking into account the age and sex of family members as well as activity of adults using the quantity suggested for a balanced diet by ICMR (2010_a). The mean quantity of each food group purchased for a day by the family was then compared with this requirement and the percentage requirement for each food group for each family was computed. The families were categorized into four groups on the basis of percentage of requirement met as less than 25 per cent, 25 to 50 per cent, 50 to 75 per cent and more than 75 per cent of requirement.

The frequency of use of different food items by the families was assessed by computing the frequency scores using the formula suggested by Reaburn *et al.* (1979). The formula is given below.

$$\text{Percentage of total score} = \frac{R_1S_1 + R_2S_2 + \text{---------} R_nS_n}{n}$$

S_n = Scale of rating, R_n = Percentage of respondents selecting a rating n

= Maximum scale rating.

To conduct the recall method of diet survey, standard measuring cups, spoons and a weighing scale were used to estimate the quantity of food used by the families. The house wife or member of the family who cooks and serves the food was asked to recall the details of raw food items used during the previous day either in cup measurements or in grams. The cup measurements were then converted into grams. From the data obtained, the quantity of each food item used by the family for the day was computed on a per consumption unit basis. For this, the adult consumption unit suggested by Gopalan *et al*. (1989) for different age and sex categories as well as activity of adult was used to compute the total consumption unit of the family. This total consumption unit obtained was used to compute the quantity of food item consumed per consumption unit for a day. Then, the quantity consumed by different age and sex categories and as per activity (adults) was computed on the basis of their respective consumption unit. Here also, the food items were grouped under the ten food groups namely cereals, pulses, roots and tubers, other vegetables, green leafy vegetables, fruits, milk and milk products, non vegetarian items (meat, fish and egg), sugar and jaggery and fats and oils. The adult male and female members were categorised on the basis of their activity as sedentary, moderate and heavy. The male members who were working as contractor, broker and sales boy were included under sedentary activity; goldsmith, agricultural labourer, carpenter, electrician, driver, tapper, painter, mechanic, dobby and cook were included under moderate activity and wood cutter as heavy activity. Among female member's, housewives and tailors were included under sedentary activity and servant maid and agricultural labourer as moderate activity.

The quantity of different food groups consumed was compared with the requirement suggested by ICMR (2010_a) for a balanced diet for each category. From

the quantity of food items consumed per consumption unit, the nutritive value of food stuffs with respect to energy, protein, fat, calcium, iron, carotene, thiamine, riboflavin, niacin and vitamin C was computed using the food composition table suggested by Gopalan *et al*. (1989). The per capita nutrient intake of different groups based upon age, sex and activity was compared with the RDA suggested by ICMR (2010_b). The percentage of RDA met among different groups was computed to find out the adequacy of nutrient intake.

3.5.2. Assessment of nutritional status

3.5.2.1. Anthropometric measurements

For children as well as adolescents and adults who can stand, weight was measured using a bathroom weighing balance, which was checked for zero error, before taking the measurement. The weight of infants and children who cannot stand was recorded using a beam balance.

Height was measured using a fiberglass tape. The subject was asked to stand erect looking straight on a leveled surface, without shoes, with heels together, toes apart, buttocks, shoulder and occiput against the wall. The height was recorded in centimeters. For infants, children and elderly who cannot stand, the crown heel length in the lying position was measured instead of the standing height using tape and expressed in centimeters.

Mid Upper Arm Circumference (MUAC) of children was taken on the left hand with a flexible fibre glass tape. The measurement was recorded in centimeters at the midpoint between the tip of the acromion process of the scapula and the tip of the olecranon process of the fore arm bone ulna. The arm was left hanging freely and the tape was gently but firmly placed embracing the arm without exerting too much pressure as suggested by Jelliffe (1966).

Height, weight and MUAC of children were compared with the standard measurements suggested for the respective age and sex and the results were interpreted. For comparison reference standards suggested for height and weight by WHO (2006) was used for children upto three years. For children in between three to

twelve years, the 95th centile values of weight and height for given age/gender considered as standard reference values for Indians (ICMR 2010$_b$) were used for comparison. For MUAC, standards suggested by Gopaldas and Seshadri (1987) were used.

Children below 12 years were classified into different grades of nutritional status on the basis of classification suggested by Gomez *et al.* (1956) for weight for age and Waterlow (1972) for height for age.

The head and chest circumferences of children below five years were measured with a flexible fibre glass tape. The head circumference was measured passing the tape round the head over the supra-orbital ridges of the frontal bone in front and the most protruding point of the occiput on the back of the head. Chest circumference was taken at the nipple level in mid inspiration. The head and chest circumference ratio was computed from these two measurements.

BMI of adolescents, adults and elderly was computed using weight and height measurements and were categorised into different grades of nutritional status on the basis of the classification suggested by WHO (2004) for Asian population.

3.5.2.2. Food weighment survey

One day food weighment survey was conducted among the subsample during the three seasons. In this method, both the raw as well as the cooked foods included by the family for a day was weighed using the food weighing balance. The amount of cooked food item consumed by both women and children (subsample) was also weighed. Any other extra foods consumed were also taken into account. The amount of cooked food item consumed by the respondent was then converted to its raw equivalent using the formula,

$$\text{Individual intake in terms of raw equivalents (g)} = \frac{\text{Total raw amount of each ingredient (g)}}{\text{Total cooked amount (g)}} \times \text{Individual intake of cooked amount (g)}$$

The quantity of each food item consumed by women and preschool children was categorised under each food group and compared with the quantity specified for a balanced diet by ICMR (2010_a) for women engaged in sedentary activity and children in the age group of four to six years.

The nutritive value of the foods consumed was then calculated using the food composition tables suggested by Gopalan *et al.* (1989) and compared with the RDA of nutrients suggested for adult women engaged in sedentary activity and preschool children in the age group of four to six years.

3.5.2.3. Clinical examination

Clinical examination of the subsample (women and preschool children) was conducted with the help of a qualified medical officer using a schedule formulated for this purpose and the schedule is given in Appendix III.

3.5.2.4. Biochemical examination

Haemoglobin, total serum protein, serum albumin, serum globulin and serum creatinine were estimated among women and preschool children selected as subsample using standard procedures. Haemoglobin was estimated by Sahli's method (Wintrobe, 1975). Total protein, albumin and creatinine were estimated using the methods suggested by (Henry *et al.*1975), (Boumas *et al.*1971) and (Bowers, 1980) respectively. From the serum protein and serum albumin, serum globulin was computed by subtracting serum albumin from serum protein.

3.5.3. Assessment of food security

To measure the overall food security, the food security core module questionnaire prepared by USDA (2000) was modified slightly and the modified one was used to collect the relevant informations. The food security core module questionnaire covered full range of severity of food scarcity observed under current conditions for families with and without children (Appendix IV). In order to

determine the relative position of the family's scores, the response to each question in the food security core module was coded as either affirmative or negative (1 or 0) and the total was computed. The maximum affirmative responses for families with and without children were 18 and 10 respectively. The set of food security questions included in the core survey module was combined into a single overall measure called food security scale so as to have a continuous, linear scale which measured the degree of severity of food insecurity / hunger experienced by a family in terms of a single numerical value ranging from 0 to 9.3. The food security scale values and status level classifications were determined using the food security scale values suggested by USDA (2000). The details are given in Appendix V. Scale value and the type of food security were determined by selecting the column corresponding to the total number of affirmative answers given by the family. On the basis of the intensity of food insecurity, the families were grouped into four categories like food secure, food insecure without hunger, food insecure with moderate hunger and food insecure with severe hunger. This was done separately for families with and without children.

Food security of the families was also assessed using the indicators suggested by MSSRF (2008). The seven indicators suggested by MSSRF (2008) were modified to suit the situation of the present study. The indicators suggested by MSSRF (2008) and the modified indicators used in the present study are given in Table 1. The indicator No. 1, 4 and 6 were measured for each family using the index as given below. For example, in the case of indicator No: 1 for per capita energy intake of the family, the index was determined as:

$$\text{Index} = \frac{\text{Actual per capita energy intake (Kcal)} - \text{Minimum per capita energy intake (Kcal)}}{\text{Maximum per capita capita energy intake (Kcal)} - \text{Minimum per capita energy intake (Kcal)}}$$

Like this, the index for iron (No.4) for adult women as well as children (No.6) below six years were also determined.

The indicator No.2 for drinking water facilities was coded as 0, 1 and 2 with zero indicating public well for drinking water facility, one indicating facilities like public tap, and two indicating those families which depended on own well and well in the neighbourhood for drinking water. The indicator No. 3 for toilet facilities was coded as 0 and 1 with zero indicating no toilet facilities and one indicating toilet facilities within the premises.

Table 1. Modified indicators for measurement of food security

Sl. No.	Indicator	
	MSSRF (2008)	**Modified**
1	Percentage of population consuming less than 1890 Kcal per consumption unit	Per capita energy intake (Kcal/CU) of the family
2	Percentage of households not having access to safe drinking water	Families having access to safe drinking water
3	Percentage of households not having access to toilet facilities within premises	Families having access to toilet within premises
4	Percentage of ever married women (15-49 years) who are anaemic	Actual iron intake of adult women
5	Percentage of women (15 – 49 years) with chronic energy deficiency	Actual BMI of adult women
6	Percentage of children in the age group (6- 35 months) who are anaemic	Actual iron intake of children below six years
7	Percentage of children in the age group (6 – 35 months) who are stunted	Percentage deviation in the height of children below six years from the standard

The indicator for coding BMI (indicator No.5) was coded as 1, 2 and 3 with one indicating obesity with a BMI above 27.5 kg/m^2, two indicating undernutrition having a BMI less than 18.5 kg/m^2 as well as for overweight with a BMI of 23 to27.5 kg/m^2 and three indicating normal BMI in between 18.5 to 23 kg/m^2. Theindicator No. 7 for stuntedness among children was categorised as 1, 2, 3 and 4 with one indicating < 85 per cent of standard height, two indicating 85 to 90 per cent of standard height, three indicating the percentage of height in between 90 to 95 per cent

and four indicating above 95 per cent of standard height for age. The indices were calculated for families with and without children separately. Thus, for computing the composite index for families with children all the seven indicators mentioned in Table1 were used while for families without children the composite index was computed using five parameters by excluding item No. 6 and 7. Thus, five parameters were considered for families without children. The indicators under consideration were summed up to derive a composite index for families with and without children separately. The summary statistics namely mean and standard deviation were calculated and families were categorised as less than mean – standard deviation (SD), between mean – SD and mean, between mean and mean + SD, and above mean + SD indicating severe food insecurity, moderate food insecurity, mild food insecurity and food secure respectively.

To find out the nutritional security of the family members on the basis of age, sex and activity, the mean nutrient intake computed during the three periods of the recall survey was used. The percentage of RDA met for each nutrient was determined by comparing with the RDA suggested by ICMR (2010_b) for specific groups based on age, sex and activity. These were then coded as 1, 2, 3 and 4 and 5 respectively for less than 25 per cent RDA, 25 to 50 per cent RDA, 50 to 75 per cent RDA and 75 to 100 per cent RDA and more than 100 per cent RDA met for different nutrients. These codes were summed up to arrive at an aggregate score for each age/sex/activity groups.

For computing the nutritional security of families, mean intake of energy, protein, fat, calcium, iron, carotene, thiamine, riboflavin, niacin and vitamin C of the family members per consumption unit determined by the recall method of dietary survey was used. The total nutrient intake per consumption unit computed on the basis of the family composition was compared with the RDA suggested by ICMR (2010_b) for an adult man engaged in sedentary activity. The percentage of RDA met for each nutrient for each of the families was determined. These were then coded as 1, 2, 3, 4 and 5 respectively for less than 25 per cent RDA, 25 to 50 per cent RDA, 50 to 75 per cent RDA, 75 to 100 per cent RDA and above 100 per cent RDA met for different

nutrients. The codes obtained for different nutrients were then summed up for the selected families to arrive at an aggregate score.

To find out the impact of food security on the nutritional status of family members, the total nutritional security scores obtained for the families was cross tabulated with the food security scores (USDA, 2000). To find out the impact of food security on the nutritional status of women, logistic regression was worked out. For this, food security scores of (USDA, 2000) and BMI of women were taken into consideration. Body Mass Index of women was coded as 0 and 1, zero indicating under nutrition/ overweight/ obesity and one indicating normal BMI in between 18.5 to 23 kg/m^2. In the case of preschool children, the correlation of food security and percentage deviation of weight and height from the standard measurements was worked out.

Multinomial logistic regression analysis was carried out to find out the factors influencing food security. Using the food security scores, the whole sample was trichotomised as food insecure with hunger, food insecure with moderate hunger and food insecure without hunger and food secure and these scores were used as dependent variables. Type of family, family size, education of head of the family, monthly income of the family, expenditure on food, expenditure on cereals, pulses and fish and intake of nutrients (10 nutrients) were used as explanatory variables.

3.5.4. Conduct of Participatory Rural Appraisal (PRA) sessions

Participatory Rural Appraisal (PRA) sessions were conducted among women and preschool children selected as subsample to interact with the subjects more closely so that they could define their own problems thereby obtaining more qualitative data and information through the sessions than from the survey. For the sessions, seven PRA tools were prepared well in advance to obtain more information about the subjects. The tools comprised of daily routine diagram, enterprise preference matrix, bioresource inflow-outflow diagram, livelihood analysis, venn diagram, social cum resource map and pair wise preference ranking.

Daily routine diagram reflected the daily activities of women and preschool children and showed how they spent their day, whether engaged in income earning activities and is there any scope for venturing into supplementary income generation activities. The PRA tool namely enterprise preference matrix was used to assess the preference and priorities of people towards enterprises as perceived by them for taking up supplementary income generating activities. In this, a screened list of enterprises were evaluated against different weighted criteria (attributes) by assigning scores to each criteria related to each enterprise. In the matrix, the enterprises were plotted along the horizontal axis and the criteria along the vertical axis. The exercise helped to find out the reason for preferring certain enterprise. In the enterprise column, the figures in parenthesis represented the product of weightage score of the attribute and the score assigned by the respondents against each attribute related to a particular enterprise.

Bioresource inflow – outflow diagram helped to understand how a community worked and about its resources. The bioresource inflow represented the inflow of resources from the village or outside village to the family. The outflow indicated the products sold by the family to generate income. Livelihood analysis showed the expenditure pattern of the family.

Venn diagram established the relationship between a community and its institutional and personnel environment. This helped to find out how different organizations, groups and key people were related to each other in terms of contact, co-operation and flow of information and provision of services. The circles of different diameter symbolized the community and institutions. The participants were asked to draw a big circle in the centre of paper that represented them. The most important organizations or persons were then drawn as big circles and the less important ones as smaller circles. The women were then made to compare the size of circles and to adjust them so that the sizes of circles represented the importance of the institution or persons. Then, the degree of contact/ co-operation between themselves and the service accessibility were represented by their distance from the central circle. Those that are in close contact with them ought to be close to their own circle and vice versa.

Social cum resource map helped to get a full picture about each area selected. The map was very useful to get an idea about the important institutions, organisations, resources and assets in the locality, its accessibility to the people and suggestions for improvement of such institutions.

Food preferences of women and preschool children were obtained by means of pair wise preference ranking. This was done with the help of a matrix, which had two identical list of items, one across the top and the other drawn down the left side. Each item was compared directly against the other until they were ranked from highest to lowest. Each open box or cell in the matrix represented a paired comparison of two items or alternatives. In the present study, preference of breakfast as well as lunch items for women and children were assessed. A matrix was drawn which indicated a list of breakfast as well as lunch items to be compared across the top and the same list within the same sequence down the left side. Women and children were asked to select from each pair separately the item preferred by them and the preference was marked in the respective cells. The exercise was continued with all the other combinations. When all the combinations were tried, the ranking was given for items according to the number of preferences recorded by the respondents.

3.6. Analysis of the data

Statistical analysis was carried out using percentage analysis,'t' test, chi square, Pearson correlation, Spearman correlation and multinomial logistic regression. The data was analysed using version 17.0 of Statistical Package for Social Sciences (SPSS).

RESULTS

4.
RESULTS

The results of the study entitled **"Food and Nutritional Security Scenario of BPL Families of Central Zone of Kerala"** are presented in this chapter under the following headings:

4.1. Socioeconomic profile of the families
4.2. Food consumption pattern of the families
4.3. Food and nutritional adequacy of the family members
4.4. Nutritional status of family members
4.5. Food and nutritional security of the families
4.6. Factors influencing food and nutritional security

4.1. Socioeconomic profile of the families

The socioeconomic details of the BPL families of Central Zone of Kerala with reference to their religion, caste, type of family, family size, composition, education and occupational status of family members, monthly income, land holdings, cropping pattern, possession of animals, details of savings, credit, monthly expenditure pattern, housing conditions, access to safe drinking water, personal habits, morbidity and mortality among family members, health facilities in the locality and immunisation pattern among children are furnished in this section from Tables 2 to 21.

4.1.1. Religion, caste, type of family and family size

Details of religion, caste, type of family and family size are presented in Table 2. Majority of the families (78%) belonged to Hindu community and only four per cent were Muslims. Regarding caste, 39.5 per cent and 38.75 per cent of the families were backward caste and scheduled caste respectively. Among the samples, 69.5 per cent were of nuclear type and the rest were joint families.

With respect to family size, it was seen that 59.75 per cent of families had four to six members and 34 per cent were having up to three members. Rest of the families had more than seven members.

Table 2. Details regarding religion, caste, type of family and family size

Sl.No.	Details	Number of families	Per cent
1	**Religion**		
	Hindu	312	78
	Christian	72	18
	Muslim	16	4
	Total	**400**	**100**
2	**Caste**		
	Forward caste	87	21.75
	Other backward caste	158	39.5
	Scheduled caste	155	38.75
	Total	**400**	**100**
3	**Type of family**		
	Joint	122	30.5
	Nuclear	278	69.5
	Total	**400**	**100**
4	**Family size**		
	1 – 3	136	34
	4 – 6	239	59.75
	7 – 9	21	5.25
	10 – 12	3	0.75
	13 – 15	1	0.25
	Total	**400**	**100**

4.1.2. Family composition

The distribution of family members on the basis of age and sex are furnished in Table 3. It was found that 48.12 per cent of the total family members were in the age group of 20 to 49 years and consisted of 48.85 per cent male and 47.43 per cent female members. The members aged 50 years and above comprised of 21.72 per cent with 19.59 per cent male and 23.72 per cent female members. Members of the family who were less than 20 years of age comprised 30.16 per cent.

Table 3. Distribution of family members according to age and sex

Age (years)	Number		Total
	Male	Female	
0-10	109 (13.87)	100 (11.92)	209 (12.86)
11-19	139 (17.69)	142 (16.93)	281 (17.30)
20-29	131 (16.67)	118 (14.06)	249 (15.32)
30-39	125 (15.90)	142 (16.92)	267 (16.43)
40-49	128 (16.28)	138 (16.45)	266 (16.37)
50-59	92 (11.70)	84 (10.01)	176 (10.83)
≥60	62(7.89)	115 (13.71)	177 (10.89)
Total	**786 (100)**	**839 (100)**	**1625 (100)**

Figures in parentheses are percentage

4.1.3. Educational status of family members above 18 years

It was seen that 87.08 per cent of male and 75.08 per cent female members above 18 years had studied up to higher secondary level (Table 4). Those members who had college level education were only 12.03 per cent and among this 5.41 per cent were male and 6.62 per cent were female members. Only 18.30 per cent female and 7.51 per cent male members were not undergone formal education.

Table 4. Educational status of family members above 18 years

Educational Status	18 – 45 years		45-60 years		>60 years		Total	
	M	F	M	F	M	F	M	F
Lower Primary	30 (7.94)	39 (10.13)	42 (30.22)	55 (38.46)	25 (44.64)	29 (27.36)	97 (16.93)	123 (19.40)
Upper Primary	52 (13.76)	52 (13.51)	41 (29.50)	34 (23.78)	14 (25)	11 (10.38)	107 (18.67)	97 (15.30)
High school	191 (50.53)	165 (42.86)	32 (23.02)	19 (13.29)	1 (1.79)	2 (1.89)	224 (39.09)	186 (29.34)
Higher Secondary	69 (18.25)	69 (17.92)	2 (1.44)	1 (0.70)	0	0	71 (12.39)	70 (11.04)
College	30 (7.94)	40 (10.39)	1 (0.71)	2 (1.40)	0	0	31 (5.41)	42 (6.62)
No formal education	6 (1.58)	20 (5.19)	21 (15.11)	32 (22.37)	16 (28.57)	64 (60.37)	43 (7.51)	116 (18.30)
Total	**378 (100)**	**385 (100)**	**139 (100)**	**143 (100)**	**56 (100)**	**106 (100)**	**573 (100)**	**634 (100)**

Figures in parentheses are percentage M - Male F – Female

4.1.4. Educational status of children and adolescents

Details pertaining to the educational status of children and adolescents are given in Table 5. It was found that 10.33 per cent boys and 11.71 per cent girls were yet to initialized into education. Only 11.74 per cent boys and 9.27 per cent girls were attending balwadies. Children whose educational status was lower primary constituted 23.94 per cent boys and 20.97 per cent girls. Upper primary educational status was attained by

21.60 per cent of boys and 20.49 per cent of girls. Regarding high school educational status, 23.94 per cent of boys and 17.56 per cent of girls attained the same. Similarly, higher secondary educational status was attained by 8.45 per cent of boys and 20 per cent of girls.

Table 5. Educational status of children and adolescents

Educational	0 – 5 years		6- 10 years		11 -15 years		16-17 years		Total	
	B	**G**	**B**	**G**	**B**	**G**	**B**	**G**	**B**	**G**
Not started	22 (42.31)	24 (47.06)	0	0	0	0	0	0	22 (10.33)	24 (11.71)
Balwadi	22 (42.31)	18 (35.29)	3 (5.36)	1 (2.04)	0	0	0	0	25 (11.74)	19 (9.27)
Lower Primary	8 (15.38)	9 (17.65)	39 (69.64)	34 (69.39)	4 (5.33)	0	0	0	51 (23.94)	43 (20.97)
Upper Primary	0	0	14 (25)	13 (26.53)	31 (41.34)	29 (43.28)	1 (3.33)	0	46 (21.60)	42 (20.49)
High school	0	0	0	1 (2.04)	39 (52)	33 (49.26)	12 (40)	2 (5.26)	51 (23.94)	36 (17.56)
Higher Secondary	0	0	0	0	1 (1.33)	5 (7.46)	17 (56.67)	36 (94.74)	18 (8.45)	41 (20)
Total	**52 (100)**	**51 (100)**	**56 (100)**	**49 (100)**	**75 (100)**	**67 (100)**	**30 (100)**	**38 (100)**	**213 (100)**	**205 (100)**

Figures in parentheses are percentage B - Boys G - Girls

4.1.5. Occupational status of family members

The details on the occupational status of family members are given in Table 6. Among 573 male and 634 female members above 18 years, 68.41 per cent male and

34.70 per cent female members were working as casual labourers on daily wages. Those who were unemployed without any regular income constituted 16.41 per cent male and

60.88 per cent female members. In the PRA sessions conducted through daily routine diagram among women and children also indicated that most of the women were engaged in household activities during most of the time. Among children, it was found that they

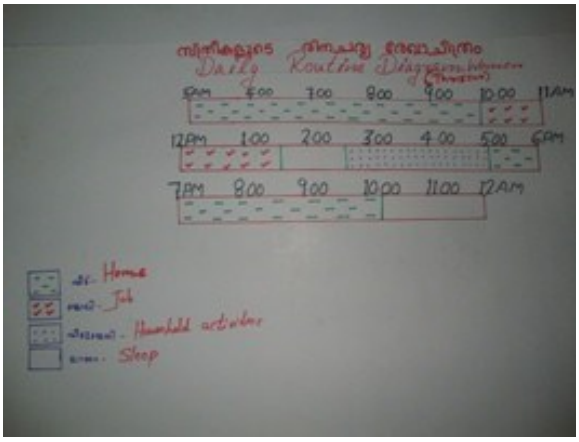
were engaged in studies both at school and at home. The daily routine diagram of women and children are illustrated in Plates 1 and 2.

In the enterprise preference exercise, women gave the highest weightage score to the attributes 'more profit' (9.75) followed by 'easy to start' (8.25). The less important attributes were 'need less skill' (5.75) and 'low perishability' (6.5).It was also seen that women preferred dairying as the most important enterprise followed by goat and poultry rearing. The details are given in Table 7.

Table 6. Occupational status of family members

Occupational Status	**18 – 45 years**		**45 – 60 years**		**>60 years**		**Total**	
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Agricultural labourers	2 (0.53)	0	2 (1.44)	0	1 (1.79)	0	5 (0.87)	0
Private employment	38 (10.05)	10 (2.60)	6 (4.32)	1 (0.70)	0	0	44 (7.68)	11 (1.74)
Daily wages	271 (71.70)	138 (35.84)	103 (74.10)	72 (50.35)	18 (32.14)	10 (9.44)	392 (68.41)	220 (34.70)
Tapping	16 (4.23)	7 (1.82)	5 (3.60)	1 (0.70)	1 (1.79)	0	22 (3.84)	8 (1.26)
Own Business	5 (1.32)	5 (1.30)	8 (5.75)	3 (2.10)	3 (5.36)	1 (0.94)	16 (2.79)	9 (1.42)
Unemployed	46 (12.17)	225 (58.44)	15 (10.79)	66 (46.15)	33 (58.92)	95 (89.62)	94 (16.41)	386 (60.88)
Total	**378 (100)**	**385 (100)**	**139 (100)**	**143 (100)**	**56 (100)**	**106 (100)**	**573 (100)**	**634 (100)**

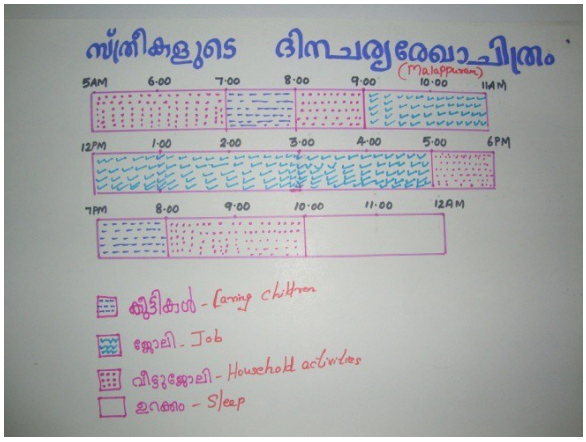
Figures in parentheses are percentage M – Male F – Female



Thrissur

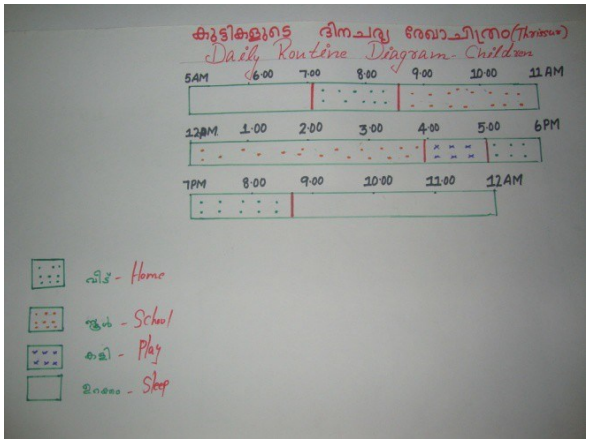
Ernakulam

Palakkad



Malappuram

Plate 1. Daily routine diagram of women



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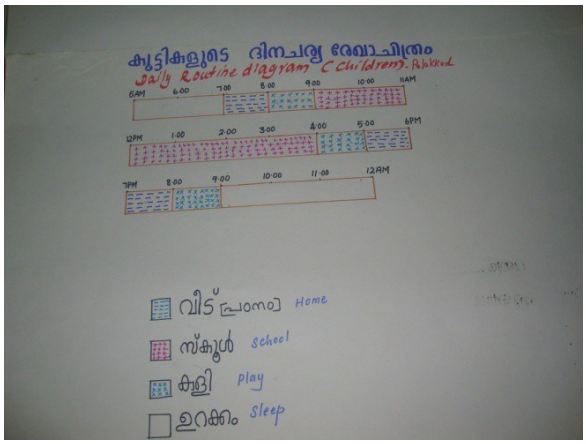

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Plate 2. Daily routine diagram of children

Table 7. Supplementary enterprises preferred by women

Attributes	Weightage score (10)	Enterprise							
		Cow (40)	**Goat (40)**	**Poultry (40)**	**Stitching (40)**	**Pickle (40)**	**Agriculture (40)**	**Food processing (40)**	**Spice powders (40)**
Easy to start	8.25	13 (107.25)	32 (264)	32 (264)	23 (189.75)	13 (107.25)	22 (181.50)	29 (239.25)	22 (181.50)
Minimal investment	7.5	23 (172.50)	32 (240)	36 (270)	27 (202.50)	22 (165)	25 (187.50)	18 (135)	20 (150)
Needs only less skill	5.75	36 (207)	38 (218.50)	31 (178.25)	27 (155.25)	17 (97.75)	28 (161)	18 (103.50)	15 (86.25)
High demand	7.5	39 (292.50)	12 (90)	29 (217.50)	24 (180)	16 (120)	28 (210)	26 (195)	20 (150)
More profit	9.75	39 (380.25)	34 (331.50)	23 (224.25)	27 (263.25)	18 (175.50)	27 (263.25)	19 (185.25)	24 (234)
Low perishability	6.5	40 (260)	32 (208)	24 (156)	24 (156)	25 (162.5)	16 (104)	16 (104)	36 (234)
Total score		1419.5	1352	1310	1146.75	828	1107.25	962	1035.75
Rank		**1**	**2**	**3**	**4**	**8**	**5**	**7**	**6**

Figures in parenthesis are product of weightage score and mean score

4.1.6. Educational and occupational status of the head of the family

Regarding the educational status of the head of the family, it was found that 31.75 per cent had lower primary level of education and 27.75 per cent had no formal education. Fifty eight per cent of the family heads were working as labourers on daily wages, and 31.50 per cent were unemployed without any regular income. The details are given in Table 8.

Table 8. Education and occupation of the head of family

Education	N	Per cent	Occupation	N	Per cent
Lower primary	127	31.75	Agricultural labour	5	1.25
Upper primary	73	18.25	Private job	17	4.25
High School	81	20.25	Daily wages	232	58
Higher Secondary	7	1.75	Tapping	14	3.50
College	1	0.25	Own Job	6	1.50
No formal education	111	27.75	Unemployed	126	31.50
Total	**400**	**100**		**400**	**100**

N- Number of families

4.1.7. Monthly income

Details pertaining to the monthly income of the families are given in Table 9. The income of 72 per cent of the families was in the range of Rs.4, 001/- to Rs. 12,000/- per month. Monthly income in between Rs.12, 001/- to 20,000/- was earned by 15.75 per cent of the families. Only 1.25 per cent had a monthly income in between Rs 20, 001/- to Rs 24,000. The families earning a monthly income of less than Rs.4000/- constituted only

11 per cent.

Table 9. Monthly income of the families

Income (Rs.)	Number	Per cent
<4000	44	11
4001 – 8000	151	37.75
8001 – 12000	137	34.25
12001 – 16000	48	12
16001 – 20000	15	3.75
20001 – 24000	5	1.25
Total	**400**	**100**

4.1.8. Per capita income

The details regarding the per capita monthly income of the families (Table 10) indicated that 47.5 per cent of families had a per capita income in the range of Rs.1,000 to Rs.2,000 and 49 per cent had Rs 2,001 to Rs 6,000. Only 3.5 per cent had a per capita income below Rs.1,000.

Table 10. Per capita income of the families

Per capita income (Rs.)	Number	Per cent
<1000	14	3.5
1000 – 2000	190	47.5
2001 – 3000	113	28.25
3001 – 4000	54	13.5
4001 – 5000	25	6.25
5001 – 6000	4	1
Total	**400**	**100**

4.1.9. Possession of land and agricultural details

The details on possession of land, area available and cultivation practices are furnished in Table 11. Only 56.25 per cent of the families had own inherited land. Rest of the families got the ownership through title deeds distributed recently. Seventy five per cent of the families had land holdings less than 10 cents and 17.25 per cent had 10 to 30 cents and the rest (8%) had more than 30 cents of land. Majority of the families selected for the study were not using their land for agricultural purposes. In 12.5 per cent of families crops like rubber, coconut, pepper, banana, paddy, arecanut and tamarind were present. Among this, 52 per cent received an income between Rs. 1000 to Rs. 4000 per month.

4.1.10. Possession of domestic animals

Among the families selected for the study, only 33 per cent had domestic animals like cow, goat, buffalo and hen and 35.61 per cent purchased them from neighbours. It was also seen that majority (84.85%) did not earn any income from the domestic animals but used for domestic consumption. The details are given in Table 12.

4.1.11. Bioresource-inflow-outflow of the community

The Bioresource-inflow-outflow diagram prepared in the PRA session to understand the available resources or assets and to understand the resource inflow and outflow from a village and household indicated that almost all the domestic resources like cereals, vegetables, milk, meat, fish, egg and spices were purchased from outside. Only very few per cent of the families marketed vegetables (12.5%) and milk (37.5%). The details are illustrated in Plate 3.

Table 11. Possession of land and details of crops

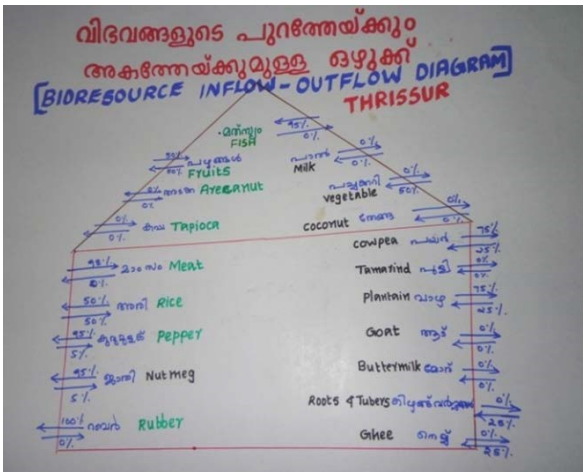
Sl .No.	Details	No of families	Per cent
1	Own inherited land	225	56.25
	Land received from Government	175	43.75
	Total	**400**	**100**
2	**Area (cents)**		
	<10 cent	299	74.75
	10 - 20 cent	47	11.75
	21 - 30 cent	22	5.50
	>31 cent	32	8
	Total	**400**	**100**
3	**Crops present within the land**		
	Rubber	24	48
	Coconut	9	18
	Pepper	3	6
	Banana	3	6
	Coconut and banana	1	2
	Tamarind	1	2
	Paddy	2	4
	Rubber and pepper	1	2
	Arecanut	1	2
	Rubber and coconut	4	8
	Coconut and pepper	1	2
	Total	**50**	**100**
4	**Monthly income from agriculture (Rs)**		
	<1000	24	48
	1000 – 2000	12	24
	2001 – 3000	11	22
	3001 – 4000	3	6
	Total	**50**	**100**

Table 12. Domestication of animals

Sl. No.	Details	No of Families	Per cent
1	Domestic animals (livestock)	132	33
	No livestock	268	67
	Total	**400**	**100**
2	**Source**		
	Purchased	34	25.76
	From Government	19	14.39
	Hatched	32	24.24
	From neighbours	47	35.61
	Total	**132**	**100**
3	**Income received per month(Rs.)**		
	Nil	112	84.85
	<1000	3	2.27
	1000 – 2000	4	3.03
	2001 – 3000	2	1.52
	3001 – 4000	1	0.76
	4001 – 5000	7	5.30
	>5001	3	2.27
	Total	**132**	**100**

4.1.12. Savings

It was seen from Table 13 that among the families surveyed, only 27.25 per cent had the habit of saving money. Among the families who had savings, 82.57 per cent saved money in group insurance. Rest of the families saved money in post office (10.09%) and private chitties (7.34%). It was found that 22.02 per cent saved up to Rs 3,000/- per year and others (72.48%) saved Rs 3,000/ to Rs.10, 000/- annually. Only 5.50 per cent of families saved more than Rs.10, 000/- per year.



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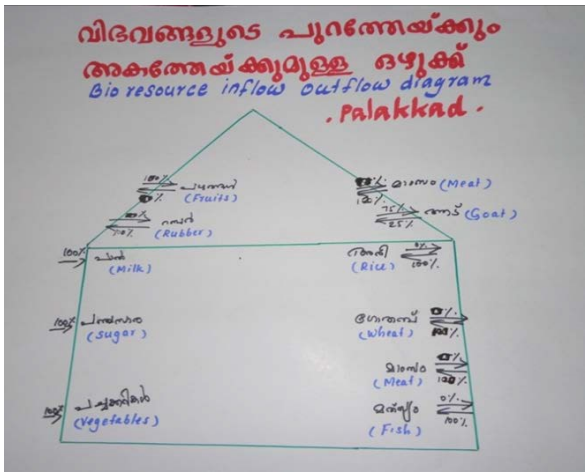

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Plate 3. Bioresource-inflow-outflow of the community

Table 13. Details about savings

Sl. No.	Details	No of families	Per cent
1	Saved money	109	27.25
	No savings	291	72.75
	Total	**400**	**100**
2	**Mode of savings**		
	Post office	11	10.09
	Group insurance	90	82.57
	Chitty	8	7.34
	Total	**109**	**100**
3	**Amount saved per year (Rs.)**		
	<3000	24	22.02
	3000 – 5000	53	48.62
	5001 – 7000	13	11.93
	7001 – 9000	4	3.67
	9001 – 10000	9	8.26
	>10001	6	5.50
	Total	**109**	**100**

4.1.13. Indebtedness

One third of the respondents had availed credit and among this, 50.76 per cent availed loan from commercial banks and 38.63 per cent from co- operative society. Forty one per cent families borrowed between Rs. 10,000/- to Rs. 70,000/- and 46.21 per cent above Rs.70, 000/-. Duration of the loan was of medium term among 73.48 per cent of the families and the rest had taken loan for short term (10.61%) as well as long term (15.91%) periods. The loan was availed mainly for house construction by 56.06 per cent. The loan was also availed for agriculture (5.30%), marriage (14.39%), education (11.36%), health (4.55%), purchase of vehicles (6.82%) and livestock (1.52%). The loan installment to be repaid varied from less than Rs.1000/- to more than Rs.3000/- per month. The details are furnished in Table 14.

Table 14. Details of loan taken

Sl No	Details	No: of families	Per cent
1	Availed credit	132	33
	No credit support	268	67
	Total	**400**	**100**
2	**Source**		
	Co-operative society	51	38.63
	Commercial bank	67	50.76
	Kudumbasree	13	9.84
	Friends	1	0.76
	Total	**132**	**100**
3	**Amount taken (Rs.)**		
	<10000	17	12.88
	10000 – 30000	28	21.21
	30001 – 50000	20	15.15
	50001 – 70000	6	4.55
	>70001	61	46.21
	Total	**132**	**100**
4	**Term** Short		
	term Medium	14	10.61
	term Long	97	73.48
	term **Total**	21	15.91
		132	**100**
5	**Purpose**		
	Agriculture	7	5.30
	Livestock	2	1.52
	Marriage	19	14.39
	House construction	74	56.06
	Education	15	11.36
	Health	6	4.55
	Purchase of transport vehicle	9	6.82
	Total	**132**	**100**
6	**Amount to be repaid/month**		
	<1000	50	37.88
	1000 – 2000	49	37.12
	2001 – 3000	15	11.36
	>3001	18	13.64
	Total	**132**	**100**

4.1.14. Monthly expenditure pattern

Details pertaining to the monthly expenditure pattern of the families are furnished in Table 15. It was found that 75.50 per cent of the families spent 16 to 50 per cent of their income for food while only 4.75 per cent spent above 50 per cent of their monthly income on food. Majority of the families did not spend money for house maintenance (94.75%), education (66.75%) and health (62.25%). Most of the families spent less than five per cent of their monthly income for purchase of kitchen equipments (94.75%), transportation (41.75%), recreation (66.75%), electricity (90%) and fuel (65.50%). The livelihood analysis conducted in the PRA also indicated that the families spent major portion of their income for food. Comparatively very lesser part of their monthly income was spent for health and education. The details of livelihood analysis are illustrated in Figure 2.

4.1.15. Housing conditions

From table 16 it is clear that 98.5 per cent of families were residing in their own houses. Majority of the houses (92.25%) were constructed with brick and had tiled roof (70.50%) and cement flooring (87.5%). Sixty five per cent of houses were having two rooms. Electricity and toilet facilities were present in 97.25 per cent and 93.50 per cent of houses respectively. Own well was found only in 43.25 per cent of the houses and 35.25 per cent and 11.50 per cent depended on public tap and public well respectively for drinking water. Majority (97.25%) of the families properly disposed waste and 95.25 per cent of the surroundings were found to be clean.

Regarding the recreational facilities in the houses, it was observed that 75.50 per cent depended on television for spending their leisure time. Among the kitchen utensils present, it was found that 21.50 per cent had pressure cooker in their kitchen. LPG and wood were mainly used as fuel for cooking by 62 per cent of the families.

Table 15. Monthly expenditure pattern of the families

Monthly income spent(%)	Food	Clothing	Kitchen equipment	Maintenance of house	Transport	Recreation	Education	Electricity	Health	Fuel	Repay ment	Rent	Cattle feed
Nil	0	0	0	379 (94.75)	56 (14)	132 (33)	267 (66.75)	11 (2.75)	249 (62.25)	132 (33)	268 (67)	394 (98.50)	366 (91.50)
<5	0	63 (15.75)	379 (94.75)	8 (2)	167 (41.75)	267 (66.75)	74 (18.50)	360 (90)	89 (22.25)	262 (65.50)	19 (4.75)	0	28 (7)
5-10	11 (2.75)	330 (82.50)	18 (4.50)	9 (2.25)	155 (38.75)	1 (0.25)	32 (8)	25 (6.25)	46 (11.50)	4 (1)	31 (7.75)	3 (0.75)	3 (0.75)
11-15	68 (17)	5 (1.25)	1 (0.25)	1 (0.25)	13 (3.25)	0	11 (2.75)	3 (0.75)	8 (2)	1 (0.25)	33 (8.25)	1 (0.25)	3 (0.75)
16-20	114 (28.50)	2 (0.50)	2 (0.50)	2 (0.50)	7 (1.75)	0	6 (1.50)	1 (0.25)	5 (1.25)	0	14 (3.50)	2 (0.50)	0
21-25	78 (19.50)	0	0	1 (0.25)	0	0	3 (0.75)	0	2 (0.50)	0	8 (2)	0	0
26-30	55 (13.75)	0	0	0	2 (0.50)	0	1 (0.25)	0	1 (0.25)	0	11 (2.75)	0	0
31-35	22 (5.50)	0	0	0	0	0	2 (0.50)	0	0	0	5 (1.25)	0	0
36-40	21 (5.25)	0	0	0	0	0	2 (0.50)	0	0	0	3 (0.75)	0	0
41-45	10 (2.50)	0	0	0	0	0	0	0	0	0	0	0	0
46-50	2 (0.50)	0	0	0	0	0	1 (0.25)	0	0	0	1 (0.25)	0	0
51-55	8 (2)	0	0	0	0	0	1 (0.25)	0	0	1 (0.25)	3 (0.75)	0	0
>55	11 (2.75)	0	0	0	0	0	0	0	0	0	4 (1)	0	0
Total	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**	**400 (100)**

Figures in parentheses are percentage

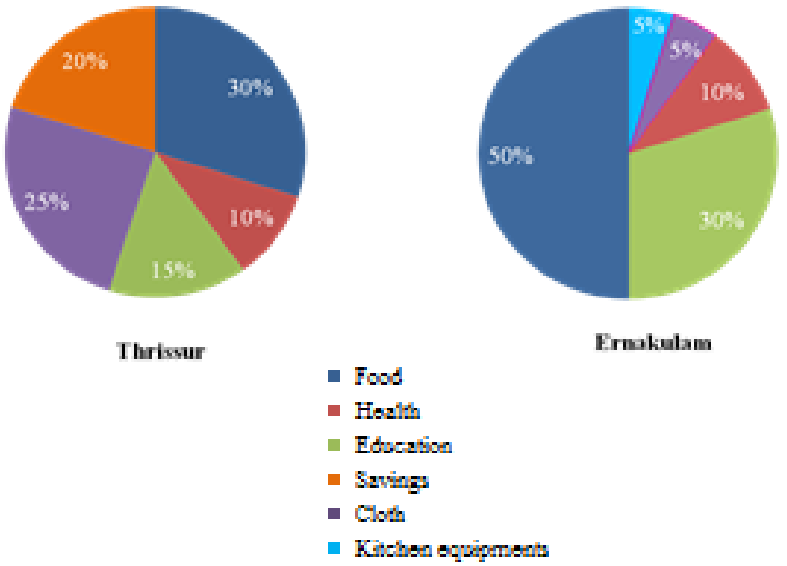

Fig.2. Livelihood analysis of the families

Table 16. Housing conditions of the families

Sl. No.	Housing conditions	No. of Families (N = 400)	Per cent
1	**Type of house**		
	Own	394	98.5
	Rented	6	1.50
2	**Number of rooms**		
	One	25	6.25
	Two	261	65.25
	Three or more	114	28.50
3	**Type of wall**		
	Brick	369	92.25
	Mud	30	7.50
	Thatched	1	0.25
4	**Type of floor**		
	Cement	350	87.5
	Tiled	37	9.25
	Mud	13	3.25
5	**Type of roof**	99	24.75
	Thatched	282	70.50
	Tiled	19	4.75
6	**Electricity**		
	Present	389	97.25
	Absent	11	2.75
7	**Toilet facilities**		
	Present	374	93.50
	Absent	26	6.50
8	**Details of toilet**		
	Own	373	93.25
	Public	1	0.25
	Open area	25	6.25
	Pit latrine	1	0.25
9	**Source of drinking water**		
	Own well	173	43.25
	Public tap	141	35.25
	Public	46	11.50
	well Pond	0	0
	Neighbour	40	10

10	**Mode of waste disposal**		
	Properly disposed at home	389	97.25
	Improperly disposed at home	4	1
	Improper disposal at outer surroundings	7	1.75
11	**Sanitary condition**		
	House yard is clean	381	95.25
	Not clean	19	4.75
12	**Leisure time activities**		
	Radio	28	7
	Television	302	75.50
	Radio and television	46	11.50
	Television and newspaper	7	1.75
	Radio, television and news paper	2	0.50
	Nil	15	3.75
13	**Kitchen utensils**		
	Nil	190	47.50
	Pressure cooker	86	21.50
	Mixie	50	12.50
	Cooker and grinder	1	0.25
	Pressure cooker and mixie	73	18.25
14	**Fuel for cooking**		
	LPG	3	0.75
	Kerosene and wood	14	3.50
	Electric heater and wood	2	0.50
	Wood	127	31.75
	LPG and wood	248	62
	LPG , kerosene and wood	5	1.25
	Agricultural waste , LPG and kerosene	1	0.25

4.1.16. Details regarding personal habits

Details regarding personal habits of the family members are furnished in Table 17. It was seen that in 59.5 per cent of the families, the member's especially adult men had the habit of smoking, alcohol consumption, chewing tobacco, betel leaf etc.

Table 17. Personal habits of the family members

Sl. No.	Personal habits	No. of families	Per cent
1	Smoking	44	11
	Chewing tobacco	3	0.75
	Smoking and chewing tobacco	4	1
	Smoking and betel leaf	1	0.25
	Chewing pan	1	0.25
	Chewing betel leaf	11	2.75
	Tobacco and betel leaf	1	0.25
	Alcohol consumption	77	19.25
	Alcohol and smoking	82	20.50
	Betel leaf and alcohol	5	1.25
	Smoking , alcohol and chewing betel leaf	9	2.25
	Nil	162	40.50
	Total	**400**	**100**
2	**Frequency**		
	Daily	175	73.53
	Attested once in a week	63	26.47
	Total	**238**	**100**

4.1.17. Health care facilities in the locality

All the families indicated that they had proper health facilities in their locality. The families depended on Primary Health Centre (PHC) (43.75%) and Government hospital (37.50%) for medical facilities. Only 18.75 per cent depended on private hospital. The distance to the nearest health centre was less than 10 km for all the families. It was seen that 17.25 per cent of the families were not utilising the health facility in their locality mainly due to improper functioning. In majority of the families (95.50%) health problems were not reported during the period under study. But, 4.50 per cent of families indicated incidence of tuberculosis, xerosis, diabetes and heart problems among the members. Supplements like tablets, tonics and powders from PHC were received by 59.50 per cent of the families. The details are furnished in Table 18.

Table 18. Health care facilities in the locality

Sl. No.	Details	No : of families	Per cent
1	Provision for health facility	400	100
2	**Health facility available**		
	Primary Health Centre	175	43.75
	Private hospital	75	18.75
	Government hospital	150	37.50
	Total	**400**	**100**
3	**Distance to nearest health centre**		
	0 – 5 km	250	62.50
	6 – 10 km	150	37.50
	Total	**400**	**100**
4	**Utilisation of local health facility**		
	Properly utilised	331	82.75
	Not utilised	69	17.25
	Total	**400**	**100**
5	**Reason for not utilising the health facility**		
	Not in function	50	72.46
	Too far away	2	2.90
	Not good	17	24.64
	Total	**69**	**100**
6	**Purpose of visit to health center**		
	Treatment of illness	213	64.35
	Immunization	18	5.43
	Accident	4	1.21
	Birth control	3	0.91
	Injection	93	28.10
	Total	**331**	**100**
7	**Health problems among the members**		
	No problems	382	95.50
	Health problems present	18	4.50
	Total	**400**	**100**

8	**Name of disease**		
	TB	8	44.44
	Xerosis	8	44.44
	Diabetes, Cardiovascular disease	2	11.12
	Total	**18**	**100**
9	Supplements received from PHC	238	59.50
	No supplements received from PHC	162	40.50
	Total	**400**	**100**
10	**Form of supplements**		
	Powders	17	7.14
	Tablets	24	10.08
	Tonics	1	0.42
	Powders and tablets	196	82.36
	Total	**238**	**100**
11	**Frequency of receiving supplements**		
	Weekly once	2	0.84
	Monthly once	226	94.96
	Occasionally	10	4.20
	Total	**238**	**100**

4.1.18. People-institution linkages

It was found that the women gave equal importance to ration shop, anganwadi, school, health centre and hospital. But they had more access and benefits from ration shop when compared to other organizations (Table 19). It was interesting to note that panchayat president and ward members did not provide proper services to the people and so the women put them far away from the Venn diagram. This opinion was more or less similar in all the four districts. The details are depicted in Plate 4.

Table 19. Details of people – institution linkage

Sl. No	Persons/ Organisations	Ranks on personal importance	Ranks for service accessibility
1	Ration shop	1	1
2	Anganwadi	1	2
3	School	1	3
4	Health Centre	1	2
5	Hospital	1	4
6	Panchayat	2	5
7	Bank	3	5
8	Village office	4	5
9	Post office	5	6
10	Panchayat president	6	7
11	Ward member	7	7

4.1.19. Morbidity and mortality pattern among the members

Details regarding morbidity and mortality pattern among the members during the previous year are furnished in Table 20. It was seen that in 52.25 per cent of the families, the members did not suffer from any diseases during the previous year. Others (47.75%) indicated that the members suffered from diseases like fever, pain in the leg, diarrhoea and dysentry. Details about deworming treatment taken during the last one year indicated that 65.50 per cent had taken deworming measures and the rest (34.50%) avoided the treatment.

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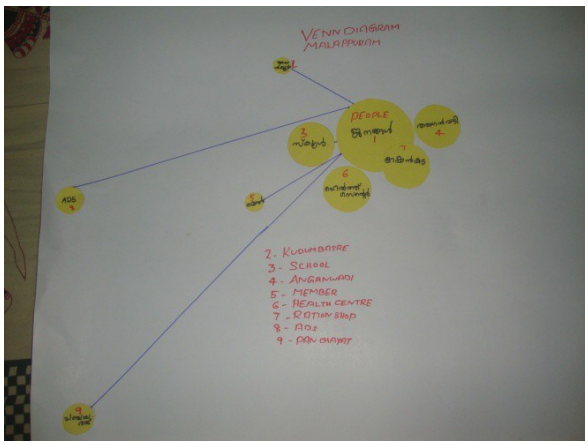

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Plate 4. People-institution linkages in the four districts

Table 20. Details of morbidity and mortality pattern

Sl. No.	Details	No : of families	Per cent
1	Suffered from illness during last one year	191	47.75
	No disease	209	52.25
	Total	**400**	**100**
2	**Name of the disease**		
	Fever	83	43.45
	Cough	3	1.57
	Cough and cold	14	7.33
	Diarrhoea	8	4.19
	Dysentry	5	2.62
	Leg pain	78	40.84
	Total	**191**	**100**
3	**Epidemic prevalent in locality**		
	Measles	1	0.25
	Chicken pox	23	5.75
	Nil	376	94
	Total	**400**	**100**
4	**Deworming treatment (in the last one year)**		
	Taken	262	65.50
	Not taken	138	34.50
	Total	**400**	**100**

4.1.20. Immunisation coverage among children

Children were immunised in majority of the families (93.25%). Among these 92.50 per cent had taken the immunisation as per ICDS recommendations. The families who had not yet taken immunisation due to financial reasons and unawareness constituted

6.75 per cent of the families. The results are furnished in Table 21.

Table 21. Details about immunisation for children

Sl. No.	Details	No : of families	Per cent
1	Immunised	373	93.25
	Not immunised	27	6.75
	Total	**400**	**100**
2	**Name of Immunisation**		
	All immunisation as per ICDS schedule	370	92.50
	OPV and tetanus	2	0.50
	Tetanus	1	0.25
	Nil	27	6.75
	Total	**400**	**100**
3	**Reason for not immunised**		
	Financial reasons	12	44.45
	Unawareness	5	18.52
	Lack of money and unawareness	6	22.22
	No children	4	14.81
	Total	**27**	**100**

4.1.21. Social cum resource mapping of the area

The social cum resource map drawn by women participated in the PRA sessions indicated that institutions like school, anganwadi and health center were present near to the locality. The panchayat and village offices were far from most of the areas and hence the physical accessibility to these offices was less. The details are illustrated in Plate 5.

4.2. Food consumption pattern of the families

The results pertaining to the food consumption pattern of the families with respect to food habits, meal pattern, monthly expenditure pattern on food, food purchasing pattern, frequency of use of food items, coping strategies adopted during food crisis, preservation and storage practices adopted by the families are given in this section.

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Plate 5. Social cum resource mapping of the four districts

4.2.1. Food habit

Almost all the families (99.25%) selected for the study were found to be non vegetarians (Table 22).

Table 22. Details of food habit

Sl. No.	Details	No: of families	Per cent
1	**Food Habit**		
	Vegetarian	3	0.75
	Non - vegetarian	397	99.25
	Total	**400**	**100**

4.2.2. Meal pattern

Details regarding the meal pattern of the families showed that 97.50 per cent of families had three major meal per day. Rest of the families (2.50%) followed two meal pattern (Table 23). Advance meal planning was noticed only in 36.5 per cent of families. Preference for home made food was also noticed among all the families. Majority (98%) of the families maintained regular time schedule for taking meal.

Table 23. Details about meal pattern

Sl . No.	Details	No. of families (N=400)	Per cent
1	**Planning meal in advance**		
	Planned meal in advance	146	36.50
	No meal planning	254	63.50
2	**No :of meal/ day**		
	Two	10	2.50
	Three	390	97.50
3	**Time schedule for taking meal**		
	Kept regular time schedule	392	98
	No regular time schedule	8	2

With respect to the food preference of women and children collected through the PRA sessions indicated that women and children preferred idli, dosai, appam, puttu, and uppuma for breakfast. Rice porridge with vegetable was preferred by women for lunch whereas rice with meat was the most preferred item among children. The details are given in Tables 24 and 25.

Table 24. Food preference of women and children for breakfast

Sl. No	Food item	Women		Children	
		Score (20)	Rank	Score (20)	Rank
1	Appam	12	1	11	1
2	Dosai	7	2	10	2
3	Idli	7	2	2	3
4	Uppuma	7	2	6	4
5	Puttu	7	2	5	5

***Pooled data of four districts**

Table 25. Food preference of women and children for lunch

Sl. No	Food item	Women		Children	
		Score (20)	Rank	Score (20)	Rank
1	Rice – meat	5	3	10	1
2	Rice porridge - chutney	9	2	9	2
3	Rice – fish	5	3	7	3
4	Rice – vegetable	9	2	7	3
5	Rice porridge - vegetable	12	1	7	3

***Pooled data of four districts**

4.2.3. Consumption of raw vegetables and fruits

Consumption of raw fruits and vegetables was not observed among 52 per cent of the families. Financial constraint has been pointed out as the main reason for non inclusion. Among 42.19 per cent families the most preferred fruit was found to be orange (Table 26).

Table 26. Consumption of raw vegetables and fruits

Sl. No.	Details	No: of families	Per cent
1	Consumed raw vegetables and fruits	192	48
	Not consumed	208	52
	Total	**400**	**100**
2	**Reasons for not consuming raw vegetables and fruits**		
	Financial constraint	110	52.88
	Dislike	91	43.75
	Unable to chew	7	3.37
	Total	**208**	**100**
3	**Type of raw fruits and vegetables consumed**		
	Orange	81	42.19
	Banana	28	14.58
	Papaya, guava	16	8.33
	Carrot	44	22.92
	Tomato Papaya,	7	3.65
	carrot Mango,	14	7.29
	jack fruit Apple	1	0.52
	Total	1	0.52
		192	**100**
4	**Frequency of consumption**		
	Daily	6	3.12
	Weekly thrice	31	16.15
	Weekly twice	57	29.69
	Weekly once	50	26.04
	Occasionally	44	22.92
	Monthly once	4	2.08
	Total	**192**	**100**

4.2.4. Food expenditure pattern

The details on the monthly food expenditure pattern of the families are furnished in Table 27. It was found that majority of the families spent up to 10 per cent of their total food expenditure for the purchase of cereals (100%), pulses (57.5%), fats (55.75%), spices and condiments (66.5%) and sugar and jaggery (99.25%).

For the purchase of fish and other vegetables, 54.75 per cent and 61.25 per cent of the families spent 11 to 20 per cent of the monthly expenses incurred for food. Families did not spend any money for the purchase of green leafy vegetables, roots and tubers, fruits, milk and milk products and egg constituted 61 per cent, 55.50 per cent, 60.50 per cent, 67.75 per cent and 91.75 per cent respectively.

4.2.5. Food purchasing pattern

The details pertaining to the place of purchase of different food items are furnished in Table 28. It was seen that all families depended on ration shop to purchase cereals. Majority (94.50%) of the families also purchased sugar from ration shop. More than 74 per cent of the families purchased pulses (94%), other vegetables (74.25%), fats and oils (99%) and spices and condiments (84.25%) from private shop. Meat and fish were purchased from butcher shops and fish vendors respectively by 73.25 per cent and 95 per cent of the families.

From Table 29 it was seen that majority of the families purchased cereals, pulses, roots and tubers, other vegetables, meat, fats and oils, sugar and jaggery once in a week, whereas green leafy vegetables, fruits, spices and condiments were purchased once in a month. Fish was purchased by 43.25 per cent of the families twice in a week. Majority of the families did not purchase milk and milk products (67.75%) and egg (91.5%).

The quantity of different food items purchased by the families during the three periods of the study determined by food purchase inventory for a week was converted for a day. This quantity was compared with the quantity of different food groups to be consumed by the families which was computed as per ICMR (2010_a) recommendations based on family composition.

Table 27. Food expenditure pattern of the families

Food Items	Percentage of monthly income spent on food												
	Nil	**<5**	**5-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	**>50**	**Total**
Cereals	0	396 (99)	4 (1)	0	0	0	0	0	0	0	0	0	400 (100)
Pulses	8 (2)	3 (0.75)	227 (56.75)	121 (30.25)	31 (7.75)	10 (2.50)	0	0	0	0	0	0	400 (100)
Green leafy vegetables	244 (61)	87 (21.75)	65 (16.25)	3 (0.75)	1 (0.25)		0	0	0	0	0	0	400 (100)
Other vegetables	3 (0.75)	1 (0.25)	22 (5.50)	119 (29.75)	126 (31.50)	108 (27)	14 (3.50)	7 (1.75)	0	0	0	0	400 (100)
Roots and tubers	222 (55.50)	16 (4)	137 (34.25)	22 (5.50)	2 (0.50)	1 (0.25)	0	0	0	0	0	0	400 (100)
Fruits	242 (60.50)	4 (1)	72 (18)	65 (16.25)	13 (3.25)	2 (0.50)	0	1 (0.25)	0	1 (0.25)	0	0	400 (100)
Fats and oils	0	9 (2.25)	214 (53.50)	119 (29.75)	34 (8.50)	19 (4.75)	4 (1)	0	0	1 (0.25)	0	0	400 (100)
Spices and condiments	0	17 (4.25)	249 (62.25)	90 (22.50)	31 (7.75)	9 (2.25)	3 (0.75)	1 (0.25)	0	0	0	0	400 (100)
Sugar and jaggery	0	330 (82.50)	67 (16.75)	2 (0.50)	1 (0.25)	0	0	0	0	0	0	0	400 (100)
Milk and Milk products	271 (67.75)	1 (0.25)	20 (5)	31 (7.75)	26 (6.50)	30 (7.50)	11 (2.75)	4 (1)	4 (1)	1 (0.25)	1 (0.25)	0	400 (100)
Meat	100 (25)	0	1 (0.25)	15 (3.75)	36 (9)	68 (17)	65 (16.25)	55 (13.75)	32 (8)	19 (4.75)	8 (2)	1 (0.25)	400 (100)
Fish	10 (2.50)	2 (0.50)	61 (15.25)	134 (33.50)	85 (21.25)	55 (13.75)	19 (4.75)	23 (5.75)	4 (1)	5 (1.25)	1 (0.25)	1 (0.25)	400 (100)
Egg	367 (91.75)	18 (4.50)	13 (3.25)	1 (0.25	1 (0.25)	0	0	0	0	0	0	0	400 (100)

Figures in parentheses are percentage

Table 28. Place of purchase of different food items

Food items	Ration shop	Maveli store	Private shop	Butcher shop	Fish vendor	Neighbour	Own	Society	Market	Never	Total
Cereals	400 (100)	0	0	0	0	0	0	0	0	0	400 (100)
Pulses	0	16 (4)	376 (94)	0	0	0	0	0	8 (2)		400 (100)
Green leafy vegetables	0	0	96 (24)	0	0	2 (0.50)	0	0	60 (15)	242 (60.50)	400 (100)
Other vegetables	0	0	297 (74.25)	0	0	0	1 (0.25)	0	99 (24.75)	3 (0.75)	400 (100)
Roots and tubers	0	0	124 (31)	0	0	3 (0.75)	0	0	52 (13)	221 (55.25)	400 (100)
Fruits	0	0	124 (31)	0	0	1 (0.25)	0	0	34 (8.50)	241 (60.25)	400 (100)
Fats and oils	0	4 (1)	396 (99)	0	0	0	0	0	0	0	400 (100)
Spices and condiments	0	63 (15.75)	337 (84.25)	0	0	0	0	0	0	0	400 (100)
Sugar and jaggery	378 (94.50)	5 (1.25)	17 (4.25)	0	0	0	0	0	0	0	400 (100)
Milk and milk products	0	0	6 (1.50)	0	0	52 (13)	21 (5.25)	71 (17.75)	0	250 (62.50)	400 (100)
Meat	0	0	5 (1.25)	293 (73.25)	0	0	0	0	2 (0.50)	100 (25)	400 (100)
Fish	0	0	0	5 (1.25)	380 (95)	0	0	0	5 (1.25)	10 (2.50)	400 (100)
Egg	0	0	16 (4)	0	0	16 (4)	46 (11.50)	0	2 (0.50)	320 (80)	400 (100)

Figures in parentheses are percentage

Table 29. Frequency of purchase of food items

Food item	Daily	W4	W3	W2	W1	M1	Never	Total
Cereals	1 (0.25)	0	8 (2)	83 (20.75)	296 (74)	12 (3)	0	400 (100)
Pulses	0	2 (0.5)	17 (4.25)	72 (18)	227 (56.75)	82 (20.5)	0	400 (100)
Roots and tubers	0	3 (0.75)	14 (3.5)	82 (20.5)	183 (45.75)	118 (29.5)	0	400 (100)
Green leafy vegetables	0	0	0	4 (1)	52 (13)	344 (86)	0	400 (100)
Other vegetables	1 (0.25)	4 (1)	25 (6.25)	66 (16.5)	199 (49.75)	105 (26.25)	0	400 (100)
Fruits	0	0	1 (0.25)	8 (2)	78 (19.5)	313 (78.25)	0	400 (100)
Milk& milk products	95 (23.75)	2 (0.5)	2 (0.5)	1 (0.25)	8 (2)	21 (5.25)	271 (67.75)	400 (100)
Meat	0	0	2 (0.5)	9 (2.25)	156 (39)	133 (33.25)	100 (25)	400 (100)
Fish	0	44 (11)	109 (27.25)	173 (43.25)	49 (12.25)	15 (3.75)	10 (2.5)	400 (100)
Egg	0	0	0	2 (0.5)	32 (8)	0	366 (91.5)	400 (100)
Fats and oils	0	0	0	2 (0.5)	298 (74.5)	100 (25)	0	400 (100)
Sugar and jaggery	0	0	1 (0.25)	8 (2)	303 (75.75)	88 (22)	0	400 (100)
Spices and condiments	0	0	0	0	14 (3.5)	386 (96.5)	0	400 (100)

Figures in parentheses are percentage W4 – Four times per week. W3- Weekly thrice. W2 - Weekly twice. W1 - Weekly once. M1- Monthly once.

The percentage of requirement met for different food groups on the basis of the quantity purchased by the families are given in Table 30.

Table 30. Percentage of requirement met by the families on the basis of the quantity of foods purchased

Food items	<25% of requirement			25to 50% of requirement			50 to 75% of requirement			75 to 100% of requirement		
	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter
Cereals	14 (3.5)	7 (1.75)	16 (4)	78 (19.5)	59 (14.75)	71 (17.75)	132 (33)	105 (26.25)	119 (29.75)	176 (44)	229 (57.25)	194 (48.5)
Pulses	52 (13)	90 (22.5)	57 (14.25)	77 (19.25)	51 (12.75)	82 (20.5)	87 (21.75)	52 (13)	75 (18.75)	184 (46)	207 (51.75)	186 (46.5)
Roots and tubers	315 (78.75)	255 (63.75)	278 (69.5)	67 (16.75)	94 (23.5)	99 (24.75)	15 (3.75)	30 (7.5)	15 (3.75)	3 (0.75)	21 (5.25)	8 (2)
Green leafy vegetables	360 (90)	376 (94)	362 (90.5)	27 (6.75)	19 (4.75)	27 (6.75)	9 (2.25)	4 (1)	9 (2.25)	4 (1)	1 (0.25)	2 (0.5)
Other vegetables	325 (81.25)	296 (74)	323 (80.75)	57 (14.25)	86 (21.5)	57 (14.25)	16 (4)	10 (2.5)	16 (4)	2 (0.5)	8 (2)	4 (1)
Fruits	350 (87.5)	329 (82.25)	348 (87)	34 (8.5)	45 (11.25)	37 (9.25)	10 (2.5)	18 (4.5)	9 (2.25)	6 (1.5)	8 (2)	6 (1.5)
Milk& milk products	345 (86.25)	349 (87.25)	348 (87)	40 (10)	36 (9)	36 (9)	13 (3.25)	13 (3.25)	14 (3.5)	2 (0.5)	2 (0.5)	2 (0.5)
Non vegetarian items	22 (5.5)	17 (4.25)	17 (4.25)	11 (2.75)	4 (1)	7 (1.75)	27 (6.75)	14 (3.5)	22 (5.5)	340 (85)	365 (91.25)	354 (88.5)
Sugar and jaggery	60 (15)	89 (22.25)	67 (16.75)	9 (2.25)	0	6 (1.5)	26 (6.5)	14 (3.5)	24 (6)	305 (76.25)	297 (74.25)	303 (75.75)
Fats and Oils	68 (17)	114 (28.5)	85 (21.25)	24 (6)	12 (3)	15 (3.75)	36 (9)	23 (5.75)	34 (8.5)	272 (68)	251 (62.75)	266 (66.5)

Figures in parentheses are percentage

The quantity of non vegetarian items, sugar and jaggery and fats and oils purchased by more than 60 per cent of the families met above 75 per cent of the required amount during all the three seasons. It was also seen that 44 to 57 per cent and 46 to 52 per cent of the families also purchased cereals and pulses respectively so as to meet more than 75 per cent of the requirement during all the three seasons. The quantity of green leafy vegetables, other vegetables, fruits, milk and milk products purchased by more than 74 per cent of the families met less than 25 per cent of the requirement during all the three seasons. The quantity of roots and tubers purchased by 63.75 per cent to 78.75 per cent of the families also met less than 25 per cent of the requirement.

4.2.6. Frequency of use of food items

From Table 31 it is clear that all the families used cereals, fats and oils, spices and condiments, sugar and jaggery daily. Majority (98.50%) of the families used other vegetables also daily. Pulses, fish and meat were used thrice in a week by 57 per cent,43.75 per cent and 19.25 per cent of the families. The frequency score of different food items computed by the formula suggested by Reaburn *et al.* (1979) indicated that maximum score of 100 per cent was obtained for cereals, fats and oils, sugar and jaggery and spices and condiments. The frequency score obtained for plant foods namely pulses, green leafy vegetables, other vegetables, roots and tubers and fruits were found to be 76.93 per cent, 37.58 per cent, 99.14 per cent, 43.58 per cent and 34 per cent respectively. For milk and milk products, meat, fish and egg, the frequency score obtained varied from 23.82 per cent to 82.21 per cent with the maximum score for fish and minimum score for egg (Table 32).

On the basis of the percentage score obtained, the foods were categorised into three groups namely most frequently used (score above 75%),medium frequently used (score in between 50 to 75%) and less frequently used (score below 50%) foods (Table 33). The results indicated that cereals, pulses, other vegetables, fats and oils, spices, sugar and jaggery and fish were the most frequently used food items while meat was the only food item used moderately by the families. Green leafy vegetables,roots and tubers, fruits, milk and milk products and egg were used to a lesser extent.

Table 31. Frequency of use of different food items

Food items	Daily	W3	W2	W1	M2	M1	Occasionally	Total
Cereals	400 (100)	0	0	0	0	0	0	400 (100)
Pulses	15 (3.75)	228 (57)	100 (25)	38 (9.50)	0	10 (2.50)	9 (2.25)	400 (100)
Green leafy vegetables	0	6 (1.50)	60 (15)	72 (18)	1 (0.25)	14 (3.50)	247 (61.75)	400 (100)
Other vegetables	394 (98.50)	3 (0.75)	0	0	0	0	3 (0.75)	400 (100)
Roots and tubers	0	31 (7.75)	89 (22.25)	37 (9.25)	3 (0.75)	18 (4.50)	222 (55.5)	400 (100)
Fruits	7 (1.75)	28 (7)	54 (13.50)	46 (11.50)	1 (0.25)	14 (3.50)	250 (62.5)	400 (100)
Oils and fats	400 (100)	0	0	0	0	0	0	400 (100)
Spices and condiments	400 (100)	0	0	0	0	0	0	400 (100)
Sugar and jaggery	400 (100)	0	0	0	0	0	0	400 (100)
Milk and milk products	149 (37.25)	0	0	1 (0.25)	0	0	250 (62.5)	400 (100)
Meat	0	77 (19.25)	104 (26)	109 (27.25)	1 (0.25)	9 (2.25)	100 (25)	400 (100)
Fish	87 (21.75)	175 (43.75)	122 (30.50)	5 (1.25)	1 (0.25)	0	10 (2.5)	400 (100)
Egg	6 (1.50)	6 (1.50)	19 (4.75)	37 (9.25)	3 (0.75)	8 (2)	321 (80.25)	400 (100)

Figures in parentheses are percentage W3- Weekly thrice. W2 - Weekly twice. W1 – Weekly once. M2- Monthly twice. M1-Monthly once.

Table 32. Frequency score of different food items

Food items	Frequency score (%)
Cereals	100
Pulses	76.93
Green leafy vegetables	37.58
Other vegetables	99.14
Roots and tubers	43.58
Fruits	34
Oils and fats	100
Spices and condiments	100
Sugar and jaggery	100
Milk and milk products	46.57
Meat	55.25
Fish	82.21
Egg	23.82

Table 33. Details of frequency of use of different food items

Frequency of use	Food items
Most frequently used (score above 75%)	Cereals, pulses, other vegetables, fats and oils, spices, sugar and jaggery and fish
Medium frequently used (score in between 50 to 75%)	Meat
Less frequently used (score below 50%)	Green leafy vegetables, roots and tubers, fruits, milk and milk products and egg

4.2.7. Coping strategies adopted during food crisis

It was found that 95.75 per cent of the families did not face any problem with respect to the availability and affordability of food. Only 4.25 per cent used to face problems which resulted in a reduction in the number of meal as also purchase of lower quality foods so as to cope up with such a situation. For feeding children, 41.18 per cent of families depended on school meal. The details are given in Table 34.

Table 34. Coping strategies during food crisis

Sl. No.	Details	No. of families	Per cent
1	Problems with availability/affordability of food	17	4.25
	No problem	383	95.75
	Total	**400**	**100**
2	**Coping strategies adopted**		
	Reduce number and amount of meal	2	11.76
	Purchase lower quality foods	6	35.29
	Both	9	52.95
	Total	**17**	100
3	**Strategies taken to feed children**		
	School meal	7	41.18
	No children	10	58.82
	Total	**17**	**100**

4.2.8. Preservation and storage practices adopted

The details on preservation and storage practices followed by the families are furnished in Table 35. Different preservation methods were adopted by only 56 per cent of the families and pickling was the most important one. It was seen that 53.58 per cent preserved food for a period of one to two weeks. Most common storage method adopted by all the families was storing food in air tight plastic containers.

Table 35. Details of preservation practices adopted

Sl. No.	Details	No. of families	Per cent
1	Food preserved	224	56
	Not preserved	176	44
	Total	**400**	**100**
2	**Food items**		
	Mango	77	34.38
	Lemon	31	13.84
	Mango and lemon	85	37.94
	Amla and mango	25	11.16
	Mango, lemon and tapioca	2	0.89
	Chilly	2	0.89
	Lemon , pineapple	1	0.45
	Lemon, amla	1	0.45
	Total	**224**	**100**
3	**Method adopted**		
	Pickling	209	93.30
	Pickling and drying	8	3.57
	Drying	3	1.34
	Salting	1	0.45
	Pickling and syruping	2	0.89
	Salting and drying	1	0.45
	Total	**224**	**100**
4	**Duration**		
	<1 week	72	32.14
	1-2 week	120	53.58
	3-4 week	3	1.34
	1 to 2 month	27	12.05
	>2 months	2	0.89
	Total	**224**	**100**

4.3. Food and nutritional adequacy of the family members

Food and nutritional adequacy of the family members was ascertained by conducting one day recall method of diet survey among the families. This was conducted during March to May (summer season), June to August (rainy season) and November to January (winter season). Mean food intake of children, adolescents and adults per consumption unit was computed and compared with the quantity suggested

for a balanced diet by ICMR (2010_a) to find out the food adequacy. From the quantity of foods consumed, the nutritive value of the diet was computed for different groups and compared with the RDA suggested by ICMR (2010_b) for nutrients to find out the nutritional adequacy. The results pertaining to the food and nutritional adequacy of the family members in the BPL families of Central Zone of Kerala during the three periods of the study are furnished in this section from Tables 36 to 56.

4.3.1. Per capita food intake of family members in comparison with the requirement

The per capita food intake of children, adolescents and adults in comparison with the quantity suggested by ICMR (2010_a) for a balanced diet for respective age/sex/activity groups are given from 4.3.1.1. to 4.3.1.10.

4.3.1.1. Cereals

The cereal intake of family members is furnished in Table 36. It was seen that the cereal intake of all age groups except children in the age group of zero to three, four to six and seven to nine years was lower than the quantity suggested for a balanced diet during all the three seasons. The cereal intake of children up to nine years was found to be significantly higher than the requirement during all the three seasons. Though, the cereal intake of girls in the age groups of 13 to 15 years and women engaged in sedentary work was slightly higher than the requirement during summer season, the increase was found to be statistically insignificant.

4.3.1.2. Pulses

From Table 37 it was found that among different groups who included pulses in the diet, the intake was found to be lower than the requirement during rainy season. During summer season also the pulse intake was found to be lower than the requirement in all the age groups except girls in the age group of 13 to 15 years and women engaged in sedentary activity. During winter, though the intake of pulses was higher than the suggested requirement among boys and girls in the age group of 13 to 15 years and women engaged in sedentary activity the increase was found to be

Table 36. Per capita intake of cereals among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
<3	60	39	123.56	6.58	9.66**	39	124.76	3.44	18.81**	39	121.01	2.96	20.61**
4-6	120	61	167.85	4.80	9.97**	61	183.58	5.76	11.04**	61	172.68	5.51	9.57**
7-9	180	58	197.04	5.32	3.21**	58	211.31	4.63	6.76**	58	198.07	5.98	3.02**
10-12(B)	300	41	240.11	11.91	5.03**	41	233.29	8.40	7.94**	41	234.04	7.19	9.17**
10-12(G)	240	30	216.86	8.55	2.71*	30	225.53	8.47	1.71NS	30	233.25	8.88	0.76NS
13-15 (B)	420	38	290.34	10.05	12.90**	38	310.65	11.95	9.15**	38	291.07	9.83	13.12**
13-15 (G)	330	39	345.52	17.37	0.89NS	39	277.98	11.05	4.71**	39	264.37	8.99	7.30**
16-17 (B)	450	28	324.15	12.35	10.19**	28	298.92	15.61	9.68**	28	293.79	12.60	12.39**
16-17 (G)	330	35	328.02	18.50	0.107NS	35	294.05	12.48	2.88**	35	281.19	11.006	4.44**
Men (SW)	375	121	352.23	11.02	2.07*	121	308.72	8.24	8.044**	121	304.47	6.08	11.59**
Men (MW)	450	328	407.30	9.25	4.62**	328	370.30	5.33	14.96**	328	349.60	4.44	22.63**
Men (HW)	600	3	557.74	170.22	0.248NS	3	293.10	76.75	3.10NS	3	307.63	60.48	4.83*
Women (SW)	270	292	274.65	6.77	0.69NS	292	247.28	4.005	5.67**	292	235.96	3.42	9.95**
Women (MW)	330	197	296.66	7.47	4.46**	197	278.62	5.71	8.99**	197	267.80	4.38	14.20**

N = Number of family members

B – Boys. G – Girls. Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker

** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 37. Per capita intake of pulses among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	30	13	15.56	1.39	10.40^{**}	25	13.49	2.24	7.37^{**}	16	20.13	2.84	3.46^{**}
4-6	30	28	23.06	3.60	1.93^{NS}	41	21.41	1.96	4.36^{**}	27	30.04	3.53	0.011^{NS}
7-9	30	27	25.94	1.89	2.14^{*}	42	25.22	3.52	1.36^{NS}	20	37.42	4.70	1.58^{NS}
10-12(B)	30	10	27.87	2.22	0.96^{NS}	24	20.75	2.79	3.32^{**}	19	40.08	6.06	1.66^{NS}
10-12(G)	30	11	28.11	4.15	0.46^{NS}	13	15.78	2.68	5.30^{**}	18	38.73	5.11	1.71^{NS}
13-15 (B)	45	13	37.37	3.09	2.47^{*}	18	28.14	2.55	6.62^{**}	22	56.20	7.34	1.53^{NS}
13-15 (G)	30	18	38.24	4.06	2.03^{NS}	25	27.56	3.60	0.678^{NS}	16	38.53	4.49	1.90^{NS}
16-17 (B)	45	11	34.01	3.02	8.62^{**}	16	26.71	3.92	4.66^{**}	11	39.08	8.96	2.33^{*}
16-17 (G)	45	16	25.52	2.87	6.78^{**}	16	32.12	4.79	2.69^{*}	18	37.30	5.76	1.34^{NS}
Men (SW)	45	51	38.25	3.18	2.12^{*}	70	30.40	2.28	6.42^{**}	55	41.53	3.70	0.94^{NS}
Men (MW)	60	127	45.58	2.22	6.51^{**}	193	38.64	1.86	11.47^{**}	122	50.72	2.85	3.26^{**}
Men (HW)	90	3	33.47	2.75	20.56^{**}	1	20.69	0	0	0	0	0	0
Women (SW)	30	112	33.69	1.92	1.92^{NS}	165	26.30	1.40	2.65^{**}	127	36.11	1.97	3.10^{**}
Women (MW)	45	77	32.82	1.81	6.73^{**}	107	26.51	1.68	11^{**}	92	44.13	2.76	0.32^{NS}

N = Number of family members

B – Boys. G – Girls. Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker

** Significant at 1 % level * Significant at 5 % level NS – Non Significant

statistically significant only among women. The intake of pulses during winter season was found to be lower than the requirement among all other age groups. The decrease observed among most of the age groups during different seasons was found to be statistically significant.

4.3.1.3. Roots and tubers

In the case of roots and tubers, it was seen that (Table 38) the intake was lower than the requirement among all age groups who included roots and tubers in the diet during the three periods of study. The decrease was found to be significantly lower than the requirement among all age groups during all the three periods of the study except in the case of adult men engaged in heavy activity during rainy season.

4.3.1.4.Green leafy vegetables

The intake of leafy vegetables was found to be lower than the quantity suggested for almost all age groups during different seasons (Table 39). Only very few families included green leafy vegetables in the diet. The decrease was found to be statistically significant among seven to nine years, adult men and women engaged in sedentary activity and women engaged in moderate activity during rainy season. During summer season, though the intake was lower than the requirement for different age groups, the decrease was found to be statistically insignificant. During winter season, the intake of leafy vegetables was found to be higher than the requirement among children (4 to 6 years), boys (10 to 12 years), girls (13 to15 years and 16 to17 years), adult men (sedentary and moderate activity) and adult women (sedentary activity). However, the increase was found to be statistically significant only among children in the age group of four to six years and men engaged in moderate activity.

4.3.1.5.Other vegetables

From Table 40 it could be seen that the mean intake of other vegetables was significantly lower than the requirement among all age groups during the three periods of study except adult men engaged in heavy activity. The intake of other vegetables among adult men engaged in heavy work was found to be zero during summer and winter seasons.

Table 38. Per capita intake of roots and tubers among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	50	26	14.89	2.10	16.68**	30	14.55	2.74	12.92**	26	24.27	5.39	4.78**
4-6	100	46	18.21	1.68	48.75**	50	21.07	2.53	31.16**	48	27.19	4.01	18.15**
7-9	100	43	20.40	2.80	28.42**	50	26.18	3.52	20.10**	41	27.08	4.91	14.84**
10-12(B)	100	23	34.50	5.69	11.52**	36	23.35	4.19	18.30**	23	16.18	2.35	35.74**
10-12(G)	100	21	28.15	6.84	10.51**	24	39.19	14.67	4.14**	19	29.11	6.78	10.46**
13-15 (B)	150	30	36.43	6.69	16.98**	31	20.75	3.98	32.44**	24	26.25	6.25	19.80**
13-15 (G)	100	29	36.21	6.66	9.58**	36	28.92	10.34	6.87**	16	28.90	3.05	23.33**
16-17 (B)	200	20	37.18	8.55	19.03**	26	54.66	24.40	5.96**	19	38.46	8.80	18.36**
16-17 (G)	200	26	39.70	7.69	20.84**	29	25.10	5.37	32.55**	25	30.40	4.98	34.05**
Men (SW)	200	90	38.96	3.47	46.44**	104	30.72	3.24	52.32**	61	43.43	5.39	29.02**
Men (MW)	200	244	44.12	2.24	69.53**	289	43.14	3.87	40.50**	150	56.03	5.05	28.53**
Men (HW)	200	2	13.30	0.50	376.42**	3	86.22	72.17	1.58NS	0	0	0	0
Women (SW)	200	216	30.90	1.77	95.44**	207	26.79	2.15	80.45**	202	33.03	2.33	71.81**
Women (MW)	200	147	32.91	2.29	73.05**	164	32.11	4.43	37.93**	124	51.07	5.60	26.59**

N = Number of family members B – Boys. G – Girls Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker

** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 39. Per capita intake of leafy vegetables among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	50	14	57.73	12.23	0.633^{NS}	3	44.57	15.59	0.34^{NS}	0	0	0	0
4-6	50	1	21.43	0	0	5	39.59	9.25	1.13^{NS}	5	107.37	18.21	3.15^{*}
7-9	100	1	19.45	0	0	2	53.39	12.23	3.81^{*}	3	79.60	22.53	0.91^{NS}
10-12(B)	100	0	0	0	0	2	84.44	2.04	7.61^{NS}	2	112.20	24.39	0.500^{NS}
10-12(G)	100	2	41.88	19.66	2.96^{NS}	3	88.27	30.29	0.39^{NS}	0	0	0	0
13-15 (B)	100	2	63.89	13.04	2.77^{NS}	5	103.21	22.89	0.14^{NS}	0	0	0	0
13-15 (G)	100	1	50	0	0	5	74.15	11.53	2.24^{NS}	2	135.37	35.37	1^{NS}
16-17 (B)	100	0	0	0	0	0	0	0	0	0	0	0	0
16-17 (G)	100	1	50.85	0	0	3	82.41	7.41	2.38^{NS}	2	107.51	2.25	3.34^{NS}
Men (SW)	100	7	69.65	24.77	1.22^{NS}	9	80.64	6.74	2.87^{*}	4	174.03	46.90	1.58^{NS}
Men (MW)	100	13	100.63	19.04	0.033^{NS}	24	97.76	11.75	0.191^{NS}	13	164.28	19.10	3.21^{**}
Men (HW)	100	0	0	0	0	1	155.55	0	0	0	0	0	0
Women (SW)	100	21	87.52	12.60	0.991^{NS}	18	65.37	9.02	3.84^{**}	14	111.56	13.64	0.85^{NS}
Women (MW)	100	9	73.72	13.74	1.91^{NS}	12	75.01	10.39	2.41^{*}	3	94.64	31.40	0.171^{NS}

N=Number of family members B – Boys. G – Girls Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 40. Per capita intake of other vegetables among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	50	2	22.12	2.12	13.14*	22	15.37	2.57	13.48**	7	37.89	4.00	2.47*
4-6	100	26	55.03	8.37	5.37**	38	21.54	2.98	26.33**	14	42.46	10.69	5.38**
7-9	100	24	63.35	9.93	3.69**	33	21.64	2.37	33.09**	13	72.21	14.24	1.95NS
10-12(B)	200	16	53.85	6.65	21.96**	28	34.78	6.64	24.90**	11	75.93	14.91	8.32**
10-12(G)	200	12	39.23	6.19	25.98**	19	30.75	5.62	30.14**	10	69.17	9.53	13.73**
13-15 (B)	200	17	65.12	13.82	9.76**	24	62.03	8.46	16.31**	13	81.37	15.68	7.57**
13-15 (G)	200	11	65.99	8.87	15.12**	27	28.45	3.50	48.10**	10	80.79	12.65	9.43**
16-17 (B)	200	7	49.79	19.92	10.07**	19	31.17	4.98	33.93**	12	30.64	3.61	46.86**
16-17 (G)	200	16	77.57	9.39	13.03**	24	38.90	7.86	20.48**	17	48.27	8.24	18.42**
Men (SW)	200	48	79.04	9.91	12.21**	90	34.23	3.31	50.06**	43	60.95	6.44	21.59**
Men (MW)	200	104	103.40	8.62	11.20**	196	46.30	2.91	52.89**	84	112.35	9.40	9.32**
Men (HW)	200	0	0	0	0	1	155.55	0	0	0	0	0	0
Women (SW)	200	106	68.45	5.17	25.43**	191	26.91	1.79	96.56**	88	78.06	5.66	21.53**
Women (MW)	200	59	69.17	6.81	19.22**	124	34.64	2.62	63.02**	63	84.35	6.81	16.98**

N = Number of family members B – Boys. G – Girls Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker

** Significant at 1 % level * Significant at 5 % level NS – Non Significant

4.3.1.6. Fruits

The mean intake of fruits among girls in the age group of 16 to 17 years and adult men was found to be higher than the requirement during rainy season (Table 41). The increase was found to be statistically insignificant. During summer season, though the intake of fruits was found to be higher than the requirement among boys in the age group of 13 to 15 years and 16 to17 years and adult men and adult women (moderate worker), the increase was found to be statistically significant only among adult men engaged in moderate work. During winter, though the intake was found to be higher than the requirement among 16 to17 year boys and adult men engaged in moderate work, the increase was statistically insignificant. Among all other age groups the intake of fruit was found to be lower than the requirement.

4.3.1.7. Milk and milk products

Among different age groups who included milk and milk products in the diet, it was seen that the mean intake was significantly lower than the requirement during all the three periods of the study. The details are given in Table 42.

4.3.1.8. Non vegetarian foods

The mean intake of non vegetarian items namely meat and fish was higher than the requirement in all age groups except children in the age group of 0 to 3 years during rainy and winter seasons and girls in the age group of 10 to 12 years during winter season. The decrease in the intake was found to be statistically significant only among children below 3 years (Table 43).

4.3.1.9. Fats and oils

The intake of fats and oils was found to be significantly lower than the requirement in all age groups during the three seasons. The results are given in Table 44.

4.3.1.10. Sugar and jaggery

The intake of sugar and jaggery was also found to be significantly lower than the requirement during all the three periods of the study among different age groups (Table 45).

Table 41. Per capita intake of fruits among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	100	6	37.39	1.35	46.31^{**}	2	40.89	1.67	35.35^{*}	0	0	0	0
4-6	100	8	52.26	2.28	20.92^{**}	5	59.75	1.95	20.66^{**}	0	0	0	0
7-9	100	11	82.99	8.78	1.94^{NS}	3	66.33	2.30	14.66^{**}	1	82.36	0	0
10-12(B)	100	3	96.47	9.95	0.354^{NS}	2	85.11	0.008	18.61^{**}	1	8.42	0	0
10-12 G	100	4	97.81	21.99	0.099^{NS}	11	16.77	5.95	13.98^{**}	0	0	0	0
13-15 B	100	4	107.23	13.17	0.55^{NS}	2	99.26	7.15	0.10^{NS}	2	64.79	22.17	1.59^{NS}
13-15 G	100	3	89.14	23.10	0.470^{NS}	3	96.64	35.57	0.094^{NS}	0	0	0	0
16-17 B	100	4	100.51	1.76	0.29^{NS}	1	96.77	0	0	2	107.47	7.47	1^{NS}
16-17 G	100	2	84.82	22.32	0.680^{NS}	3	118.13	17.42	1.04^{NS}	1	96.78	0	0
Men SW	100	19	110.34	10.55	0.980^{NS}	11	100.66	11.53	0.05^{NS}	6	90.88	10.31	0.89^{NS}
Men MW	100	37	127.98	9.77	2.86^{**}	21	110.22	7.36	1.39^{NS}	17	111.58	8.40	1.38^{NS}
Men HW	100	2	178	78	1^{NS}	1	244.45	0	0	0	0	0	0
Women SW	100	41	94.95	6.90	0.732^{NS}	16	86.20	4.80	2.87^{*}	15	77.58	5.92	3.79^{**}
Women MW	100	25	100.79	10.40	0.076^{NS}	16	88.86	8.09	1.38^{NS}	7	88.37	10.01	1.16^{NS}

N = Number of family members B – Boys. G – Girls Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker

** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 42. Per capita intake of milk and milk products among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	500	14	48.35	5.50	82.07**	16	45.27	4.45	102.22**	14	51.95	8.45	53.04**
4-6	500	19	64.65	5.35	81.36**	21	56.89	4.84	91.63**	19	63.39	4.58	95.28**
7-9	500	18	65.99	7.60	57.14**	15	70.12	9.42	45.65**	15	67.16	8.74	49.52**
10-12(B)	500	14	75.39	7.63	55.66**	17	62.98	6.56	66.66**	13	59.29	6.83	94.56**
10-12(G)	500	11	69.38	8.38	51.39**	10	77.74	10.94	38.61**	10	74.31	9.19	46.33**
13-15 (B)	500	13	94.25	9.04	44.87**	17	93.25	7.73	52.62**	15	87.21	6.63	62.28**
13-15 (G)	500	11	89.05	9.39	43.75**	12	85.67	10.25	40.43**	9	82.22	10.08	41.47**
16-17 (B)	500	9	75.45	9.38	45.26**	9	80.28	12.67	33.12**	11	80.57	15.27	27.47**
16-17 (G)	500	12	90.51	10.55	38.81**	13	92.21	10.11	40.34**	12	91.07	13.67	29.91**
Men (SW)	300	55	82.55	7.003	31.05**	51	91.85	5.84	35.67*	43	107.99	9.84	19.52**
Men (MW)	300	106	123.38	5.55	31.85**	140	120.01	5.03	35.79**	99	129.66	7.27	23.44**
Men (HW)	300	2	180.08	42.14	2.85NS	2	121.32	10.22	17.49**	0	0	0	0
Women (SW)	300	93	86.04	4.22	50.73**	102	83.45	4.10	52.79**	99	89.84	5.09	41.33**
Women (MW)	300	56	102.50	7.85	25.15**	67	92.62	5.99	34.65**	63	96.73	5.65	35.95**

N = Number of family members B – Boys. G – Girls Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 43. Per capita intake of non vegetarian foods among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	50	31	34.86	2.56	5.91**	30	37.88	4.92	2.46*	16	26.44	4.67	1.64NS
4-6	50	45	53.85	4.07	0.95NS	43	68.18	6.09	2.98**	42	49.58	4.71	0.089NS
7-9	50	44	53.65	4.23	0.86NS	41	55.10	4.15	1.23NS	45	62.21	6.08	2.007NS
10-12(B)	50	20	66.72	8.35	2.004NS	30	67.36	7.89	2.20*	29	72.85	8.28	2.76*
10-12(G)	50	25	57.01	5.46	1.28NS	23	59.11	7.80	1.17NS	16	47.61	5.20	0.459NS
13-15 (B)	50	29	76.55	8.88	2.99**	30	71.12	6.85	3.08**	21	70.79	5.66	3.67**
13-15 (G)	50	34	75.54	6.43	3.97**	31	76.03	9.20	2.83**	19	77.97	12.51	2.24*
16-17 (B)	50	23	68.91	4.98	3.80**	21	83.16	10.57	3.14**	17	85.62	9.68	3.68**
16-17 (G)	50	25	80.75	9.38	3.28**	27	66.64	8.10	1.850NS	22	85.44	10.97	3.23**
Men (SW)	30	94	99.42	11.03	6.29**	91	81.05	5.51	9.26**	77	86.62	5.49	10.31**
Men (MW)	30	250	107.42	3.61	21.44**	245	106.07	4.41	17.25**	192	99.43	4.26	16.28**
Men (HW)	30	3	113.35	26.31	3.17NS	3	114.12	35.42	2.38NS	0	0	0	0
Women (SW)	30	221	75.11	4.34	10.39**	227	76.15	3.45	13.39**	195	69.60	3.11	12.72**
Women (MW)	30	139	80.68	3.43	14.76**	145	78.43	4.33	11.19**	126	76.20	4.20	11.01**

N = Number of family members B – Boys. G – Girls Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker

** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 44. Per capita intake of fats and oils among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	25	39	4.37	0.40	51.83**	39	5.84	0.65	29.58**	39	4.08	0.25	82.24**
4-6	25	61	6.84	0.35	51.45**	61	8.84	0.69	23.41**	61	6.23	0.26	71.98**
7-9	30	58	7.79	0.41	53.78**	58	8.90	0.68	30.88**	58	7.41	0.45	50.74**
10-12(B)	35	29	9.09	0.52	50.18**	41	10.95	1.17	20.63**	40	7.80	0.45	60.19**
10-12(G)	35	30	9.32	0.57	45.40**	21	7.42	0.71	39.02**	30	8.44	0.48	54.99**
13-15 (B)	45	38	10.74	0.50	68.98**	38	11.61	0.99	33.90**	37	10.39	0.67	51.42**
13-15 (G)	40	35	10.80	0.63	46.06**	35	15.82	2.76	8.75**	27	10.78	0.77	38.19**
16-17 (B)	50	28	11.97	0.76	50.06**	28	12.79	1.23	30.33**	28	11.35	0.87	44.31**
16-17 (G)	35	35	10.62	0.62	39.60**	35	12.85	1.42	15.55**	35	11.31	0.76	30.99**
Men (SW)	25	121	13.13	0.56	21.13**	121	14.02	0.82	13.44**	120	12.23	0.56	22.85**
Men (MW)	30	328	15.63	0.40	36.19**	328	18.31	0.62	18.73**	328	14.74	0.40	38.24
Men (HW)	40	3	19.83	5.44	3.71NS	3	15.96	6.63	3.63NS	0	0	0	0
Women (SW)	20	292	11.50	0.40	21.27**	292	13.04	0.51	13.56**	292	11.22	0.41	21.30**
Women (MW)	25	196	12.61	0.46	27.10**	196	14.10	0.71	15.38**	195	12.27	0.46	27.71**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 45. Per capita intake of sugar and jaggery among family members in comparison with the requirement (g/cu/ day)

Age group (years)	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	15	38	4.68	0.25	41.34**	35	5.32	0.27	35.56**	39	5.26	0.30	32.29**
4-6	20	60	7.73	0.39	31.08**	58	9.26	0.49	22.03**	60	8.10	0.38	30.92**
7-9	20	58	8.69	0.38	30.13**	58	9.87	0.50	20.15**	57	9.23	0.42	25.66**
10-12(B)	30	0	0	0	0	40	11.06	0.71	26.62**	39	10.23	0.91	21.66**
10-12(G)	30	30	8.54	0.56	38.24**	29	10.61	0.78	24.77**	29	9.04	0.67	31.46**
13-15 (B)	20	36	10.90	0.46	19.58**	37	12.28	0.91	8.48**	36	12.25	1.22	6.34**
13-15 (G)	25	35	9.71	0.56	27.40**	38	11.62	0.93	14.35**	27	11.31	0.58	23.56**
16-17 (B)	30	20	9.004	0.46	45.77**	28	12.53	0.70	25.05**	28	10.72	0.37	52.52**
16-17 (G)	25	35	9.87	0.61	24.66**	34	11.70	0.75	17.72**	34	10.93	0.80	17.53**
Men (SW)	20	120	10.57	0.34	27.35**	115	13.17	0.61	11.29**	118	11.20	0.37	24.01**
Men (MW)	30	322	13.31	0.29	57.41**	311	15.65	0.38	37.68**	322	13.72	0.36	45.15**
Men (HW)	55	3	13.87	2.02	20.39**	3	9.53	1.73	26.23**	0	0	0	0
Women (SW)	20	285	9.27	0.23	47.10**	276	11.21	0.33	26.56**	287	9.87	0.27	38.11**
Women (MW)	30	155	9.78	0.32	63.18**	189	11.82	0.38	47.23**	191	15.55	4.92	2.94**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

4.3.2. Food adequacy of family members

The details pertaining to the percentage of family members who included different food groups in the diet is furnished in Table 46. It was seen that cereals, fats and oils, sugar and jaggery were the food items consumed by more than 90 per cent of family members during all the three periods of the study. The percentage of family members who included pulses, roots and tubers, other vegetables, green leafy vegetables and fruits varied from 39 to 58 per cent, 59 to 82 per cent, 29 to 64 per cent, 4 to 7 per cent and 4 to 13 per cent respectively during the three periods. Animal foods were included in the diet of 32 to 38 per cent (milk and milk products), and 62 to 75per cent (non vegetarian items) of families.

Table 46. Dietary inclusion of different food groups among family members

Food item	Summer	Rainy	Winter
Cereals	1310 (100)	1310 (100)	1310 (100)
Pulses	517 (39.47)	756 (57.71)	563 (42.98)
Roots and tubers	963 (73.51)	1079 (82.37)	778 (59.39)
Green leafy vegetables	72 (5.50)	92 (7.02)	48 (3.66)
Other vegetables	448 (34.20)	836 (63.82)	385 (29.39)
Fruits	169 (12.90)	97 (7.40)	52 (3.97)
Milk& milk products	433(33.05)	492 (37.56)	422 (32.21)
Non vegetarian items	983 (75.03)	987 (75.34)	817 (62.37)
Fats and Oils	1293 (98.70)	1296 (98.93)	1290 (98.47)
Sugar and jaggery	1197 (91.37)	1251 (95.50)	1267 (96.72)

Figures in parentheses are percentage

4.3.3. Per capita nutrient intake of family members in comparison with the RDA

The per capita nutrient intake of family members belonging to different age groups during the three periods were computed from the quantity of foods consumed and was compared with the RDA suggested by ICMR (2010_b) for the respective groups. The results obtained are furnished in this section from Tables 47 to 56.

The results indicated that the energy intake of different age groups was significantly lower than the RDA suggested during all the three seasons except adult men engaged in heavy activity where the decrease was found to be statistically insignificant (Table 47).

The protein intake was found to be lower than the RDA among all age groups during summer, rainy and winter seasons except in the case of children below three years and four to six years (Table 48). The increase observed in the protein intake of these two groups was found to be statistically significant only among four to six years during the three seasons.

The intake of fat was also found to be significantly lower than the RDA among different age groups during the three seasons except men engaged in heavy activity and boys in the age group of 10 to 12 years during winter season where the decrease was statistically insignificant (Table 49). The intake of fat among men engaged in heavy activity during summer and winter seasons were found to be high when compared to RDA. However, the increase was found to be statistically insignificant.

The intake of calcium was found to be far below the RDA among all age groups during all the three seasons (Table 50). The statistical analysis also indicated that the decrease observed in the intake of calcium among different age groups during the three seasons was statistically significant except among men engaged in heavy activity during rainy and winter seasons.

The intake of iron was also found to be significantly lower than the RDA among all age groups during the three seasons (Table 51).

Table 47. Per capita energy intake of family members in comparison with RDA

Age group (years)	RDA (Kcal)	Summer				Rainy				Winter			
		N	Mean (Kcal)	SE	t value	N	Mean (Kcal)	SE	t value	N	Mean (Kcal)	SE	t value
< 3	1060	39	645.02	27.64	14.95**	39	625.34	17.79	24.43**	39	625.67	15.84	27.43**
4 – 6	1350	61	888.65	24.41	18.90**	61	931.12	25.83	16.22**	61	814.27	39.43	13.59**
7 – 9	1690	58	1030.12	35.65	18.51**	58	1034.85	22.83	28.70**	58	1005.44	24.02	28.50**
10-12(B)	2190	41	1172.58	37.15	27.39**	41	1132.50	34.44	30.71**	41	1174.75	29.25	34.71**
10-12(G)	2010	30	1116.99	29.22	30.56**	30	1111.05	43.45	20.69**	30	1141.60	32.98	26.33**
13-15 (B)	2750	38	1453.96	47.28	27.41**	38	1504.34	47.36	26.30**	38	1457.13	42.03	30.76**
13-15 (G)	2330	39	1386.60	34.65	27.23**	39	1381.47	53.66	17.68**	39	1387.14	29	32.52**
16-17 (B)	3020	28	1452.86	34.97	44.81**	28	1504.39	73.38	20.66**	28	1408.004	44.25	36.43**
16-17 (G)	2440	35	1410.44	54.04	19.05**	35	1367.86	46.62	23.0**	28	1419.77	54.09	18.86**
Men (SW)	2320	121	1540.02	29.53	26.41**	121	1524.15	36.29	21.93**	121	1517.12	26.77	29.99**
Men (MW)	2730	328	1824.32	22.20	40.80**	328	1847.40	23.82	37.05**	328	1799.02	18.38	50.67**
Men (HW)	3490	3	2031.31	402.27	3.63^{NS}	3	1691.48	304.48	5.91*	3	1661.0	235.50	7.77*
Women (SW)	1900	292	1239.85	16.49	40.02**	292	1235.27	17.84	37.27**	292	1214.06	13.78	49.77**
Women (MW)	2230	197	1348.20	19.96	44.17**	197	1391.18	23.14	36.24**	197	1341.67	17.42	50.99**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 48. Per capita protein intake of family members in comparison with RDA

Age group (years)	RDA (g)	Summe				Rain				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	16.7	39	17.39	0.74	0.94^{NS}	39	16.48	5.02	0.28^{NS}	39	17.05	1.05	0.33^{NS}
4 -6	20.1	61	25.41	2.31	2.30^{*}	61	25.59	1.31	4.19**	61	23.02	1.15	2.54*
7 - 9	29.5	58	26.75	1.10	2.50*	58	26.40	1.16	2.68*	58	23.67	1.29	4.53**
10-12(B)	39.9	41	33.80	4.22	1.45^{NS}	41	3.50	1.78	5.28**	41	31.92	1.52	5.24**
10-12(G)	51.9	30	28.62	1.38	8.56^{**}	30	29.02	2.03	5.62**	30	27.63	1.29	9.94**
13-15 (B)	54.3	38	37.77	2.53	6.55**	38	39.16	1.84	8.21**	38	36.89	1.76	9.92**
13-15 (G)	51.9	39	36.53	1.43	10.75**	39	33.62	2.24	8.15**	39	36.35	1.63	9.53**
16-17 (B)	55.4	28	37.89	1.41	16.70**	28	39.17	2.47	9.03**	28	35.88	2.02	12.68**
16-17 (G)	55.5	35	35.94	2.05	9.53**	35	36.32	2.18	8.79**	28	35.46	1.84	10.91**
Men (SW)	60	121	42.35	2.01	8.80**	121	39.96	1.40	400.29**	121	38.89	1.15	18.37**
Men (MW)	60	328	47.81	1.14	10.70**	328	49.56	1.09	9.58**	328	47.03	0.85	15.17**
Men (HW)	60	3	58.38	9.09	0.18^{NS}	3	53.49	5.48	1.19^{NS}	3	31.03	6.30	4.60*
Women (SW)	55	292	32.38	0.82	27.47**	292	32.25	0.77	29.41**	292	31.59	0.67	35.20**
Women (MW)	55	197	34.097	0.82	25.40**	197	36.64	1.03	17.80**	197	34.80	0.84	24.16**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 49. Per capita fat intake of family members in comparison with RDA

Age group (years)	RDA (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
< 3	40	39	13.06	0.91	29.73**	39	11.71	0.78	36.31**	39	12.60	0.99	27.57**
4 - 6	40	61	19.66	1.04	19.56**	61	16.82	1.0	23.23**	61	18.72	1.14	18.65**
7 -9	45	58	19.95	1.15	21.77**	59	18.02	1.03	26.10**	58	18.79	1.19	21.97**
10-12(B)	60	41	23.16	1.39	26.41**	41	18.77	1.30	31.69**	41	35.60	13.23	1.84^{NS}
10-12(G)	55	30	23.85	1.32	23.57**	30	19.06	1.52	23.69**	30	22.16	2.15	15.27**
13-15 (B)	75	38	29.02	1.77	25.94**	38	26.63	1.86	26.02**	38	25.13	2.31	21.56**
13-15 (G)	65	39	27.84	1.70	21.88**	39	26.18	2.99	12.98**	39	27.01	1.54	24.75**
16-17 (B)	85	28	28.10	1.82	31.33**	28	26.73	2.47	23.56**	28	24.53	1.98	30.51**
16-17 (G)	70	35	30.41	1.80	21.94**	35	19.05	1.77	28.80**	28	27.41	2.56	16.64**
Men (SW)	50	121	38.81	1.26	12.87**	121	27.42	1.42	15.91**	121	29.88	1.31	15.32**
Men (MW)	60	328	41.06	0.94	20.17**	328	31.33	0.88	32.48**	328	35.29	0.86	28.63**
Men (HW)	40	3	61.59	9.96	2.17^{NS}	3	34.81	4.52	1.15^{NS}	3	41.41	1.96	0.72^{NS}
Women (SW)	40	292	29.05	0.76	14.37**	292	23.73	0.73	22.40**	292	25.41	0.70	20.94**
Women (MW)	50	197	31.02	0.93	20.33**	197	25.95	0.95	23.31**	197	25.70	0.81	29.86**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 50.Per capita calcium intake of the family members in comparison with RDA

Age group (years)	RDA (mg)	Summer				Rainy				Winter			
		N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value
< 3	600	39	90.44	11.52	44.24**	39	89.62	9.86	51.74**	39	79.14	6.85	76.0**
4 -6	600	61	110.29	11.02	44.46**	61	121.63	8.57	55.84**	61	131.84	14.83	31.57**
7 -9	600	58	117.81	6.53	73.80**	58	120.01	9.55	50.25**	58	129.31	11.006	42.77**
10-12(B)	800	41	153.65	18.51	34.92**	41	144.12	10.28	63.83**	41	153.34	15.48	41.77**
10-12(G)	800	30	129.46	11.56	58.02**	30	163.40	24.41	26.08**	30	134.19	11.69	56.96**
13-15 (B)	800	38	172.35	13.50	46.50**	38	212.28	25.89	22.70**	38	177.93	13.61	45.70**
13-15 (G)	800	39	155.02	11.66	55.29**	39	176.73	18.10	34.43**	39	174.31	20.80	30.08**
16-17 (B)	800	28	157.08	12.92	49.75**	28	165.57	16.58	38.27**	28	147.24	14.97	43.61**
16-17 (G)	800	35	156.43	12.50	51.48**	35	186.23	20.09	30.55**	28	152.41	13.16	49.20**
Men (SW)	600	121	191.86	10.48	38.96**	121	187.06	8.86	46.63**	121	203.10	14.33	27.69**
Men (MW)	600	328	210.89	7.13	54.58**	328	230.49	8.12	45.52**	328	258.63	16.61	20.55**
Men (HW)	600	3	383.61	40.65	5.32*	3	471.93	204.33	0.63^{NS}	3	260.80	133.01	2.56^{NS}
Women (SW)	600	292	148.09	5.84	77.40**	292	153.94	9.53	46.81**	292	175.87	14.30	29.65**
Women (MW)	600	197	146.11	6.71	67.69**	197	155.45	15.90	27.96**	197	164.41	6.52	66.81**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 51.Per capita iron intake of the family members in comparison with RDA

Age group (years)	RDA (mg)	Summer				Rainy				Winter			
		N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value
< 3	9	39	3.34	0.32	17.59**	39	2.92	0.16	36.91**	39	2.87	0.15	40.13**
4 -6	13	61	4.29	0.33	26.60**	61	4.26	0.24	36.95**	61	4.34	0.20	43.52**
7 -9	16	58	4.62	0.19	58.93**	58	4.35	0.23	50.12**	58	4.75	0.19	58.57**
10-12(B)	21	41	5.80	0.58	25.98**	41	5.03	0.27	59.06**	41	5.64	0.26	58.42**
10-12(G)	27	30	4.65	0.22	101.72**	30	4.61	0.44	50.58**	30	5.22	0.33	65.54**
13-15 (B)	32	38	6.48	0.39	64.74**	38	6.88	0.39	63.81**	38	6.45	0.30	86.42**
13-15 (G)	27	39	6.33	0.39	52.47**	39	6.15	0.33	63.37**	39	6.39	0.34	60.70**
16-17 (B)	28	28	6.64	0.35	60.47**	28	6.70	0.40	52.94**	28	6.02	0.41	53.48**
16-17 (G)	26	35	6.37	0.48	41.19**	35	6.37	0.32	60.92**	35	6.75	0.46	42.22**
Men (SW)	17	121	7.35	0.31	31.07**	121	6.86	0.24	43.02**	121	7.27	0.38	25.36**
Men (MW)	17	328	8.36	0.27	32.24**	328	8.17	0.16	54.80**	328	8.51	0.24	36.12**
Men (HW)	17	3	10.27	1.30	5.18*	3	9.07	1.83	4.34*	3	5.70	1.51	7.49*
Women (SW)	21	292	5.89	0.20	74.90**	292	5.45	0.12	124.91**	292	5.48	0.12	134.21**
Women (MW)	21	197	6.27	0.29	50.71**	197	5.97	0.14	106.62**	197	6.04	0.21	70.10**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

With respect to carotene, it was seen that the intake was significantly lower than the RDA suggested for different age groups (Table 52). The decrease observed in the intake of carotene among men engaged in heavy activity during winter and rainy seasons was found to be statistically insignificant.

The intake of B complex vitamins namely thiamine (Table 53), riboflavin (Table 54) and niacin (Table 55) among different age groups during the three seasons was found to be lower than the RDA suggested. The decrease in the intake of thiamine and riboflavin among different age groups during all the three seasons was found to be statistically significant. In the case of niacin also, the intake was found to be significantly lower than the RDA among all age groups except in the case of girls in the age group of 16 to 17 years and men engaged in heavy activity during all the three periods.

The vitamin C intake was found to be significantly lower than the RDA among all categories during summer season except men engaged in heavy activity where the decrease was found to be statistically insignificant (Table 56). During rainy season, the intake of vitamin C among men engaged in moderate activity and heavy activity as well as women engaged in sedentary activity was found to be higher than the RDA. However, the increase was statistically insignificant. Among all other age groups, the intake of vitamin C was found to be significantly lower than the RDA except boys in the age group of 13 to 15 years. During winter season also the intake was found to be significantly lower than the RDA among all age groups.

4.3.3. Nutritional adequacy among family members

To ascertain the nutritional adequacy in terms of nutrient intake among the family members the percentage of RDA met for different nutrients among children,
adolescents and adults were computed and the results are furnished in Tables 57 to 60.

Table 52.Per capita carotene intake of family members in comparison with RDA

Age group (years)	RDA (µg)	Summer				Rainy				Winter			
		N	Mean (µg)	SE	t value	N	Mean (µg)	SE	t value	N	Mean (µg)	SE	t value
< 3	3200	34	243.49	61.23	48.28**	37	342.79	126.18	22.64**	36	280.41	59.55	49.03**
4 -6	3200	57	304.30	47.05	60.70**	59	367.31	103.29	27.43**	53	791.82	245.97	9.79**
7 -9	4800	51	442.75	73.64	59.17**	55	438.46	100.21	43.53**	47	547.81	170.47	24.94**
10-12(B)	4800	37	432.22	77.005	56.72**	41	478.49	129.65	33.33**	35	855.08	251.39	15.69**
10-12(G)	4800	28	638.89	144.55	28.79**	26	904.70	337.34	11.55**	28	321.22	84.97	52.71**
13-15 (B)	4800	35	705.77	153.18	26.73**	37	865.02	312.09	12.61**	32	365.19	79.23	55.97**
13-15 (G)	4800	34	561.97	100.77	42.06**	38	639.11	220.27	18·89**	39	751.62	279.19	14.50**
16-17 (B)	4800	22	353.63	73.44	60.54**	28	436.31	126.87	34.40**	22	538.27	176.47	24.150**
16-17 (G)	4800	33	617.10	122.92	34.03**	35	755.49	227.89	17.75**	23	452.59	157.32	27.63**
Men (SW)	4800	110	782.49	121.92	32.95**	119	550.33	90.48	46.97**	104	729.11	199.99	20.36**
Men (MW)	4800	285	913.38	72.80	53.39**	319	644	85.39	48.67**	277	926.57	118.41	32.71**
Men (HW)	4800	3	683.32	453.27	9.08*	3	3325.02	2967.82	0.50^{NS}	2	1262.82	670.68	5.27^{NS}
Women (SW)	4800	261	604.29	51.35	81.70**	287	446.57	57.70	75.44**	256	619.03	82.13	50.91**
Women(MW)	4800	160	603.49	57.76	72.66**	189	514.28	80.14	53.48**	187	410.33	58.77	74.69**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 53.Per capita thiamine intake of family members in comparison with RDA

Age group (years)	RDA (mg)	Summer				Rainy				Winter			
		N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value
< 3	0.5	39	0.34	0.02	9.64**	39	0.35	0.01	12.56**	39	0.35	0.01	11.01**
4 - 6	0.7	61	0.48	0.02	11.12**	61	0.41	0.03	11.02**	61	0.50	0.02	11.66**
7 - 9	0.8	58	0.57	0.02	10.60**	58	0.57	0.02	11.88**	58	0.57	0.02	11.43**
10-12(B)	1.1	41	0.64	0.02	23.26**	41	0.62	0.02	19.50**	41	0.67	0.03	16.03**
10-12(G)	1.0	30	0.59	0.02	16.76**	30	0.57	0.02	19.63**	30	0.66	0.03	11.57**
13-15 (B)	1.4	38	0.80	0.41	14.85**	38	0.82	0.30	19.78**	38	0.83	0.03	16.59**
13-15 (G)	1.2	39	0.76	0.04	11.54**	39	0.76	0.03	14.89**	39	0.78	0.03	13.96**
16-17 (B)	1.5	28	0.79	0.04	18.02**	28	0.82	0.04	15.55**	28	0.79	0.03	20.45**
16-17 (G)	1.0	35	0.80	0.04	4.62**	35	0.81	0.03	5.71**	28	0.81	0.04	4.96**
Men (SW)	1.2	121	0.83	0.02	16.34**	121	0.83	0.20	18.39**	121	0.86	0.02	16.93**
Men (MW)	1.4	328	0.97	0.02	27.73**	328	0.99	0.01	27.94**	328	1.001	0.01	27.78**
Men (HW)	1.7	3	0.93	0.11	7.06*	3	0.82	0.15	5.70*	3	0.84	0.14	5.99*
Women (SW)	1.0	292	0.66	0.01	30.28**	292	0.66	0.01	30.99**	292	0.67	0.01	30.26**
Women (MW)	1.1	197	0.72	0.01	27.27**	197	0.73	0.01	27.46**	197	0.75	0.01	25.95**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 54. Per capita riboflavin intake of family members in comparison with RDA

Age group (years)	RDA (mg)	Summer				Rainy				Winter			
		N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value
< 3	0.6	39	0.15	0.01	39.24**	39	0.16	0.01	37.33**	39	0.17	0.01	30.87**
4 - 6	0.8	61	0.23	0.02	30.67**	61	0.22	0.01	40.49**	61	0.26	0.02	28.02**
7 - 9	1	58	0.25	0.02	45.67**	58	0.24	0.02	50.54**	58	0.25	0.01	53.47**
10-12(B)	1.3	41	0.31	0.02	42.42**	41	0.27	0.02	67.72**	41	0.31	0.02	43.45**
10-12(G)	1.2	30	0.27	0.02	48.05**	30	0.27	0.03	36.61**	30	0.28	0.20	45.62**
13-15 (B)	1.6	38	0.35	0.02	50.24**	38	0.39	0.02	48.69**	38	0.35	0.23	54.84**
13-15 (G)	1.4	39	0.35	0.32	33.25**	39	0.33	0.02	49.51**	39	0.33	0.02	44.33**
16-17 (B)	1.8	28	0.29	0.02	68.38**	28	0.32	0.03	51.90**	28	0.33	0.31	47.69**
16-17 (G)	1.2	35	0.36	0.30	27.74**	35	0.35	0.02	34.71**	28	0.34	0.03	27.64**
Men (SW)	1.4	121	0.39	0.02	51.09**	121	0.36	0.01	71.13**	121	0.38	0.16	62.10**
Men (MW)	1.6	328	0.46	0.01	79.10**	328	0.43	0.01	98.66**	328	0.47	0.16	70.14**
Men (HW)	2.1	3	0.61	0.09	16.59**	3	0.57	0.24	6.37*	3	0.48	0.14	11.55**
Women (SW)	1.1	292	0.31	0.01	75.57**	292	0.28	0.01	98.90**	292	0.31	0.009	88.10**
Women(MW)	1.3	197	0.32	0.01	74.36**	197	0.32	0.01	91.03**	197	0.32	0.010	101.67**

N = Number of family members B – Boys. G – Girls SSW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 55.Per capita niacin intake of family members in comparison with RDA

Age group (years)	RDA (mg)	Summer				Rainy				Winter			
		N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value
< 3	8	39	6.16	0.35	5.18**	39	5.80	0.17	12.69**	39	5.75	0.20	11.003**
4 - 6	11	61	8.26	0.39	7.02**	61	8.47	0.25	9.96**	61	8.14	0.24	11.85**
7 -9	13	58	9.56	0.39	8.74**	58	9.48	0.24	14.66**	58	9.54	0.31	11.32**
10-12(B)	15	41	10.90	0.59	6.90**	41	10.65	0.40	10.83**	41	11.22	0.45	8.42**
10-12(G)	13	30	10.38	0.47	5.53**	30	10.41	0.41	6.27**	30	10.15	0.24	11.64**
13-15 (B)	16	38	13.76	0.82	2.75**	38	13.98	0.47	4.34**	38	13.16	0.41	6.85**
13-15 (G)	14	39	12.81	0.48	2.47*	39	12.63	0.45	3.03**	39	13.12	0.51	1.72^{NS}
16-17 (B)	17	28	13.80	0.53	6.03**	28	13.89	0.65	4.76**	28	13.06	0.48	8.25**
16-17 (G)	14	35	13.15	0.68	1.24^{NS}	35	13.30	0.50	1.42^{NS}	28	13.09	0.53	1.73^{NS}
Men (SW)	16	121	14.35	0.40	4.10**	121	14.14	0.37	5.05**	121	14.003	0.31	6.46**
Men (MW)	18	328	16.62	0.28	4.94**	328	16.90	0.24	4.52**	328	16.46	0.20	7.62**
Men (HW)	21	3	16.53	3.49	1.28^{NS}	3	16.53	2.80	1.60^{NS}	3	13.22	2.38	3.27^{NS}
Women (SW)	12	292	11.17	0.20	4.10**	292	11.26	0.18	4.21**	292	10.90	0.16	6.95**
Women (MW)	14	197	12.13	0.24	7.79**	197	12.70	0.24	5.30**	197	12.30	0.21	8.29**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

Table 56.Per capita vitamin C intake of family members in comparison with RDA

Age group (years)	RDA (mg)	Summer				Rainy				Winter			
		N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value	N	Mean (mg)	SE	t value
< 3	40	39	5.88	1.40	24.45**	39	8.40	2.46	12.86**	37	5.60	1.72	20.03**
4 -6	40	60	7.27	1.45	22.57**	61	8.92	1.76	17.63**	59	19.68	5.83	3.48**
7 -9	40	58	8.58	1.70	18.48**	58	9.64	1.82	16.72**	58	10.02	2.68	11.20**
10-12(B)	40	41	12.79	2.77	9.81**	40	16.52	4.86	4.82**	40	13.29	4.64	5.75**
10-12(G)	40	30	8.29	2.30	13.79**	30	23.73	6.65	2.45*	28	6.32	1.18	28.66**
13-15 (B)	40	38	15.00	3.26	7.66**	38	32.38	9.50	0.80^{NS}	36	7.81	1.24	26.06**
13-15 (G)	40	39	11.62	3.48	8.15**	39	18.48	5.50	3.91**	39	16.65	5.76	4.05**
16-17 (B)	40	27	7.12	1.19	27.53**	28	14.55	5.97	4.26**	27	11.32	3.49	8.22**
16-17 (G)	40	35	9.83	2.43	12.39**	35	17.48	4.22	5.34**	27	11.65	5.13	5.53**
Men (SW)	40	120	15.18	2.36	10.51**	121	20.26	3.20	6.17**	120	14.95	3.20	7.84**
Men (MW)	40	325	15.25	1.63	15.16**	325	44.08	11.28	0.36^{NS}	322	22.39	3.09	5.69**
Men (HW)	40	3	20.87	15.07	1.27^{NS}	3	71.63	52.68	0.60^{NS}	3	7.81	2.37	13.58**
Women (SW)	40	288	11.10	1.18	24.47**	291	54.27	7.98	1.79^{NS}	291	13.15	1.58	17.01**
Women (MW)	40	193	12.77	1.68	16.18**	196	20.95	2.49	7.64**	180	9.47	1.19	25.74**

N = Number of family members B – Boys. G – Girls SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker
** Significant at 1 % level * Significant at 5 % level NS – Non Significant

4.3.3.1. Children below 10 years

It was found that among children below 10 years, 50 to 75 per cent of RDA for energy, thiamine and niacin was met among 75.95 per cent, 61.39 per cent and 54.43 per cent of children. Less than 25 per cent of RDA was met for calcium, carotene and vitamin C among 79.11 per cent, 91.77 per cent and 74.05 per cent of children. For protein and niacin 87.34 per cent and 42.41 per cent of children met more than 75 per cent of RDA (Table 57).

Table 57. Percentage of RDA met for nutrients by children below 10 years

Nutrients	<25% RDA	25 to 50% RDA	50 to 75 % RDA	>75% RDA	Total
Energy	0	21 (13.29)	120 (75.95)	17 (10.76)	158 (100)
Protein	0	0	20 (12.66)	138 (87.34)	158 (100)
Fat	23 (14.56)	97 (61.39)	37 (23.42)	1 (0.63)	158 (100)
Calcium	125 (79.11)	33 (20.89)	0	0	158 (100)
Iron	41 (25.95)	110 (69.62)	5 (3.16)	2 (1.27)	158 (100)
Carotene	145 (91.77)	9 (5.70)	3 (1.90)	1 (0.63)	158 (100)
Thiamine	0	13 (8.23)	97 (61.39)	48 (30.38)	158 (100)
Riboflavin	78 (49.37)	77 (48.73)	3 (1.90)	0	158 (100)
Niacin	0	5 (3.16)	86 (54.43)	67 (42.41)	158 (100)
Vitamin C	117 (74.05)	24 (15.19)	10 (6.33)	7 (4.43)	158 (100)

Figures in parentheses are percentage

4.3.3.2. Children in the age group of 10 to 12 years

In the age group of ten to twelve years, majority of boys (85.37%) and girls (70%) met only 25 to 50 per cent of RDA for fat (Table 58). Energy and thiamine intake of 63.41 per cent and 80.49 per cent boys and 73.33 per cent and 70 per cent girls met 50 to 75 per cent of RDA. The protein intake was found to meet 25 to 50 per

cent of RDA among 82.92 per cent of boys. The intake of calcium, iron, carotene, riboflavin and vitamin C was found to be less than 25 per cent of RDA among 60.98 per cent to 90.24 per cent boys and 56.66 per cent to 93.33 per cent girls.

4.3.3.3. Adolescents (13 to 17 years)

It was found that, 69.70 per cent, 77.27 per cent, 93.93 per cent, 74.24 per cent and 56.06 per cent of adolescent boys met less than 25 per cent of RDA for calcium, iron, carotene, riboflavin and vitamin C respectively. Most of the girls also met less than 25 per cent of RDA for calcium (72%), iron (61.33%), carotene (82.67%) and vitamin C (60%). Majority of adolescents met 50 to 75 per cent of RDA for energy (48.48% boys and 80% girls), protein (66.66% boys and 57.33% girls) and thiamine (57.58% boys and 53.33% girls). In the case of niacin, it was seen that 62.12 per cent of adolescent boys and 84 per cent adolescent girls met more than 75 per cent of RDA. The details are given in Table 59.

4.3.3.4. Adults

It was seen that 50 to 75 per cent of RDA of energy, protein and thiamine was met among 69.91 per cent, 43.81 per cent and 56.86 per cent of adult men and 73.41 per cent, 58.69 per cent and 64.42 per cent of adult women engaged in different activities. The calcium, iron, carotene, riboflavin and vitamin C intake was found to be less than 50 percent of RDA among majority of men and women. However, the intake of niacin was found to be more than 75 per cent of RDA among 83.63 per cent men and 80.57 per cent women. The results are given in Table 60.

4.3.4. Nutritional adequacy of the families

The percentage of RDA met for different nutrients among the selected families was computed from the per capita nutrient intake of the family members and comparing with the RDA suggested by ICMR (2010_b) for an adult man engaged in sedentary activity. The results are furnished in Table 61.

Table 58. Percentage of RDA met for nutrients among children (10-12 years)

Nutrients	<25%RDA		25 to 50% RDA		50 to 75 % RDA		>75% RDA		Total	
	B	G	B	G	B	G	B	G	B	G
Energy	0	0	15(36.59)	8(26.67)	26(63.41)	22(73.33)	0	0	41 (100)	30 (100)
Protein	5(12.20)	0	34(82.92)	6(20)	1(2.44)	15(50)	1(2.44)	9(30)	41 (100)	30 (100)
Fat	2(4.88)	3(10)	35(85.37)	21(70)	4(9.75)	6(20)	0	0	41 (100)	30 (100)
Calcium	35(85.37)	22(73.33)	6(14.63)	8(26.67)	0	0	0	0	41 (100)	30 (100)
Iron	31(75.61)	28(93.33)	10(24.39)	2(6.67)	0	0	0	0	41 (100)	30 (100)
Carotene	37(90.24)	26(86.67)	3(7.32)	3(10)	1(2.44)	1(3.33)	0	0	41 (100)	30 (100)
Thiamine	0	0	7(17.07)	6(20)	33(80.49)	21(70)	1(2.44)	3(10)	41 (100)	30 (100)
Riboflavin	25(60.98)	19(63.33)	16(39.02)	11(36.67)	0	0	0	0	41 (100)	30 (100)
Niacin	0	0	1(2.44)	0	24(58.53)	12(40)	16(39.03)	18(60)	41 (100)	30 (100)
Vitamin C	26(63.41)	17(56.66)	7(17.07)	5(16.67)	2(4.88)	5(16.67)	6(14.64)	3(10)	41 (100)	30 (100)

Figures in parentheses are percentage B – Boys. G - Girls

Table 59. Percentage of RDA met for nutrients among adolescents (13 -17 years)

Nutrients	<25%RDA		25 to 50% RDA		50 to 75 % RDA		>75% RDA		Total	
	B	G	B	G	B	G	B	G	B	G
Energy	0	0	32(48.48)	12(16)	32(48.48)	60(80)	2(3.04)	3(4)	66(100)	75(100)
Protein	0	0	9(13.64)	14(18.67)	44(66.66)	43(57.33)	13(19.70)	18(24)	66(100)	75(100)
Fat	9(13.64)	7(9.33)	54(81.81)	52(69.34)	2(3.03)	15(20)	1(1.52)	1(1.33)	66(100)	75(100)
Calcium	46(69.70)	54(72)	19(28.78)	21(28)	1(1.52)	0	0	0	66(100)	75(100)
Iron	5(77.27)	46(61.33)	15(22.73)	29(38.67)	0	0	0	0	66(100)	75(100)
Carotene	62(93.93)	62(82.67)	3(4.55)	10(13.33)	1(1.52)	3(4)	0	0	66(100)	75(100)
Thiamine	0	0	24(36.36)	6(8)	38(57.58)	40(53.33)	4(6.06)	29(38.67)	66(100)	75(100)
Riboflavin	49(74.24)	36(48)	17(25.76)	38(50.67)	0	1(1.33)	0	0	66(100)	75(100)
Niacin	0	0	0	1(1.33)	25(37.88)	11(14.67)	41(62.12)	63(84)	66(100)	75(100)
Vitamin C	37(56.06)	45(60)	16(24.24)	14(18.67)	5(7.58)	3(4)	8(12.12)	13(17.33)	66(100)	75(100)

Figures in parentheses are percentage B – Boys. G - Girls

Table 60. Percentage of RDA met for nutrients among adults

Nutrients	<25%RDA		25 to 50% RDA		50 to 75 % RDA		>75% RDA		Total	
	M	F	M	F	M	F	M	F	M	F
Energy	0	0	35(7.74)	55(11.25)	316(69.91)	359(73.41)	101(22.35)	75(15.34)	452 (100)	489 (100)
Protein	0	6(1.23)	35(7.74)	118(24.13)	198(43.81)	287(58.69)	219(48.45)	78(15.95)	452 (100)	489 (100)
Fat	10(2.21)	8(1.64)	152(33.63)	165(33.73)	184(40.71)	199(40.70)	106(23.45)	117(23.93)	452 (100)	489 (100)
Calcium	125(27.65)	285(58.28)	244(53.99)	174(35.58)	64(14.16)	24(4.91)	19(4.20)	6(1.23)	452 (100)	489 (100)
Iron	10(2.21)	201(41.11)	284(62.83)	282(57.67)	142(31.42)	3(0.61)	16(3.54)	3(0.61)	452 (100)	489 (100)
Carotene	389(86.06)	444(90.80)	39(8.63)	38(7.77)	15(3.32)	4(0.82)	9(1.99)	3(0.61)	452 (100)	489 (100)
Thiamine	1(0.22)	1(0.20)	34(7.52)	55(11.25)	257(56.86)	315(64.42)	160(35.40)	118(24.13)	452 (100)	489 (100)
Riboflavin	213(47.12)	196(40.08)	216(47.79)	257(52.56)	22(4.87)	36(7.36)	1(0.22)	0	452 (100)	489 (100)
Niacin	0	0	7(1.55)	9(1.84)	67(14.82)	86(17.59)	378(83.63)	394(80.57)	452 (100)	489 (100)
Vitamin C	215(47.57)	288(58.90)	111(24.56)	79(16.15)	42(9.29)	37(7.57)	84(18.58)	85(17.38)	452 (100)	489 (100)

Figures in parentheses are percentage B – Boys. G - Girls

It was found that among the families selected for the study, majority of the families met 25 to 75 per cent of RDA for energy (86.5%), protein (80.25%), fat (67.75%), iron (75.25%), niacin (56.75) and thiamine (83.75%). With respect to the intake of calcium, carotene, riboflavin and vitamin C, 54 per cent, 91.5 per cent,
65.75 per cent and 53.25 per cent of the families respectively met less than 25 per cent of RDA.

Table 61. Percentage of RDA met for nutrients by the families

Nutrients	<25%RDA	25 to 50% RDA	50 to 75 % RDA	75 to 100 % RDA	>100% RDA	Total
Energy	7(1.75)	146(36.5)	200(50)	45(11.25)	2(0.5)	400(100)
Protein	35(8.75)	185(46.25)	136(34)	39(9.75)	5(1.25)	400(100)
Fat	39(9.75)	165(41.25)	106(26.5)	66(16.5)	24(6)	400(100)
Calcium	216(54)	147(36.75)	33(8.25)	4(1)	0	400(100)
Iron	97(24.25)	271(67.75)	30(7.5)	1(0.25)	1(0.25)	400(100)
Carotene	366(91.5)	27(6.75)	5(1.25)	1(0.25)	1(0.25)	400(100)
Thiamine	7(1.75)	142(35.5)	193(48.25)	53(13.25)	5(1.25)	400(100)
Riboflavin	263(65.75)	133(33.25)	4(1)	0	0	400(100)
Niacin	4(1)	60(15)	167(41.75)	123(30.75)	46(11.5)	400(100)
Vitamin C	213(53.25)	80(20)	42(10.5)	23(5.75)	42(10.5)	400(100)

Figures in parentheses are percentage

4.4. Nutritional status of family members

The nutritional status of children, adolescents, adult and elderly in the selected families was assessed using different anthropometric measurements. The results are furnished in this section.

4.4.1. Anthropometric measurements

4.4.1.1. Anthropometric measurements of children (< 6 years)

The nutritional status of children below six years in the BPL families of the Central Zone of Kerala was assessed by measuring body weight, height and mid upper arm circumference. Head and chest circumferences of children in the age groups of six months to five years were also measured. The results pertaining to the mean anthropometric measurements and the interpretation of the grades of nutritional status of children below six years are given in this section

4.4.1.1.1. Weight

The mean weight of boys and girls below three years was found to be 10.08 kg and 10.04 kg respectively. For children in the age group of four to six years, the mean body weight was found to be 15.92 kg (boys) and 14.09 kg (girls) (Table 62).

To interpret the nutritional status of children below six years on the basis of weight for age, the percentage of weight computed on the basis of reference standards suggested for respective ages were categorized on the basis of the classification given by Gomez *et a1*. (1956) and the results are furnished in Table 63. It was seen that only
39.49 per cent of children below six years had normal nutritional status which constituted 40 per cent boys and 38.98 per cent girls. Rest of the children (60.51%) had different grades of malnutrition. It was seen that 41.67 per cent boys and 33.90 per cent girls were having grade I malnutrition and 18.33 per cent boys and 23.73 per cent girls had grade II malnutrition. Grade III malnutrition with less than 60 per cent of standard weight for age was not observed among boys. However, 3.39 per cent of girls below six years had grade III malnutrition (Figure 3).

4.4.1.1.2. Height

The mean height of boys and girls below three years was found to be 76.38 cm and 75.84 cm respectively. The mean height of children in the age group of four to six years varied from 105.16 cm (boys) to 101.47 cm (girls). The details are furnished in Table 64.

Table 62. Mean weight of family members

Age (years)	Male				Female			
	N	Mean ±SE (kg)	Min. (kg)	Max. (kg)	N	Mean ± SE (kg)	Min. (kg)	Max. (kg)
<3	24	10.08±0.65	4	19	25	10.04±0.69	2.80	16
4-6	36	15.92±0.70	9	26	34	14.09±0.46	7	20
7-9	33	21.85±0.93	14	40	32	20.88±0.87	15	35
10-12	43	30.54±1.23	19	51	33	33.88±1.38	17	49
13-15	46	41.63±1.52	24	67	39	38.90±1.27	28	59
16-17	29	49.09±1.42	38	63	38	43.87±0.88	33	60
Adults	538	57.82±0.36	31	85	564	52.26±0.43	27	83
Elderly	31	50.71±1.25	40	68	64	46.02±1.09	30	68

N = Number Min.-Minimum Max- Maximum

Table 63. Nutritional status of children (< 6 years) on the basis of weight for age

% of standard	Nutritional status	Boys		Girls		Total	
		N	Per cent	N	Per cent	N	Per cent
≤60	Grade III malnutrition	0	0	2	3.39	2	1.68
61-75	Grade II malnutrition	11	18.33	14	23.73	25	21.01
76-90	Grade I malnutrition	25	41.67	20	33.90	45	37.82
>90	Normal	24	40	23	38.98	47	39.49
	Total	**60**	**100**	**59**	**100**	**119**	**100**

N = Number

Distribution of children on the basis of height for age classification suggested by Waterlow (1972) indicated that 47.05 per cent of children below six years had normal nutritional status. Severe malnutrition was found among 21 per cent of children which constituted 15 per cent boys and 27.12 per cent girls. Rest of the children below six years had either marginal (19.33 %) or moderate (12.61 %) malnutrition. The results are given in Table 65 and Figure 4.

Table 64. Mean height of family members

Age (years)	Male				Female			
	N	Mean ±SE (cm)	Min. (cm)	Max. (cm)	N	Mean ±SE (cm)	Min. (cm)	Max. (cm)
<3	24	76.38±3.27	40	102.30	25	75.84±3.85	45	108
4-6	36	105.16±2.88	45	125	34	101.47±2.54	65	129.10
7-9	33	121.92±1.93	104	151.30	32	120.99±1.32	108	140
10-12	43	135.58±1.89	97	161	33	142.74±1.77	117	161
13-15	46	151±0.02	127	182	39	147 ±0.02	110	170
16-17	29	159±0.02	140	175	38	155±0.01	140	165
Adults	538	162±0.03	142	182	564	154±0.003	130	180
Elderly	31	156±0.01	138	174	64	149±0.01	133	162

N = Number Min - Minimum Max – Maximum

4.4.1.1.3. Mid Upper Arm Circumference (MUAC)

The mean MUAC of boys and girls below three years was found to be 14.49 cm and 14.52 cm respectively (Table 66). The MUAC of boys and girls in the age group of 4 to 6 years was 16.17 cm and 15.07 cm respectively. It was found that 25 per cent boys and 16 per cent girls below three years had MUAC below 13.5cm. Among four to six year category, only 2.78 per cent boys had a lower measurement.

Table 65. Nutritional status of children (< 6 years) on the basis of height for age

% of standard	Nutritional status	Boys		Girls		Total	
		N	Per cent	N	Per cent	N	Per cent
<85	Severe malnutrition	9	15	16	27.12	25	21.01
85 - 90	Moderate malnutrition	8	13.33	7	11.86	15	12.61
90 - 95	Marginal malnutrition	14	23.33	9	15.25	23	19.33
>95	Normal	29	48.34	27	45.77	56	47.05
	Total	**60**	**100**	**59**	**100**	**119**	**100**

N = Number

Table 66. Mean Mid Upper Arm Circumference of children (< 6 years)

Age (years)	Boys				Girls			
	N	Mean ± SE (cm)	Min. (cm)	Max. (cm)	N	Mean ± SE (cm)	Min. (cm)	Max. (cm)
<3	24	14.49 ± 0.37	11	19	25	14.52 ±0.36	10	17.20
4 - 6	36	16.17 ±0.33	12	21	34	15.07 ±0.21	12	17

N = Number Min.-Minimum Max- Maximum

4.4.1.1.4. Mean head and chest circumference of children (6 months to 5 years)

The mean head circumference of boys and girls in the age group of six months to five years was found to be 46.42 cm and 46.40 cm respectively. The mean chest circumference was 46.95 cm among boys and 47.93 cm among girls (Table 67).

Details regarding head /chest circumference ratio revealed that 54.05 per cent boys and 76.92 per cent girls had a normal ratio below one. Rest of the boys (45.95%) and girls (23.08%) had a ratio greater than one and were categorised as malnourished. The results are furnished in Table 68.

Table 67. Mean head and chest circumference of children (6 months to 5 years)

Measurement	Boys				Girls			
	N	Mean ± SE (cm)	Min. (cm)	Max. (cm)	N	Mean ± SE (cm)	Min. (cm)	Max. (cm)
Head circumference	37	46.42±0.47	40	50.40	39	46.40±0.40	42	54
Chest circumference	37	46.95±0.64	39.7	57.20	39	47.93±0.46	42.10	53

N = Number Min.-Minimum Max-Maximum

Table 68. Head/chest circumference ratio of children (6 months to 5 years)

Head /chest circumference ratio	Specification	Boys		Girls		Total	
		N	Per cent	N	Per cent	N	Per cent
<1	Normal	20	54.05	30	76.92	50	65.79
≥1	Malnourished	17	45.95	9	23.08	26	34.21
Total		**37**	**100**	**39**	**100**	**76**	**100**

N = Number

4.4.1.2. Anthropometric measurements of children (7 to 12 years)

4.4.1.2.1. Weight

The mean weight of boys and girls in the age group of seven to nine years was found to be 21.85 kg and 20.88 kg respectively. Children in the age group of 10 to 12 years had a mean weight of 30.54 kg (boys) and 33.88 kg (girls) (Table 62).

Normal nutritional status on the basis of weight for age was seen only in 39.72 per cent of children and constituted 38.16 per cent of boys and 41.54 per cent of girls (Table 69). Rest of the children had different grades of malnutrition. It was seen that 29.79 per cent, 27.66 per cent and 2.83 per cent of children had grade I**,** grade II and grade III malnutrition respectively (Figure 3).

Table 69. Nutritional status of children (7 to12 years) on the basis of weight for age

% of Standard	Nutritional status	Boys		Girls		Total	
		N	Per cent	N	Per cent	N	Per cent
≤ 60	Grade III malnutrition	1	1.31	3	4.61	4	2.83
61-75	Grade II malnutrition	24	31.58	15	23.08	39	27.66
76-90	Grade I malnutrition	22	28.95	20	30.77	42	29.79
>90	Normal	29	38.16	27	41.54	56	39.72
	Total	76	100	65	100	141	100

N=Number

4.4.1.2.2. Height

The mean height of children in the age group of seven to nine years was found to be 121.92 cm (boys) and 120.99 cm (girls). The mean height of 10 to 12 year boys and girls was found to be 135.58 cm and 142.74 cm respectively (Table 64).

Normal nutritional status on the basis of height for age was noticed among 44.68 per cent of children and constituted 42.11 per cent of boys and 47.69 per cent of girls (Figure 4). Fifty five percentage of children had different grades of malnutrition on the basis of height for age with 11.35 per cent having severe malnutrition and
29.08 per cent having marginal malnutrition. Marginal malnutrition was found to be high among girls (33.85%) when compared to boys (25%), while moderate and severe malnutrition were found to be high among boys (Table 70).

4.4.1.2.3. Mid Upper Arm Circumference (MUAC)

The mid upper arm circumference of boys and girls in the age group of seven to nine years was found to be 17.23 cm and 17.01 cm respectively. In 10 to 12 year group, the measurement was 18.25 cm among boys and 19.17 cm among girls (Table
71).

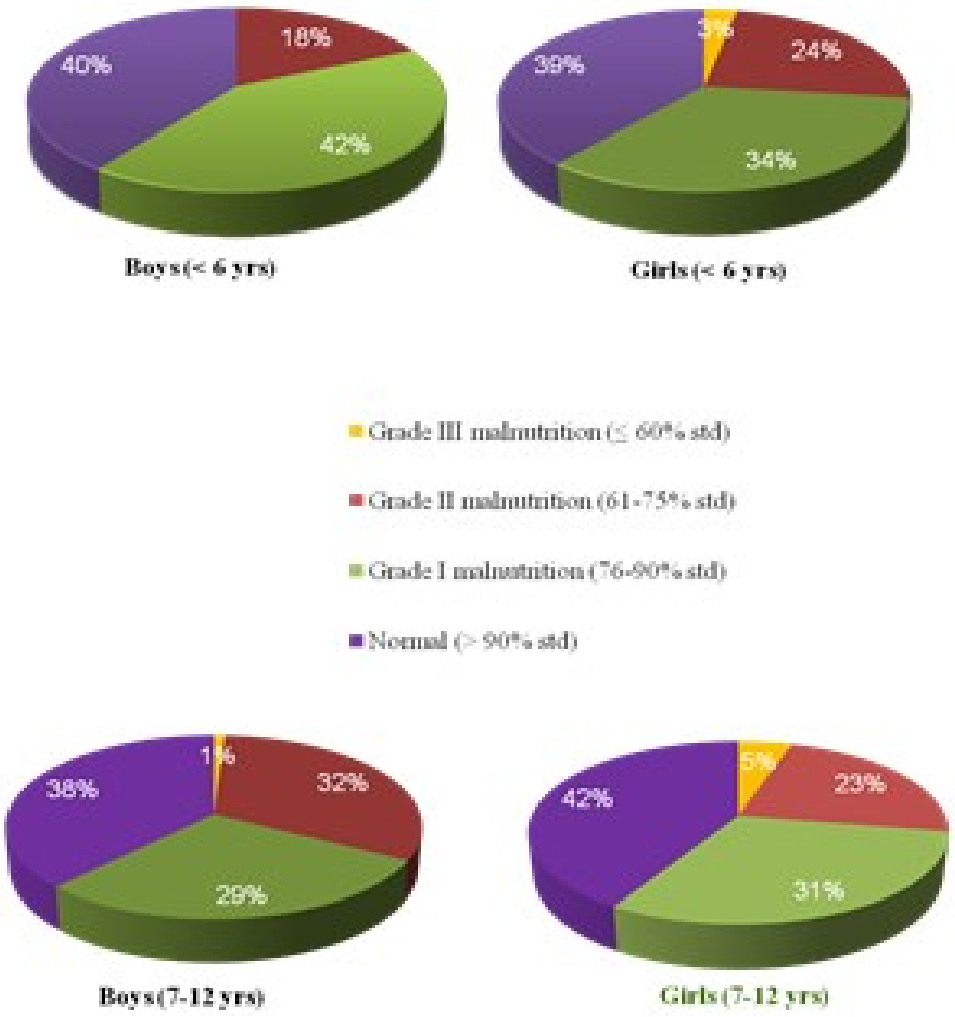


Fig. 3. Nutritional status of children (< 12 years) based on weight for age

Table 70. Nutritional status of children (7 to 12 years) on the basis of height for age

%of standard	Nutritional status	Boys		Girls		Total	
		N	Per cent	N	Per cent	N	Per cent
<85	Severe malnutrition	12	15.79	4	6.15	16	11.35
85 – 90	Moderate malnutrition	13	17.10	8	12.31	21	14.89
90 – 95	Marginal malnutrition	19	25	22	33.85	41	29.08
>95	Normal	32	42.11	31	47.69	63	44.68
	Total	**76**	**100**	**65**	**100**	**141**	**100**

N = Number

Table 71. Mean Mid Upper Arm Circumference of children (7 to 12 years)

Age (years)	Boys				Girls			
	N	Mean ± SE (cm)	Min. (cm)	Max. (cm)	N	Mean ± SE (cm)	Min. (cm)	Max. (cm)
7 – 9	33	17.23 ±0.38	13	23.50	32	17.01 ±0.29	14.50	22
10 - 12	43	18.25 ±0.29	14.50	23.20	33	19.17 ±0.40	16	25

N = Number Min.-Minimum Max-Maximum

4.4.1.2.4. Nutritional status of children (< 12 years) on the basis of weight for age as well as height for age

The mean weight and height of children in the age group of zero to twelve years were assessed and were classified on the basis of weight for age (Gomez *et al.*,
1956) and height for age (Waterlow, 1972). The weight for age classification consisted of grade III malnutrition, grade II malnutrition, grade I malnutrition and normal. Height for age classification included severe malnutrition, moderate malnutrition, marginal malnutrition and normal. Then, the grades obtained for weight for age were cross tabulated against the grades for height for age. The results are given in Table 72.

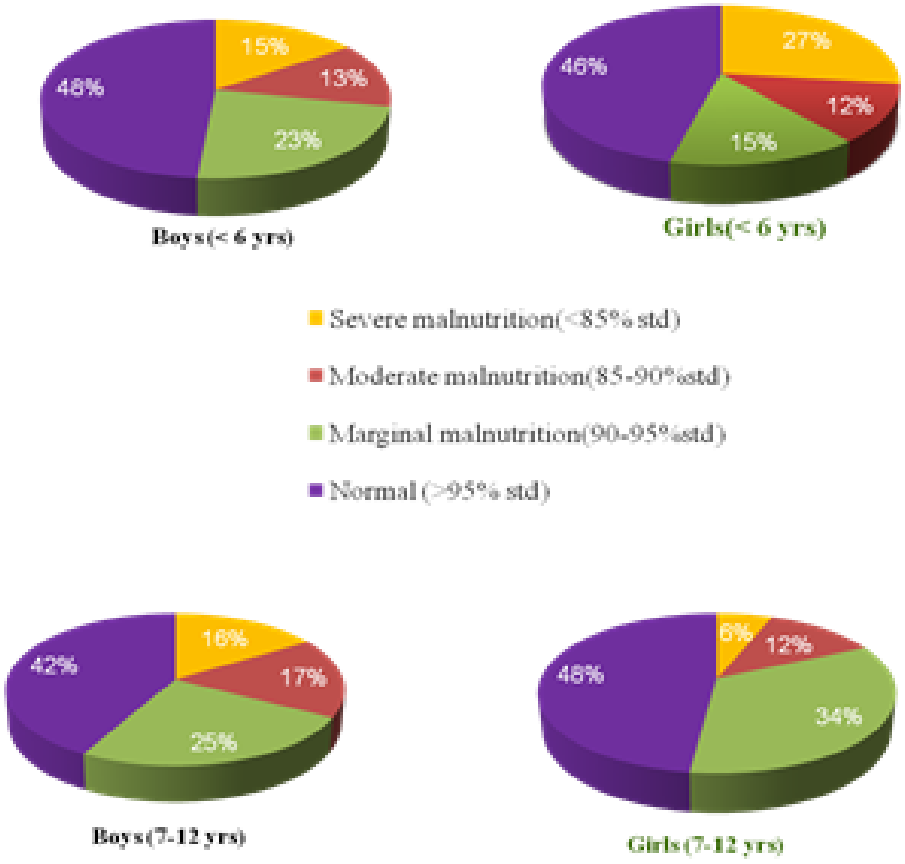


Fig. 4. Nutritional status of children (-< 12 years) based on height for age

Only one girl below three years with grade III malnutrition on the basis of weight for age was found to be having severe malnutrition on the basis of height for age. It was also seen that one boy with normal nutritional status on the basis of weight had severe malnutrition with respect to height. Among 24 boys and 25 girls below three years, only three boys and seven girls had normal nutritional status on the basis of weight as well as height.

In the age group of four to six years also, one girl with grade III malnutrition on the basis of weight for age was found to be having severe malnutrition based on height for age. One boy and five girls with grade II malnutrition (weight for age) had severe malnutrition based on height for age. It was also seen that among 36 boys and
34 girls in the age group of 4 to 6 years, 13 boys and six girls had normal nutritional status on the basis of weight for age and height for age.

In the age group of seven to nine years, ten boys and six girls out of 33 boys and 32 girls had normal nutritional status on the basis of weight for age and height for age. Two girls who had grade III malnutrition on the basis of weight for age had severe malnutrition on the basis of height for age.

In the case of 10 to 12 year boys and girls, only one boy who had Grade III malnutrition was found to be severely malnourished on the basis of height for age. Out of the total 43 boys and 33 girls in the age group of 10 to12 years, 14 boys and 14 girls had normal nutritional status on the basis of weight for age and height for age.

The results pertaining to the nutritional status of children below 12 years on the basis of both weight and height are summarised in Table 73. It was seen that only29.41 per cent boys and 26.61 per cent girls below 12 years had normal nutritional status on the basis of weight as well as height. It was also observed that 11.03 per cent boys and 13.71 per cent girls below 12 years who had grade I malnutrition had normal nutritional status on the basis of height for age. Different grades of malnutrition were observed among 61.04 per cent boys and 59.67 per cent girls on the basis of weight for age as well as height for age classification. About 15.44 per cent boys and 20.16 per cent girls who had normal nutritional status on the basis of height for age had either grade I or grade II malnutrition on the basis of weight for age classification.

Table 72. Distribution of children (< 12 years) on the basis of weight for age and height for age

Age (years)	Weight	Height									
		Severe malnutrition		Moderate malnutrition		Marginal malnutrition		Normal		Total	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
< 3	Grade III malnutrition	0	1	0	0	0	0	0	0	0	1
	Grade II malnutrition	2	3	1	0	0	0	1	1	4	4
	Grade I malnutrition	3	4	1	2	3	0	4	2	11	8
	Normal	1	0	1	2	4	3	3	7	9	12
	Total	**6**	**8**	**3**	**4**	**7**	**3**	**8**	**10**	**24**	**25**
4-6	Grade III malnutrition	0	1	0	0	0	0	0	0	0	1
	Grade II malnutrition	1	5	1	1	1	0	4	4	7	10
	Grade I malnutrition	1	2	4	2	5	1	4	7	14	12
	Normal	1	0	0	0	1	5	13	6	15	11
	Total	**3**	**8**	**5**	**3**	**7**	**6**	**21**	**17**	**36**	**34**
7-9	Grade III malnutrition	0	2	0	0	0	0	0	0	0	2
	Grade II malnutrition	5	1	3	6	2	0	1	2	11	9
	Grade I malnutrition	0	0	3	1	1	7	3	3	7	11
	Normal	0	0	0	0	5	4	10	6	15	10
	Total	**5**	**3**	**6**	**7**	**8**	**11**	**14**	**11**	**33**	**32**
10-12	Grade III malnutrition	1	0	0	0	0	1	0	0	1	1
	Grade II malnutrition	5	0	5	1	3	4	0	1	13	6
	Grade I malnutrition	1	1	2	0	8	3	4	5	15	9
	Normal	0	0	0	0	0	3	14	14	14	17
	Total	**7**	**1**	**7**	**1**	**11**	**11**	**18**	**20**	**43**	**33**

Table 73. Nutritional status of children (< 12 years) on the basis of weight for age and height for age

Weight	Height									
	Severe malnutrition		Moderate malnutrition		Marginal malnutrition		Normal		Total	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Grade III malnutrition	1 (0.74)	4 (3.22)	0 (0)	0 (0)	0 (0)	1 (0.80)	0 (0)	0 (0)	1 (0.74)	5 (4.02)
Grade II malnutrition	13 (9.56)	9 (7.26)	10 (7.35)	8 (6.45)	6 (4.41)	4 (3.23)	6 (4.41)	8 (6.45)	35 (25.73)	29 (23.39)
Grade I malnutrition	5 (3.68)	7 (5.66)	10 (7.35)	5 (4.03)	17 (12.51)	11 (8.87)	15 (11.03)	17 (13.71)	47 (34.57)	40 (32.26)
Normal	2 (1.46)	0 (0)	1 (0.74)	2 (1.61)	10 (7.35)	15 (12.10)	40 (29.41)	33 (26.61)	53 (38.96)	50 (40.33)
Total	21 (15.44)	20 (16.15)	21 (15.44)	15 (12.09)	33 (24.27)	31 (25)	61 (44.85)	58 (46.76)	136 (100)	124 (100)

Figures in parentheses are percentage

4.4.1.3. Anthropometric measurements of adolescents, adults and elderly

The nutritional status of adolescents, adults and elderly was determined by measuring weight and height and computing the body mass index (BMI) using the formula weight (kg) / height ^{2} (m). The samples were further categorised into different grades of nutritional status on the basis of the classification suggested by World Health Organisation (WHO, 2004) for Asian population. The results are furnished in this section from Tables 74 to 76.

4.4.1.3.1. Adolescents (13 to 17 years)

The mean weight of adolescent boys in the age group of 13-15 years and 16-17 years was found to be 41.63 kg and 49.09 kg respectively (Table 62). Among girls, the mean weight varied from 38.90 kg (13-15 years) to 43.87 kg (16-17 years).

The mean height of adolescent boys in the age group of 13-15 years and 16-17 years (Table 64) was found to be 151 cm and 159 cm respectively. The mean height of girls in the age group of 13 to 15 years and 16 to 17 years was found to be 147 cm and 155cm respectively.

The results pertaining to the nutritional status of adolescents in the age group of 13-17 years on the basis of BMI indicated that 45.39 per cent had normal nutritional status with a BMI in the range of 18.5 to 23 kg/m^2 and constituted 45.33 per cent boys and 45.45 per cent girls (Table 74). Undernutrition with a BMI below
18.5 kg/m^2 was found among 46.05 per cent of adolescents in the age group of 13-17 years. Only 7.89 per cent and 0.67 per cent had overweight and grade I obesity respectively (Figure 5).

4.4.1.3.2. Adults

The mean weight of adult men and women was found to be 57.82 kg and 52.26 kg respectively (Table 62). The mean height was observed to be 162 cm among men and 154 cm among women (Table 64).

Table 74. Nutritional status of adolescents (13 to 17 years) on the basis of BMI

BMI (kg/m^2)	Nutritional status	Boys		Girls		Total
		N	Per cent	N	Per cent	
<18.5	Undernutrition	35	46.67	35	45.45	70 (46.05)
18.5 – 23	Normal	34	45.33	35	45.45	69 (45.39)
23 - 27.5	Over weight	6	8	6	7.80	12 (7.89)
27.5 - 32.5	Obesity (Grade I)	0	0	1	1.30	1 (0.67)
	Total	75	100	77	100	152

Figures in parentheses are percentage N = Number

On the basis of BMI, it was found that 56.51 per cent men and 40.43 per cent women had normal nutritional status (Table 75). Undernutrition was found only among 8.18 per cent men and 21.10 per cent women with a BMI less than 18.5 kg/m^2. Overweight was noticed among 30.85 per cent men and 28.19 per cent women. Grade I obesity was observed only among 4.46 per cent men and 9.93 per cent women

(Figure 6).

Table 75. Nutritional status of adults on the basis of BMI

BMI (kg/m^2)	Nutritional status	Male		Female		Total
		N	Per cent	N	Per cent	
<18.5	Undernutrition	44	8.18	119	21.10	163 (14.79)
18.5 - 23	Normal	304	56.51	228	40.43	532 (48.28)
23 - 27.5	Over weight	166	30.85	159	28.19	325 (29.49)
27.5 -32.5	Obesity (Grade I)	24	4.46	56	9.93	80 (7.26)
32.5 -37.5	Obesity (Grade II)	0	0	2	0.35	2 (0.18)
	Total	538	100	564	100	1102

Figures in parentheses are percentage N = Number

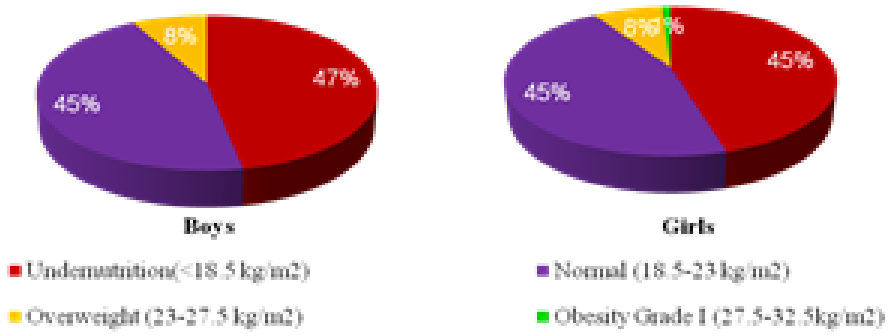


Fig. 5. Nutritional status of adolescents (13 to 17 years) based on BMI

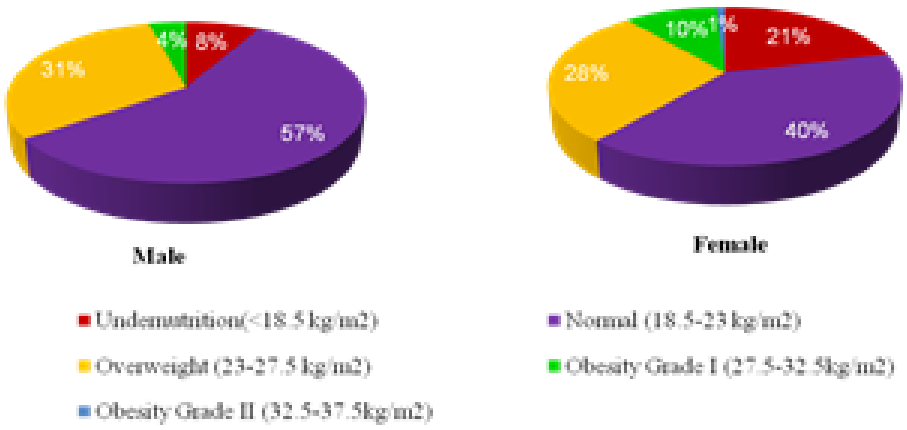


Fig. 6. Nutritional status of adults based on BMI

4.4.1.3.3. Elderly

The mean weight of elderly was found to be 50.71 kg and 46.02 kg among men and women respectively (Table 62). The mean height of elderly men and women was observed to be 156 cm to 149 cm respectively (Table 64).

The results pertaining to the nutritional status of elderly men and women on the basis of BMI are furnished in Table 76. It was found that 67.74 per cent elderly men and 40.63 per cent elderly women had normal nutritional status. The percentage of men and women with undernutrition varied from 19.36 per cent and 26.56 per cent respectively. Over weight was observed among 12.90 per cent men and 29.69 per cent women with a BMI in between 23 to 27.5 kg/m^2. Only 3.12 per cent of elderly women had grade I obesity (Figure 7).

Table 76. Nutritional status of elderly on the basis of BMI

BMI (kg/m^2)	Nutritional status	Male		Female		Total
		N	Per cent	N	Per cent	
<18.5	Undernutrition	6	19.36	17	26.56	23 (24.21)
18.5 - 23	Normal	21	67.74	26	40.63	47 (49.47)
23 - 27.5	Overweight	4	12.90	19	29.69	23 (24.21)
27.5 - 32.5	Obesity(Grade I)	0	0	2	3.12	2 (2.11)
	Total	31	100	64	100	95

Figures in parentheses are percentage N = Number

4.4.2. Actual food and nutrient intake of women and preschool children.

To assess the actual food and nutrient intake of women and preschool children, one day food weighment survey was carried out among 60 women and 60 preschool children (subsample) during summer, rainy and winter seasons. The quantity of each food item consumed by women and preschool children was computed and compared with the quantity specified by ICMR (2010_a) for a balanced diet for women engaged in sedentary activity and preschool children in the age group of four to six years respectively.

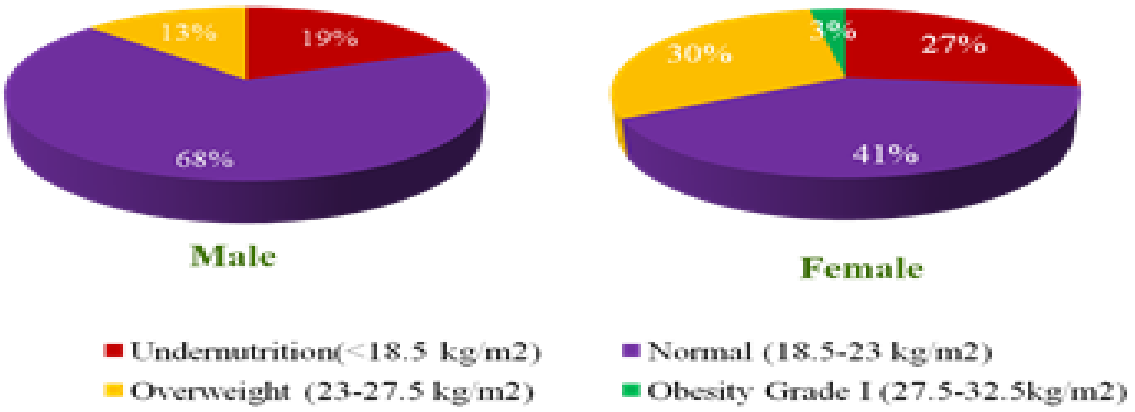


Fig. 7. Nutritional status of elderly based on BMI

The nutritive value of the food items consumed by women and children was computed using the food composition table suggested by Gopalan *et al.* (1989) and compared with the RDA of nutrients suggested by ICMR (2010_b) for women engaged in sedentary activity and preschool children respectively. The amount of food and nutrients consumed by the selected samples were statistically analysed and the results are presented in this section.

4.4.2.1. Actual food and nutrient intake of women

The details pertaining to the actual food and nutrient intake of women are presented in Tables 77 and 78 respectively. From Table 77 it is clear that the intake all food groups except cereals, pulses, fruits and non vegetarian items were lower than the quantity suggested by ICMR (2010_a) during the three periods of study. In the families who included green leafy vegetables in their diet it was seen that the quantity consumed was significantly higher than the quantity suggested during winter season.

The mean nutrient intake of women when compared with the RDA indicated that the intake of all nutrients except niacin was significantly lower than the RDA suggested during all the three seasons. The niacin intake was significantly higher than the RDA during all the three periods of the study (Table 78).

4.4.2.2. Actual food and nutrient intake of preschool children

The mean intake of roots and tubers, other vegetables, milk and milk products, fats and oils among preschool children was found to be significantly lower than the requirement during all the three periods of study. The cereal intake of children was found to be higher than the requirement during all the three periods. However, the increase was statistically significant only during rainy season. In the case of children who consumed pulses, it was seen that the intake was higher than the required quantity during winter season and the increase was statistically insignificant. The intake of green leafy vegetables was found to be significantly higher than the requirement during winter season who included green leafy vegetables in their diet (Table 79).

Table 77. Mean food intake of women in comparison with requirement

Food item	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
Cereals	270	60	274.53	5.47	0.83^{NS}	60	283.77	5.96	2.31*	60	300.02	6.20	4.84**
Pulses	30	24	44.08	3.003	4.69**	42	34.46	3.90	1.14^{NS}	25	62.09	8.11	3.96**
Roots and tubers	200	41	40.49	3.94	40.45**	49	35.26	3.69	44.60**	43	56.33	9.54	15.06**
Green leafy vegetables	100	3	60	0	0	6	49.83	10.13	4.95**	6	155.50	21.34	2.60*
Other vegetables	200	27	111.93	14.90	5.91**	33	50.20	5.36	27.97**	15	63.40	9.24	14.78**
Fruits	100	7	107.14	17.003	0.42^{NS}	7	100	0	0	3	100	0	0
Milk and milk products	300	23	119.30	11.15	16.20**	26	106.54	8.55	22.63**	22	129.27	8.59	19.88**
Non vegetarian foods	30	43	97.72	7.19	9.41**	37	90.51	6.12	9.89**	40	81.35	6.92	7.43**
Fats and oils	20	60	9.70	0.58	17.91**	59	10.29	1.02	9.55**	60	8.85	0.50	22.44**
Sugar and jaggery	20	59	14.46	0.75	7.44**	57	15.68	0.88	4.93**	60	14.85	0.87	5.90**

N = Number of women ** Significant at 1 % level * Significant at 5 % level. NS – Non Significant

Table 78. Mean nutrient intake of women in comparison with RDA

Nutrients	RDA	Summer				Rainy				Winter			
		N	Mean	SE	t value	N	Mean	SE	t value	N	Mean	SE	t value
Energy (kcal)	1900	60	1448.54	24.16	18.69**	60	1416.08	29.42	16.45**	60	1531.07	28.87	12.78**
Protein (g)	55	60	42.03	1.87	6.94**	60	38.15	1.51	11.19**	60	40.66	1.80	7.95**
Fat (g)	40	60	28.11	1.65	7.21**	60	21.97	1.59	11.37**	60	56.84	2.91	5.80**
Calcium (mg)	600	60	192.23	12.86	31.70**	60	205.03	10.52	37.55**	60	241.46	23.69	15.13**
Iron (mg)	21	60	7.06	0.30	47.15**	60	6.85	0.28	49.79**	60	7.21	0.30	46.64**
Carotene (µg)	4800	60	412.09	54.56	80.42**	60	514.85	100.57	42.61**	60	1267.99	337.06	10.48**
Thiamine (mg)	1.0	60	0.81	0.03	7.33**	60	0.83	0.02	7.07**	60	0.88	0.03	4.24**
Riboflavin (mg)	1.1	60	0.38	0.02	35.78**	60	0.38	0.02	34.68**	60	0.44	0.03	25.85**
Niacin (mg)	12	60	13.50	0.41	3.68**	60	13.29	0.30	4.27**	60	14.08	0.35	5.87**
Vitamin C (mg)	40	60	16.06	2.88	8.31**	60	18.07	2.81	7.81**	60	27.59	6.78	1.83NS

N = Number of women ** Significant at 1 % level * Significant at 5 % level. NS – Non Significant

Table 79. Mean food intake of preschool children in comparison with requirement

Food item	Requirement (g)	Summer				Rainy				Winter			
		N	Mean (g)	SE	t value	N	Mean (g)	SE	t value	N	Mean (g)	SE	t value
Cereals	120	60	123.58	2.73	1.31^{NS}	60	130.57	3.54	2.98^{**}	60	122.08	3.15	0.66^{NS}
Pulses	30	26	21.54	1.14	7.42^{**}	42	21.50	2.22	3.84^{**}	20	35.70	5.24	1.09^{NS}
Roots and tubers	100	42	20.98	2.17	36.35^{**}	50	19.06	2.04	39.62^{**}	43	28.05	4.44	16.19^{**}
Green leafy vegetables	50	3	31	8.54	3.85^{NS}	3	28.67	0.33	64^{**}	8	85.38	10.63	3.33^{*}
Other vegetables	100	29	54	6.74	6.83^{**}	28	30.86	4.16	16.61^{**}	15	30.53	4.47	15.52^{**}
Fruits	100	5	46	4.0	13.50^{**}	7	57.14	7.14	6.0^{**}	1	50	0	0
Milk and milk products	500	21	86.71	10.12	40.85^{**}	23	71.13	7.93	54.11^{**}	20	84.75	8.52	48.74^{**}
Non vegetarian foods	50	41	47.12	4.02	0.72^{NS}	36	50.33	4.007	0.08^{NS}	37	49.46	4.65	0.12^{NS}
Fats and oils	25	60	9.52	0.53	29.06^{**}	60	9.62	0.52	29.48^{**}	60	8.57	0.42	39.56^{**}
Sugar and jaggery	20	59	9.44	0.43	24.29^{**}	57	9.89	0.47	21.65^{**}	59	9.10	0.43	25.53^{**}

N = Number of preschool children ** Significant at 1 % level * Significant at 5 % level. NS – Non Significant

Table 80. Mean nutrient intake of preschool children in comparison with RDA

Nutrients	RDA	Summer				Rainy				Winter			
		N	Mean	SE	t value	N	Mean	SE	t value	N	Mean	SE	t value
Energy (Kcal)	1350	60	733.31	15.26	40.40**	60	737.99	18.56	32.97**	60	725.66	14.41	43.34**
Protein (g)	20.1	60	19.98	0.99	0.12NS	60	19.67	0.84	0.51NS	60	18.99	0.80	1.38NS
Fat (g)	40	60	19.04	0.99	21.09**	60	16.15	1.06	22.49**	60	48.83	2.54	3.48**
Calcium (mg)	600	60	104.37	8.85	56.01**	60	112.91	7.02	69.41**	60	130.91	14.14	33.17**
Iron (mg)	13	60	3.38	0.16	58.43**	60	3.57	0.15	61.77**	60	3.44	0.16	60.19**
Carotene (µg)	3200	60	233.76	37.63	78.83**	60	386.02	72.15	39.0**	60	858.65	208.75	11.22**
Thiamine (mg)	0.7	60	0.38	0.01	22.51**	60	0.41	0.01	22.29**	60	0.38	0.13	28.86**
Riboflavin (mg)	0.8	60	0.19	0.01	42.77**	60	0.203	0.015	38.84**	60	0.23	0.15	38.10**
Niacin (mg)	11	60	6.27	0.25	19.25**	60	6.34	0.16	29.04**	60	6.06	0.19	26.11**
Vitamin C (mg)	40	60	8.36	1.62	19.49**	60	8.38	1.31	24.20**	60	18.18	4.19	5.21**

N = Number of preschool children ** Significant at 1 % level * Significant at 5 % level. NS – Non Significant

The mean nutrient intake of preschool children was found to be lower than the RDA suggested for different nutrients during all the three periods except fat during winter season. When analysed statistically, the decrease was found to be significant during all the three seasons for all nutrients except proteins. The decrease noticed in the protein intake was statistically insignificant. The details are given in Table 80.

4.4.2.3. Percentage of RDA met for different nutrients among women and preschool children

From the detailed study conducted among women and preschool children, it was seen that above 50 per cent of RDA of energy, protein, fat and thiamine was met among 100 per cent, 95 per cent, 86.67 per cent and 81.67 per cent women. In the case of calcium, iron, carotene, riboflavin and vitamin C the intake was found to be below 50 per cent of RDA among 63 to 100 per cent women. The intake of iron was found to be below 50 per cent of RDA among all women. The intake of niacin was found to meet more than 75 per cent of RDA among women.

In the case of preschool children, the energy, thiamine and niacin intake met 50 to 75 per cent of RDA respectively among 76.67 per cent, 66.67 per cent and 70 per cent of children. The carotene, riboflavin and vitamin C intake was found to be less than 25 per cent of RDA among 58.33 to 81.67 per cent of children. The iron and calcium intake were found to be below 50 per cent of RDA among all children (Table
81)

4.4.3. Clinical manifestations observed among women and preschool children

The clinical manifestations observed among women and preschool children are given in Table 82. The general appearance of 85 per cent women and 95 per cent children was found to be good. The important clinical manifestations observed among women were gingivitis (6.66%), dental caries (15%), loss of luster of hair (5%) and loss of luster of skin (6.66%). Mild angular stomatitis (1.67%), dental caries (11.66%), loss of luster of hair (1.67%) and skin (5%) were found be the majorclinical manifestations observed among preschool children.

Table 81. Percentage of RDA met for nutrients among women and children

Nutrients	<25%RDA		25 to 50% RDA		50 to 75 % RDA		>75% RDA		Total	
	Women	Children	Women	Children	Women	Children	Women	Children	Women	Children
Energy	0	0	0	14 (23.33)	24 (40)	46 (76.67)	36 (60)	0	60 (100)	60 (100)
Protein	0	0	3 (5)	0	33 (55)	10 (16.67)	24 (40)	50 (83.33)	60 (100)	60 (100)
Fat	0	0	8 (13.33)	14 (23.33)	13 (21.67)	17 (28.33)	39 (65)	29 (48.34)	60 (100)	60 (100)
Calcium	17 (28.33)	46 (76.67)	31 (51.67)	14 (23.33)	12 (20)	0	0	0	60 (100)	60 (100)
Iron	8 (13.33)	24 (40)	52 (86.67)	36 (60)	0	0	0	0	60 (100)	60 (100)
Carotene	51 (85)	49 (81.67)	5 (8.33)	8 (13.33)	1 (1.67)	1 (1.67)	3 (5)	2 (3.33)	60 (100)	60 (100)
Thiamine	0	0	0	17 (28.33)	14 (23.33)	40 (66.67)	46 (76.67)	3 (5)	60 (100)	60 (100)
Riboflavin	8 (13.33)	35 (58.33)	43 (71.67)	22 (36.67)	9 (15)	3 (5)	0	0	60 (100)	60 (100)
Niacin	0	0	0	15 (25)	0	42 (70)	60 (100)	3 (5)	60 (100)	60 (100)
Vitamin C	24 (40)	37 (61.67)	14 (23.33)	11 (18.33)	10 (16.67)	9 (15)	12 (20)	3 (5)	60 (100)	60 (100)

Figures in parentheses are percentage

Table 82. Clinical manifestations among women and preschool children

S. No	Details	Women		Preschool children	
		N	Per cent	N	Per cent
1	**General appearance**				
	Good	51	85	57	95
	Fair	7	11.66	3	5
	Poor	2	3.34	0	0
	Total	**60**	**100**	**60**	**100**
2	**Eyes**				
	Normal appearance without any xerosis	60	100	60	100
	Total	**60**	**100**	**60**	**100**
3	**Mouth**				
	Mild angular stomatitis	1	1.67	1	1.67
	Gingivitis	4	6.66	0	0
	Pale tongue	1	1.67	0	0
	Normal	54	90	59	98.33
	Total	**60**	**100**	**60**	**100**
4	**Teeth** Chalky				
	teeth Pitting of	1	1.67	1	1.67
	teeth Dental	1	1.67	1	1.67
	caries Normal	9	15.0	7	11.66
	Total	49	81.66	51	85
		60	**100**	**60**	**100**
5	**Hair**				
	Loss of luster	3	5	1	1.67
	Normal	57	95	59	98.33
	Total	**60**	**100**	**60**	**100**
6	**Skin**				
	Loss of luster	4	6.66	3	5
	Diminished elasticity	2	3.34	1	1.67
	Normal	54	90	56	93.33
	Total	**60**	**100**	**60**	**100**
7	**Face**				
	Normal without any paleness	60	100	60	100
	Total	**60**	**100**	**60**	**100**

N- Number

4.4.4. Biochemical estimation of blood

Biochemical estimation of blood for haemoglobin, total protein, albumin, globulin and creatinine was conducted among 49 women and 41 preschool children who were willing to give blood samples. The results are furnished in Tables 83 and 84.

The percentage prevalence of anaemia among women and children were determined on the basis of haemoglobin level of blood and the results are given in Table 83.

It was seen that 46.94 per cent women and 68.29 per cent children had a normal haemoglobin level as suggested by WHO (2001). Mild anaemia was observed among 40.82 per cent women and 31.71 per cent children. Only 12.24 per cent women had moderate anaemia.

Table 83. Haemoglobin level of women and children

Category	Wome			Childre		
	Hb level (g/dl)	N	Per cent	Hb level (g/dl)	N	Per cent
Moderate anaemia	8 - 10.9	6	12.24	7-9.9	0	0
Mild anaemia	11-11.9	20	40.82	10-10.9	13	31.71
Normal Hb level	≥12	23	46.94	≥11	28	68.29
Total		**49**	**100**		**41**	**100**

N- Number Hb - Haemoglobin

The details pertaining to the biochemical estimation of blood for total protein, albumin, globulin, albumin-globulin ratio and serum creatinine among women and preschool children are furnished in Table 84. It was seen that all women and preschool children had normal levels of serum protein, serum albumin and serum creatinine. Normal level of serum globulin was also noticed among all women. However, among preschool children, normal serum globulin level in the range of 1.8 to 3.6 g/dl was found among 95.12 per cent of children and rest had slightly higher levels of serum globulin and hence a lower A/G ratio of less than 1.1:1.

Table 84. Blood profile observed among women and children

Blood profile	Blood level	Women		Children	
		N	Per cent	N	Per cent
Total protein (g/dl)	Normal (6 - 8.3)	49	100	41	100
Albumin (g/dl)	Normal (3.2 - 5.3)	49	100	41	100
Globulin (g/dl)	Normal (1.8 - 3.6)	49	100	39	95.12
	>3.6	0	0	2	4.88
A/G ratio	Normal (1.1 : 1)	49	100	39	95.12
	<1.1 : 1	0	0	2	4.88
Serum creatinine (mg/dl)	Normal (0.4-1.4)	49	100	41	100

N- Number

4.5. Food and nutritional security of the families

4.5.1. Food security of the families on the basis of USDA (2000)

To determine the type of food security, the families were categorised into four groups namely food secure, food insecure without hunger, food insecure with moderate hunger and food insecure with severe hunger on the basis of the total affirmative responses and the food security scale values obtained for the families. On the basis of these, the families were given code values from 0 to 3, zero indicating food secure, one indicating food insecure without hunger, two indicating food insecure with moderate hunger and three indicating food insecure with severe hunger. This grouping was done separately for households with children and without children. The food security scale values obtained for each of the families with and without children are given in Appendix VI. The total affirmative responses (raw scores) obtained for the families with and without children are given in Table 85. The details pertaining to the food security status of the families on the basis of code values are given in Table 86.

Table 85. Distribution of families on the basis of affirmative responses

Raw score	No. of families With children (out of 18)	Raw score	No. of families Without children (out of 10)	Total
0	3(1.33)	0	8(4.57)	11(2.75)
1	7(3.12)	1	15(8.57)	22(5.5)
2	3(1.33)	2	26(14.86)	29(7.25)
3	25(11.11)	3	46(26.29)	71(17.75)
4	18(8)	4	9(5.14)	27(6.75)
5	10(4.45)	5	25(14.29)	35(8.75)
6	20(8.88)	-	-	20(5)
7	22(9.78)	-	-	22(5.5)
8	18(8)	6	14(8)	32(8)
9	18(8)	7	22(12.57)	40(10)
10	16(7.11)	8	10(5.71)	26(6.5)
11	23(10.22)	-	-	23(5.75)
12	23(10.22)	-	-	23(5.75)
13	12(5.33)	-	-	12(3)
14	6(2.67)	-	-	6(1.5)
15	1(0.45)	-	-	1(0.25)
16	-	-	-	-
17	-	-	-	-
18	-	-	-	-
Total	**225(100)**		**175(100)**	**400(100)**

Figures in parentheses are percentage

Table 86. Distribution of families on the basis of food security status

Food security status	Code value	No : of families		Total
		With children	Without children	
Food secure	0	13(5.78)	49(28)	62(15.50)
Food insecure without hunger	1	95(42.22)	80(45.72)	175(43.75)
Food insecure with moderate hunger	2	98(43.55)	46(26.28)	144(36)
Food insecure with severe hunger	3	19(8.45)	0	19(4.75)
Total		**225(100)**	**175(100)**	**400(100)**

Figures in parentheses are percentage

From Tables 85 and 86, it was observed that 5.78 per cent and 28 per cent of the families with and without children respectively did not indicate any problems or concerns in meeting their food needs. All these families obtained a raw score in the range of 0 to 2 with a code value of 0 and were categorised as food secure. From Table 86, it was also clear that only 15.50 per cent of families in the Central Zone of Kerala were food secure.

In the families with children, 42.22 per cent of the families were reported to be food insecure without hunger as against 45.72 per cent of the families without children. Thus, in the Central Zone of Kerala, 43.75 per cent of the families were categorised as food insecure without hunger.

It was also seen that in the families with children 43.55 per cent were reported to be food insecure with moderate hunger as the corresponding percentage was only
26.28 in families without children. Thus, it was seen that in the BPL families of Central Zone of Kerala 36 per cent were food insecure with moderate hunger.

Food insecurity with severe hunger was noticed only in 4.75 per cent of the families. None of the families without children had food insecurity with severe hunger. However, 8.45 per cent of the families with children had food insecurity with severe hunger. The details of the food security status of the families in the Central Zone of Kerala are illustrated in Figure 8.

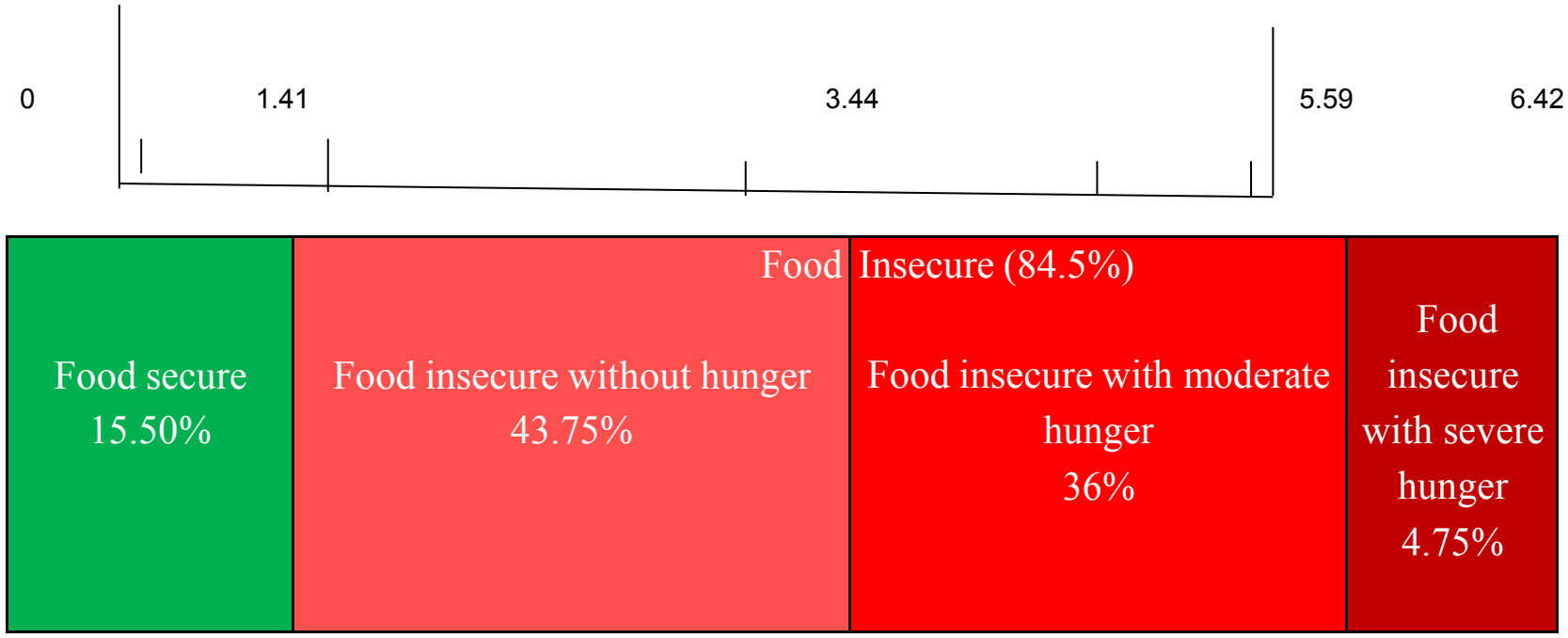


Fig. 8. Distribution of families on the basis of food security status

The food security status of the families in the four districts selected for the study when analysed, it was seen that only 10 to 18 per cent of families were food secure with the lowest in Palakkad district and highest in Malappuram district. In Ernakulam and Thrissur districts, 17 per cent of families were found to be food secure (Table 87).

Table 87. District wise food security status of families on the basis of USDA

Food security status	Code value	Percentage of families			
		Thrissur	Ernakulam	Palakkad	Malappuram
Food secure	0	17	17	10	18
Food insecure without hunger	1	59	44	36	36
Food insecure with moderate hunger	2	21	33	49	41
Food insecure with severe hunger	3	3	6	5	5
Total		**100**	**100**	**100**	**100**

4.5.2. Food security of the families on the basis of MSSRF (2008) indicators

The food security status of the selected families were also assessed using the indicators suggested by MSSRF (2008) and the families were grouped into four categories namely food secure, mild food insecurity, moderate food insecurity and severe food insecurity. The grouping was done separately for families with and without children and the details are furnished in Table 88. It was seen that on the basis of this index, 19.28 per cent and 19.87 per cent of the families with children and without children respectively were food secure which comprised of 19.75 per cent of families in the Central Zone of Kerala. Families having mild food insecurity comprised of 37.75 per cent families and constituted 32.53 per cent with children and 39.12 per cent without children. Moderate food insecurity was observed among 33.73 per cent of the families with children and 25.55 per cent of the families without children. Rest of the families (15.25%) had severe food insecurity. The details of the

food security status of the families in the Central Zone of Kerala are illustrated in Figure 9.

In the four districts selected for the study, maximum percentage of food secure families with children was present in Malappuram and Ernakulam districts followed by Thrissur and Palakkad (Table 89).

Table 88. Food security status of the families on the basis of MSSRF indicators

Food security status	Number of families		Total
	With children	Without children	
Food secure	16(19.28)	63(19.87)	79(19.75)
Mild food insecurity	27(32.53)	124(39.12)	151(37.75)
Moderate food insecurity	28(33.73)	81(25.55)	109(27.25)
Severe food insecurity	12(14.46)	49(15.46)	61(15.25)
Total	**83(100)**	**317(100)**	**400(100)**

Figures in parentheses are percentage

Table 89. District wise food security status of families on the basis of MSSRF indicators

Food security status	Percentage of families			
	Thrissur	Ernakulam	Palakkad	Malappuram
Food secure	19	14	7	15
Mild food insecurity	42	35	49	34
Moderate food insecurity	24	31	28	37
Severe food insecurity	15	20	16	14
Total	**100**	**100**	**100**	**100**

4.5.3. Nutritional security of the families

Distribution of families on the basis of nutritional security indicated that only 16.25 per cent were nutritionally secure (Table 90). It was also seen that 13.25 per cent and 17.03 per cent of the families with and without children respectively were nutritionally secure. Mild and moderate nutritional insecurity were noticed among 33 per cent and 27.5 per cent of the families respectively. Severe nutritional insecurity was seen in 23.25 per cent of the families (Figure 10).

Table 90. Distribution of families on the basis of nutrition security status

Nutritional security status	Number of households		Total
	With children	Without children	
Nutritionally secure	11(13.25)	54(17.03)	65(16.25)
Mild nutritional insecurity	31(37.35)	101(31.86)	132(33)
Moderate nutritional insecurity	21(25.30)	89(28.08)	110(27.5)
Severe nutritional insecurity	20(24.10)	73(23.03)	93(23.25)
Total	**83(100)**	**317(100)**	**400(100)**

Figures in parentheses are percentage

Among the four districts selected for the study also, only 14 (Palakkad) to 15 per cent (Thrissur, Ernakulam and Malappuram) of the families were nutritionally secure. Mild to moderate nutritional insecurity was observed among 63 to 68 per cent of the families. The details are given in Table 91.

Table 91.District wise nutritional security of families

Nutritional security status	Percentage of families			
	Thrissur	Ernakulam	Palakkad	Malappuram
Nutritionally secure	15	15	14	15
Mild nutritional insecurity	33	33	35	26
Moderate nutritional insecurity	35	30	33	37
Severe nutritional insecurity	17	22	18	22
Total	100	100	100	100

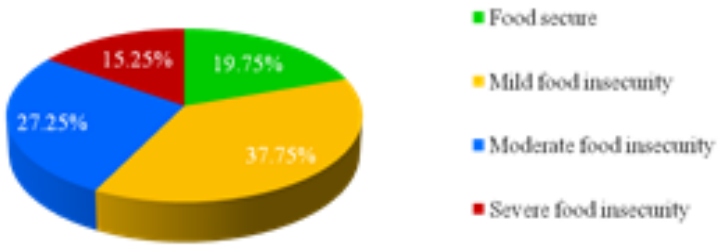


Fig. 9. Food security status of the families

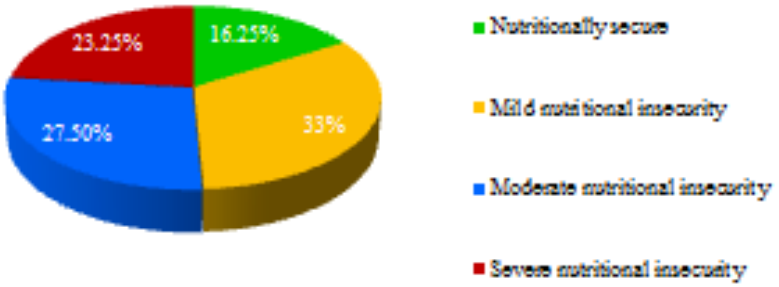


Fig. 10. Nutritional security status of the families

4.5.4. Nutritional security of family members

Nutritional security of the family members was ascertained from their nutrient intake. Percentage of nutrient intake based on RDA was converted into nutritional scores ranging from 0 to 50. An individual has to get a score above 30 so as to be atleast nutritionally secure. The family members who got a score 30 and below were classified as having nutritional insecurity in one way or other. The nutritional security score obtained for the family members in the different age/sex categories on the basis of their per capita nutrient intake are presented in Table 92.

Table 92. Nutritional score obtained among family members

Age group (years)	<15	15 – 25	26 – 30	31 - 35	36 - 40	41 - 50	Total
< 3	0	32(82.05)	7(17.95)	0	0	0	39(100)
4-6	0	40(65.57)	19(31.15)	2(3.28)	0	0	61(100)
7-9	1(1.72)	45(77.59)	12(20.69)	0	0	0	58(100)
10-12 B	1(2.44)	40(97.56)	0	0	0	0	41(100)
10-12 G	0	27(90)	3(10)	0	0	0	30(100)
13-15 B	0	32(84.21)	6(15.79)	0	0	0	38(100)
13-15 G	0	32(82.05)	7(17.95)	0	0	0	39(100)
16-17 B	0	26(92.86)	2(7.14)	0	0	0	28(100)
16-17 G	0	25(71.43)	10(28.57)	0	0	0	35(100)
Men SW	0	64(52.89)	41(33.88)	15(12.40)	1(0.83)	0	121(100)
Men MW	1(0.30)	141(42.99)	118(35.98)	54(16.46)	12(3.66)	2(0.61)	328(100)
Men HW	0	1(33.33)	1(33.33)	0	1(33.33)	0	3(100)
Women SW	1(0.34)	188(64.38)	81(27.74)	18(6.17)	3(1.03)	1(0.34)	292(100)
Women MW	0	144(73.10)	45(22.84)	7(3.55)	1(0.51)	0	197(100)
Total	**4**	**837**	**352**	**96**	**18**	**3**	**1310**

Figures in parentheses are percentage B – Boys. G – Girls. SW – Sedentary Worker. MW – Moderate Worker. HW – Heavy Worker

Among the family members, more than 60 per cent of children below 12 years (65 to 98%) and adolescent boys (84.21 to 92.86%) and girls (71.43 to 82.05%) in the age group of 13 to 17 years and adult women engaged in sedentary (64.38%) and moderate activities (73.10%) secured a score in between 15 to 25. The nutritional score among 52.89 per cent and 42.99 per cent adult men engaged in sedentary and moderate activities respectively also varied from 15 to 25.

The nutritional security scores obtained for children, adolescents and adults are illustrated in Figures 11 to 16.

From the figures, it is clear that all children below three years, seven to nine years and 10 to 12 years as well as 96.7 per cent children in the age group of four to six years secured a nutritional score below 30 and were categorised as nutritionally insecure. All adolescent boys and girls in the age group of 13 to 15 years and 16 to 17 years were also found to be nutritionally insecure. In the case of adult men engaged in sedentary, moderate and heavy activities 86.8 per cent, 79.3 per cent and 66.7 per cent respectively had different grades of nutritional insecurity. More than 90 per cent of women engaged in sedentary activity (92.5%) and moderate activity (95.9%) also were found to be nutritionally insecure.

4.5.5. Impact of food security on the nutritional status

4.5.5.1. Food and nutritional security of the families

To assess the relationship between food security and nutritional security of the families, the food security scores determined using USDA (2000) and nutritional security of the families were cross tabulated. The results are furnished in Tables 93.

On the basis of the food security code values and the nutritional security scores obtained for the families, it was seen that only 2.25 per cent of families were having food as well nutritional security. Six per cent of families having food insecurity without hunger also were found to be nutritionally secure. Severe nutritional insecurity was also noticed among 9.25 per cent and 7.75 per cent of the families having food insecurity without hunger and moderate hunger. Chi square test revealed the dependence of nutritional security on food security.

Table 93. Food and nutritional security of families

Food Security	Level of nutritional security				Total
	Nutritionally secure	Mild insecurity	Moderate insecurity	Severe insecurity	
Food secure	9 (2.25)	16 (4)	18 (4.5)	19 (4.75)	62 (15.5)
Food insecure without hunger	24 (6)	62 (15.5)	52 (13)	37 (9.25)	175 (43.75)
Food insecure with moderate hunger	30 (7.5)	45 (11.25)	38 (9.5)	31 (7.75)	144 (36)
Food insecure with severe hunger	2 (0.5)	7 (1.75)	4 (1)	6 (1.5)	19 (4.75)
Total	**65 (16.25)**	**130 (32.5)**	**112 (28)**	**93 (23.25)**	**400 (100)**

Figures in parentheses are percentage Chi square = 18.37^{NS}

4.5.5.2. Impact of food security on the nutritional status of women and children

To find out the impact of food security of the families on the nutritional status of women and children, logistic regression and correlation analysis were done. The results are given in Tables 94 and 95. From Table 94, it is clear that food security is having a positive impact on the normal BMI of women. The odds of having a normal BMI when there is food security is 74 per cent. Thus, food security favours normal BMI of women among 74 per cent of families. In order to find out the impact of food security on the nutritional status of children, the correlation of food security on the percentage deviation of weight and height of preschool children from the standard was worked out. The correlation coefficients were found to be significant (Table 95).

Table 94. Impact of food security on the nutritional status of women

Parameter	Regression coefficient	Odds ratio
Food security	1.061^{**}	2.88

** significant at 1% level

Table 95. Impact of food security on the nutritional status of children

	Parameter	Weight	Height
Food security	Pearson correlation	0.362	0.578
	Significance(2– tailed)	0.001	0.000

4.6. Factors influencing food security

Multinomial logistic regression analysis was carried out using the food security scores of USDA module. Based on these scores, the whole sample was classified as food insecure with severe hunger, food insecure with moderate hunger, food insecure without hunger and food secure. After giving codes to these classifications, the same was used as dependent variable. Type of family, family size, education of the head of family, monthly income of the family, expenditure on food, expenditure on cereals, pulses and fish and energy, protein, calcium, carotene, fat, iron, riboflavin, niacin, thiamine and vitamin C intake were used as explanatory variables. The results are furnished in Table 96.

Among the parameters selected, family size, monthly income of the family and food expenditure were found to be significant by influencing the first stage of transition from food insecurity with severe hunger to food insecurity with moderate hunger. The probability that family size will improvise food insecurity with severe hunger to food insecurity with moderate hunger was found to be 78.11 per cent whereas the corresponding probability was 23.72 per cent in the case of income and
98.52 per cent in the case of food expenditure.

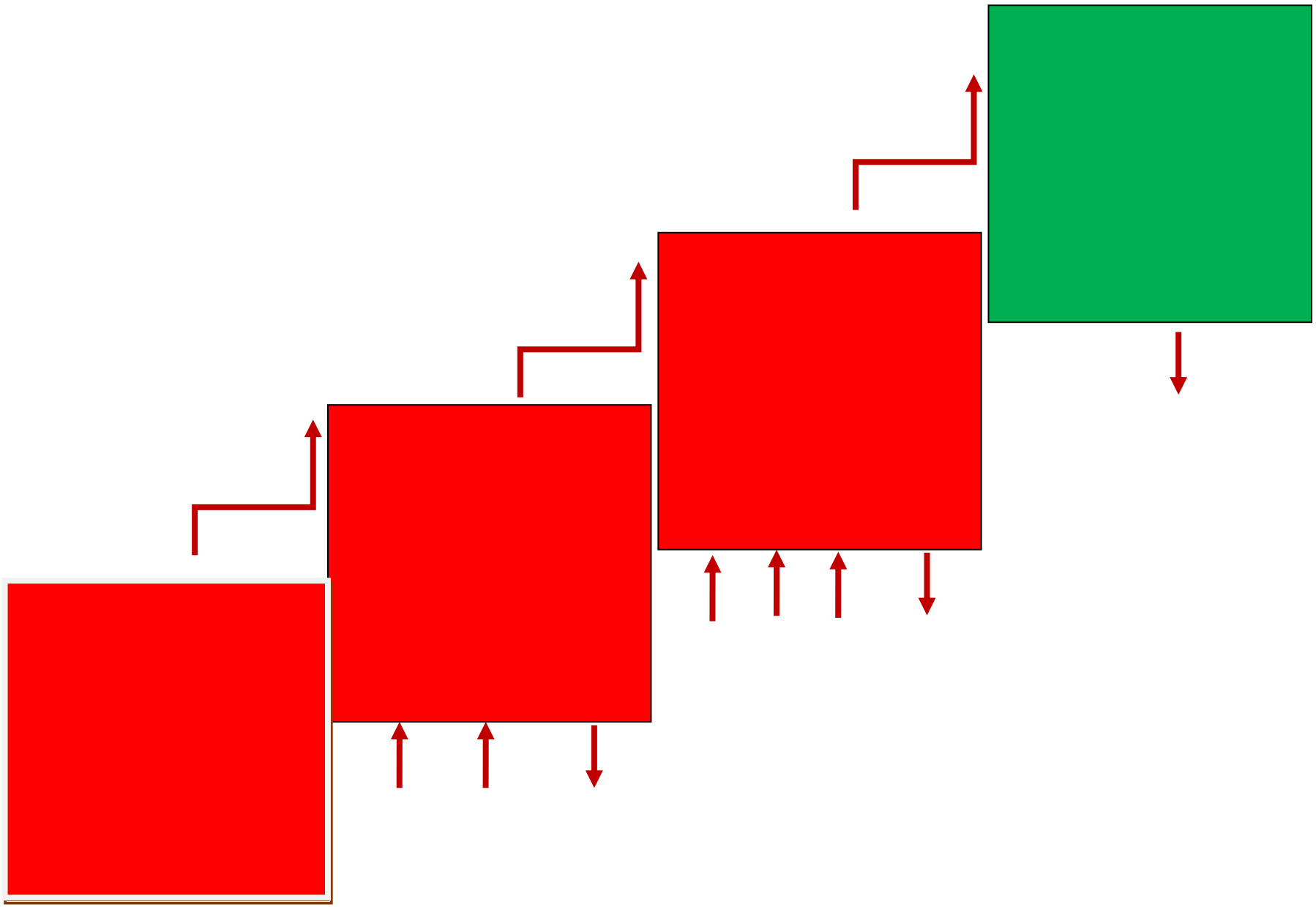
In the next transition stage from food insecurity with moderate hunger to a stage of food insecurity without hunger, the factors influencing were family size, monthly income, food expenditure and expenditure on fish. The probability that family size will improvise food insecurity with moderate hunger to a stage of food insecurity without hunger was 72.54 per cent whereas it was 31.92 per cent in the case of income, 49.97 per cent in the case of food expenditure and 43.02 per cent in the case of expenditure on fish.

Table 96. Parameter estimates of multinomial logistic regression

Stages of food security	Factors	B	Significance	Exp(B)
Food insecurity with severe hunger	Intercept	17.924	0.000	
	Type of family	0.175	0.835	1.191
	Family size	1.272	0.003	3.568
	Education of head of family	0.013	0.935	1.014
	Income	-1.168	0.000	0.311
	Expenditure on food	-0.002	0.013	0.998
	Cereals(expenditure)	-15.180	0	2.554E-7
	Pulses(expenditure)	0.290	0.528	1.337
	Fish(expenditure)	0.066	0.713	0.936
	Energy intake	0.002	0.498	1.002
	Protein intake	0.021	0.614	1.021
	Calcium intake	-0.005	0.558	0.996
	Carotene intake	0.001	0.258	1.001
	Fat intake	-0.021	0.703	0.979
	Iron intake	0.137	0.617	1.147
	Riboflavin intake	0.510	0.928	1.665
	Niacin intake	-0.794	0.130	0.452
	Thiamine intake	-3.952	0.505	0.019
	Vitamin C intake	0.007	0.575	1.007
Food insecurity with moderate hunger	Intercept	1.737	0.552	
	Type of family	0.681	0.195	1.975
	Family size	0.971	0.000	2.642
	Education of head of family	0.089	0.328	1.093
	Income	-0.756	0.000	0.469
	Expenditure on food	0.000	0.065	0.999
	Cereals(expenditure)	0.046	0.982	0.955
	Pulses(expenditure)	0.208	0.326	1.232
	Fish(expenditure)	-0.281	0.007	0.755
	Energy intake	0.000	0.990	1.000
	Protein intake	0.026	0.243	1.026
	Calcium intake	-0.002	0.683	0.998
	Carotene intake	0.001	0.106	1.001

	Fat intake	-0.024	0.439	0.976
	Iron intake	0.008	0.960	1.008
	Riboflavin intake	-3.854	0.217	0.021
	Niacin intake	0.084	0.593	1.088
	Thiamine intake	0.103	0.972	1.108
	Vitamin C intake	-0.008	0.352	0.992
Food insecurity without hunger	Intercept	1.061	0.670	
	Type of family	-0.113	0.813	0.893
	Family size	0.581	0.026	1.789
	Education of head of family	-0.064	0.446	0.938
	Income	-0.164	0.148	0.848
	Expenditure on food	0.000	0.448	1.000
	Cereals(expenditure)	-0.125	0.933	0.882
	Pulses(expenditure)	0.263	0.206	1.300
	Fish(expenditure)	-0.102	0.271	0.903
	Energy intake	0.000	0.959	1.000
	Protein intake	0.005	0.802	1.005
	Calcium intake	0.002	0.590	1.002
	Carotene intake	0.001	0.258	1.001
	Fat intake	-0.016	0.586	0.984
	Iron intake	-0.100	0.477	0.904
	Riboflavin intake	-4.080	0.173	0.017
	Niacin intake	0.131	0.412	1.140
	Thiamine intake	0.397	0.887	1.487
	Vitamin C intake	0.00	0.780	1.002

Finally, to scale up from food insecurity without hunger to food security, family size was the only factor which was found to be significant. The probability that family size will influence food security is 64.14 per cent. Thus, it can be concluded that among all the parameters considered, family size was the most significant factor followed by monthly income, food expenditure and expenditure on fish (Figure 17).



DISCUSSION

5. DISCUSSION

The discussion pertaining to the findings entitled **"Food and Nutritional Security Scenario of BPL Families of Central Zone of Kerala"** is presented in this chapter under the following headings:

5.1. Socioeconomic profile of the families
5.2 Food consumption pattern of the families
5.3. Food and nutritional adequacy of the families
5.4. Nutritional status of family members
5.5. Food and nutritional security of the families

5.1. Socioeconomic profile of the families

The socioeconomic conditions are considered as the most important factors influencing the food and nutritional security of families. Poor socioeconomic conditions are the root causes for most of the nutritional problems observed in our country. The socioeconomic profile of the BPL families of Central Kerala ascertained in this study indicated that 78 per cent belonged to Hindu community followed by 18 per cent Christians and four per cent Muslims. Only 21.75 per cent of families belonged to forward caste and the rest belonged to other backward caste (39.5%) and scheduled caste (38.75%). Various studies conducted among the low income families of Kerala by Karuna (1993), Augustine (1993), Smitha (1999), Vijayan (2003), Lawrence (2003), Jyothi (2003), Deepa (2009), Shiji (2009) and Anusha (2012) also indicated the predominance of Hindu community. A study conducted by NNMB (2006) in the rural areas of nine states including Kerala also indicated the predominance of Hindu community in different states, with the lowest percentage (61.8%) in Kerala and the highest in Andhra Pradesh (97.3%).

The caste system is reported to be responsible for perpetuating poverty in rural areas. As observed in the present study, Mathew and Nair (1986), Kannan (1986), Ranganathan (1996) and Shiji (2009) also indicated that majority of the families studied in low income groups, belonged to other backward communities or scheduled caste. In the report published by NNMB (2006) also it was seen that 76.7 per cent of the families in rural areas of India belonged to other backward communities, scheduled castes and scheduled tribes.

Due to urbanization and changes in social values, joint family system is disintegrating in different communities of Kerala. Unlike other states, small family norm has become very popular even among the low income groups probably due to better medical and educational facilities and the constant exposure of the public to small family norm through different media. In the present study also, nuclear family system was found among 69.5 per cent of the families. Similar findings were observed among the different labour communities of Kerala by Seshadrinath (1993), Karuna (1993), Ranganathan (1996), Shyna (1996), Jose (1998), Smitha (1999), Anil *etal*. (2001), Ukkuru (2001), Pratheesh (2002), Jyothi (2003), Lawrence (2003), Vijayan (2003), Chandran (2005), Shiji (2009), Deepa (2009), Latheef (2011), Athulya (2012) and Anusha (2012). In rural areas of Kerala, NNMB (2006) indicated nuclear family system among 67.6 per cent of families with an average family size of 4.5. In the nuclear family system, the per capita availability of food and other resources will be higher than that in the joint family system and hence the nuclear family system observed among BPL families of Central Kerala might enhance their food security. In contrast to the present finding, the studies conducted by Aneena and Usha (2007) among fishermen and Hari (2008) among scheduled tribe communities found the predominance of joint family system among majority of the households.

Family size is a major factor influencing nutrition security of the family members and thus food security of the families. In the present study, it was seen that 59.75 per cent of the families had four to six members and 34 per cent had one to three members. Thus, 93.75 per cent of the families could be categorized under small or medium size with upto six members. Medium sized families were also observed by Jayanthakumari (1993), Smitha (1999), Lawrence (2003), Jyothi (2003) Archana (2008), Deepa (2009), Shiji (2009), Anusha (2012) and Athulya (2012) among the agricultural labour households of Kerala. However, studies conducted by Aneena (2003) among fishermen and Hari (2008) among scheduled tribes indicated large family size due to joint family system in the households. In the rural areas of Kerala, NNMB (2006) observed a family size below five among 58.5 per cent of families. One of the important reasons for small or medium family size in the BPL families might be the nuclear family system observed among them. Thus, nuclear family system as well as the small family norm observed in the study might have direct

influence on per capita income and per capita availability of food and in turn might have a direct impact on food security of the households.

Kerala is the only state in India with a sex ratio in favour of females. Though, the sex ratio of India has improved from 933 in 2001 to 940 in 2012, in Kerala the sex ratio is in favour of females. As per the census of 2011, the sex ratio of Kerala is the highest with 1084 females for 1000 males (Mathrubhumi Year Book, 2012). For all other states, the sex ratio is adverse to women. In the present study also, the sex ratio of BPL families was found to be 1067 females for 1000 males. Studies conducted by Pratheesh (2002), Lawrence (2003), Deepa (2009) and Anusha (2012) also indicated a sex ratio in the range of 1092 to 1277 females per 1000 males among labour households. However, Jyothi (2003) indicated a sex ratio in favour of male members among agricultural labour households of Palakkad district.

Age and sex based distribution of family members indicated that among the total population, the child population in the age group of zero to ten years was found to be 12.86 per cent. The child population was found to be low when compared to adults. This trend observed among BPL families is a favorable phenomenon since children in family demand more time, attention and better food than adults and economically they are depended on adults. Similar trend were reported by Deepa (2009) and Anusha (2012) in studies among labour households in Kerala in which they observed a decrease in the percentage of younger age group and an increase in the older age group.

Literacy is an important demographic characteristic which is an indicator of level of advancement of people. The present study revealed that majority of male (92.49%) and female (81.7%) members above 18 years of age were literate. NNMB (2006) also indicated that in rural areas of Kerala 91.7 per cent of the population were literate. In the present study it was also seen that the male members were more educated than their female counterparts. Similar results were reported by Sujatha (1990), Augustine (1993), Shyna (1996), NIN (1996), Mathen (1998), Smitha (1999), Anil *et al.* (2001) and Lawrence (2003). This supports the reports of Census of India 2011 which ranked Kerala as the most literate state with a higher literacy of 93.9 per cent (Bose, 2011). As observed in the present study, the Census report also indicated highest literacy among male (96%) members when compared to females (92%) in

Kerala. In contrast to the findings of the present study, Augustine (1993), Smitha (1999), Anil *et al.* (2001), Jyothi (2003) and Agarwal *et al*. (2006) indicated higher literacy rate among female members.

The occupational status of family members is an important factor influencing the food purchasing pattern and thus the health and nutritional status of family members. In the present study, it was seen that 68.41 per cent of male and 34.70 per cent of female members were working on daily wages. As observed in the present study, Jose (1998), Smitha ((1999), also indicated occupation as daily wage labourers among male and female members in the unorganized sector. Employed male members outnumbered the employed female members. This might be due to the increased wages of male members when compared to female members. Since most of the women were engaged in household activities as indicated in the PRA, if the women are involved in income generating activities it will improve the income and food security status of the families.

Access to food depends on access to income and regular employment. Monthly income is a major factor influencing economic status and in turn household food security. Majority (72%) of the families in the study earned a monthly income in between Rs 4000/- to 12,000. The major source of income in most of the families was the daily wages received by the family members. The slightly higher monthly income observed among the BPL families could be due to the hike in the daily wages of men and women labourers over the years. In contrast to this, studies conducted by Karuna (1993), Udaya (1996), Ranganathan (1996), Varma (1996), Jose (1998), Smitha (1999), Jyothi (2003), Aneena (2003), Lawrence (2003), Deepa (2009) and Anusha (2012) indicated a monthly income of Rs.6000/- among the different labour categories. In the present study, the daily wages of labourers varied from Rs. 500/- in Palakkad to Rs.600/- in Thrissur and Ernakulam districts for men and Rs. 250/- in Palakkad to Rs.400/- in Malappuram for women.

Land holdings of the families are considered as an important determinant indicating resources of the household. It was seen that only 56.25 per cent of families owned land and the rest were residing in colonies in which the land was acquired from Government. Among the families who possessed land, 74.75 per cent owned less than 10 cents of land. Anusha (2012) in a study conducted among farm labour

households of Kuttanad indicated that only 36 per cent of the households possessed land.

Though, 33 per cent of the families possessed domestic animals, only 15.15 per cent of these families earned an extra income from this source. The lack of domestic animals among majority of the families might be due to the lack of proper space or land required for rearing the animals. In contrast to this, Anusha (2012) indicated the possession of domestic animals among 55 per cent of the households with an extra earning from domestic animals among 58 per cent of the families.

In the PRA sessions conducted on bioresource inflow-outflow, it was seen that almost all the domestic resources were purchased from outside and only a less percentage of families marketed their resources. This means that the inflow of resources outnumbered outflow

It was seen that only 27.25 per cent of families had the habit of saving money by investing in group insurance, post office and private chitties. Though, the families earned better income, most of families did not have the habit of saving money for future needs. Similar findings were indicated by Lawrence (2003), Jyothi (2003) and Deepa (2009). In contrast to this Shyna (1996), Udaya (1996), Smitha (1999) and Anusha (2012) observed the habit of investing money among most of the labour households even though their monthly income was low so as to meet their future needs.

The findings of the study indicated that 67 per cent of families did not have any debt and the rest availed loan up to Rs.70, 000/- from Cooperative society, Bank and Kudumbasree for house construction, marriage, education, purchase of vehicles and domestic animals. Studies conducted by Udaya (1996), Smitha (1999) Aneena (2003), Lawrence (2003), Deepa (2009) and Anusha (2012) also indicated that most of the labour households of Kerala took loan from different sources so as to meet their family needs.

Monthly expenditure pattern of families especially the percentage of income spent on food is another factor influencing food security. It was seen that 76 per cent of families spent 16 to 50 per cent of their monthly income for purchase of food items. Contradictory to this, studies conducted among various labour groups of Kerala

by Karuna (1993), Augustine (1993), Jyothi (2003) Lawrence (2003) and Deepa (2009) indicated expenditure in the range of 45 to 75 per cent for the purchase of food items. The lower expenditure incurred for purchase of food items by the BPL families is due to the fact that they are getting cereals especially rice and wheat as well as sugar for a subsidised rate from the ration shop. This also indicates the effectiveness of PDS in Kerala. The lower expenditure spent for education and health care also is due to the free education provided by the Government for children belonging to BPL categories up to higher secondary level and free health facilities imparted through PHC's and Government hospitals.

It is the right of every person to have proper housing, sanitation, environmental hygiene and availability of safe drinking water. The type of house is considered as an index of the economic status of households. The details on housing conditions of the BPL families indicated that 98.5 per cent lived in their own houses which were built with brick as the wall material (92.25%), tiles as the roofing material (70.5%) and cement as flooring material (87.5%). Most of the houses (65.25%) had two rooms. Studies conducted by Jose (1998), Jyothi (2003), Lawrence (2003), Vijayan (2003), Chandran (2009), and Latheef (2011) also indicated that most of the labour households resided in their own houses with tiles or concrete roofs and cement as flooring material. Toilet and electricity facilities were found in 94 to 97 per cent of the houses. However, 43.25 per cent had own well and 47 per cent of the families depended on public tap or well also for drinking water facilities. This might be due to the fact that most of the BPL families studied resided in colonies and shared the well/tap for drinking water. NNMB (2006) report also revealed that in rural areas of Kerala open well for drinking water facilities were available among 81.9 per cent families. Even though they are residing in colonies, the toilet and electricity facilities were found to be better due to the facilities provided by the Government for BPL families. In rural areas of Kerala, NNMB (2006) also indicated sanitary latrine facilities in 88.37 per cent of the households. Almost all the houses and surroundings were found to be clean.

Unhealthy personal habits of family members indicated that in 60 per cent of families, the male members were found to be addicted to smoking, alcohol consumption, chewing tobacco, betel leaf etc. Studies conducted by Karuna (1993), George and Domi (2002), Latheef (2011), Athulya (2012) and Anusha (2012) also

observed unhealthy habits mainly alcoholism among the male members of the families and indicated that this is one of the major contributory factors for the socioeconomic backwardness of the households. In the present study also this might be the major factor for the lack of savings in most of the BPL families.

Even though, the health care system in Kerala is good, each and every person is not getting the full benefit from the prevailing system. It is often seen that the needy do not get the best medical care due to financial constraints and the ever increasing medical expenses. An analysis of the health care facilities prevailing in the study area revealed that all families had access to proper health facilities like PHC, Government hospital or private hospital within a distance of 10 kms. Though, proper health facilities are available in the locality, only 82.75 per cent families utilised the available facilities. Rest of the families did not utilise the available facilities mainly due to the improper functioning or lack of proper facilities in the centers. It was also seen that 41 per cent of families are not getting any supplements from Primary Health Centers.

Though, mortality rate is quite low in Kerala, the population continue to suffer from high morbidity rates like chicken guinea, dengue fever, H_1N_1 etc. But, in the present study in most of the families the family members suffered from fever during the previous year.

The people-institution linkage indicated that women gave importance to ration shop, anganwadi, school, health centre and hospitals. But, they had more access and benefits from the ration shop as the families were always benefited to get rice, wheat and sugar at subsidised rate from the ration shop. Anganwadi and health centre was then more close to them as they provided supplementary foods and medicines respectively at free of cost to the families. Free education provided by government to children belonging to BPL families gave better ranking to the schools. The services provided by panchayat president and ward members were found to be not upto the mark and women put them far away in the Venn diagram. This opinion was more or less similar in all the four districts. Thus, it was seen that the people representatives are not working as per the expectations of the people. The people representatives should have a better role perception and role performance so as to listen to the problems and needs of the people.

It was seen that 93.25 per cent of families had taken complete immunization for children. Chiddarwar and Sonali (2000), Fry *et al*. (2002), Brahmam *et al*. (2002) and Hari (2008) also indicated about the proper immunization among children.

The social cum resource mapping of the area indicated that institutions like school, anganwadi and health center were present near to the locality in all the four districts. Though, most of the areas surveyed were colonies, the availability of these in the locality showed a full picture of the services provided by the Government. However, in some areas the health centre was not functioning properly and people depended on other hospitals far away from the locality. The panchayat and village offices were also found to be far away from most of the areas and the physical accessibility to these offices was low. Steps should be taken to improve the services and accessibility of health centers, panchayat and village offices.

5.2. Food consumption pattern of the families

Food is a symbol of security to people. The food consumption pattern of the population will depend upon the availability of foods in the region where they live. Precise information on the food consumption pattern of people is essential not only for assessing the nutritional status of the community but also for elucidating the food needs of the population at regional and national levels.

The present study showed that almost all the families (99.25%) were non vegetarians and majority (97.5%) followed three meal a day pattern. Similar findings were reported by Karuna (1993), Smitha (1999), Lawrence (2003), Aneena (2003), Vijayan (2003), Latheef (2011), Athulya (2012) and Anusha (2012) among the different labour categories of Kerala.

Most (98%) of the families kept regular time schedule for taking meal. Though, advance meal planning helps better organisation and faster completion of household chores, in the present study it was seen that only 36.50 per cent of families planned their meal in advance. As observed in the present study, studies conducted by Karuna (1993), Ranganathan (1996) and Jose (1998) also indicated a regular time schedule for consuming meal among the rural households of Kerala. Contrary to the present finding, Lawrence (2003) indicated that majority of agriculture labourer families planned their meal in advance depending on availability of foods.

Details regarding consumption of raw fruits and vegetables indicated that 52 per cent of families did not consume these items mainly due to lack of money. Similar findings were reported by Udaya (1996), Smitha (1999), Jyothi (2003) and Anusha (2012) among agricultural labourers of Kerala. Among families who included raw fruits, most of the families preferred to include orange due to the affordable price when compared to other fruits available in the market.

Food expenditure is an important factor influencing the food consumption pattern and in turns the food security. In the present study, it was found that majority of families spent up to 10 per cent of their total food expenditure for the purchase of cereals (100%) and sugar and jaggery (99.25%). For pulses, fats and oils, spices and condiments, majority spent up to 15 per cent of their food expenditure. For fish, 11 to 25 per cent of their food expenditure was spent by 68.5 per cent of the families. Fifty five to 92 per cent of the families did not spent any money for the purchase of roots and tubers, green leafy vegetables, fruits, milk and milk products and egg. In contrast to the present findings, various studies conducted by Ranganathan (1996), Jose (1998), Smitha (1999), Lawrence (2003) and Anusha (2012) among the low income groups indicated maximum amount of expenditure for cereals. The lower expenditure incurred for cereals and sugar in the present study is mainly due to the availability of these items through the PDS in Kerala from where the BPL families used to get rice or wheat at the rate of Rs. 1/kg and sugar at the rate of Rs. 12/kg. This indicates the effective utilization of the Public Distribution System prevalent in Kerala by the BPL families.

With respect to the expenditure incurred for purchase of fish, the study conducted by Lawrence (2003) and Deepa (2009) also indicated expenditure up to 15 per cent for the purchase of fish among coir workers and agricultural labourers. In contrast to this, Jyothi (2003) in her study among women labourers involved in rice cultivation revealed that though all the families were non vegetarians, the money spent for purchase of non vegetarian items among 90 per cent of families was less than five per cent of the monthly income spent on food.

The food purchase inventory over a period of one week with respect to the quantity of various food items purchased by the families revealed that all items were purchased to a lesser extent when compared to the actual requirement of the families

thus indicating lower availability of food items. Vijayan (2003) and Anusha (2012) in their studies conducted among agricultural labourers also observed an inadequate availability of all foods except roots and tubers and fish. Regarding the purchase of various food items, most of the families purchased almost all the food items on weekly basis. Cereals and sugar were purchased once in a week from ration shop and fish was purchased daily by most of the families. With respect to the percentage of requirement met on the basis of the quantity of food purchased, it was seen that the quantity of cereals, pulses, sugar, non vegetarian items and fats and oils purchased met more than 75 per cent of requirement among family members during all the three periods of study. These items were also found to be the most frequently used food items by the families. The food stuff which supplies the protective nutrients like green leafy vegetables, other vegetables, fruits and milk and milk products provided less than 25 per cent of the requirement among the families. This calls for the need for nutrition education and dissemination of information on procuring balanced diet from available resources.

The economic status of the families and the local availability of food items are the two important factors which influence the frequency of use of various food items in their diet. The frequency score with respect to use of foods revealed that most frequently used food items were cereals, pulses, other vegetables, fats and oils, spices and condiments, sugar and jaggery and fish. Least frequently used food items included green leafy vegetables, roots and tubers, fruits, milk and milk products and egg. Almost similar dietary pattern among different categories of labour households was reported by Jose (1998), Smitha (1999), Jyothi (2003), Lawrence (2003), Deepa (2009), Latheef (2011), Athulya (2012) and Anusha (2012).

Most common preservation and storage methods adopted by the families were found to be pickling of mango and lemon and storing the food grains in air tight containers. This is in line with the results obtained by Jyothi (2003), Lawrence (2003), Deepa (2009) and Anusha (2012).

5.3. Food and nutritional adequacy of the families

Food and nutritional adequacy of children, adolescents and adults belonging to different age/sex categories determined by one day recall method of dietary survey during three different periods were compared with the quantity recommended for a

balanced diet (ICMR 2010_a) to find out the food adequacy. To find out the nutritional adequacy, the nutrient intake of the family members was compared with the RDA suggested for different nutrients by ICMR (2010_b). From these results the percentage adequacy of different food groups and nutrients among the family members were also determined.

From the intake of food stuffs it was seen that the quantity of almost all foods groups consumed by all categories of family members per consumption unit were significantly lower than the requirement during all the three periods of survey except non vegetarian food items. Average intake of food stuffs as percentage of requirement among different age groups are illustrated in Figures 18 to 23. From these figures also it is clear that except non vegetarian items, intake of almost all food groups was lower than the requirement among different age groups. Most of the food groups met less than 50 per cent of the suggested requirement. The food intake data also indicated that energy yielding foods like cereals, fats and oils and sugar and jaggery were included in the diet of majority of family members while body building foods like pulses, milk and milk products, meat, fish and egg which supply proteins as the main nutrient were included only in the diet of 32 to 76 per cent of family members. The protective foods namely green leafy vegetables, roots and tubers, other vegetables and fruits which supply most of the vitamins and minerals were included in the diet of 3 to 82 per cent of family members during different periods of the study.

The nutritional adequacy of diet indicated that the per capita intake of all nutrients was significantly lower than the RDA among almost all age and sex categories. However, the protein intake of children, fat intake of adult men engaged in heavy work, niacin intake of 16 to17 years' girls and vitamin C intake of men and women engaged in sedentary activity as well as men engaged in heavy work were found to be higher than the RDA. Different studies conducted among different groups in Kerala and different other states by Agarwal (1980), Lawrence (2003), Jyothi (2003), Archana (2008) and Anusha (2012) have reported lower food and nutrient intake among rural population than the minimum amount required for physical sustenance and healthy living. Among majority of the family members also, the energy and thiamine intake was found to be in between 50 per cent to 75 per cent of RDA. The protein intake of most of the adolescent boys and girls and adult men and women also provided 50 to 75 per cent of RDA. In the case of 83 per cent children

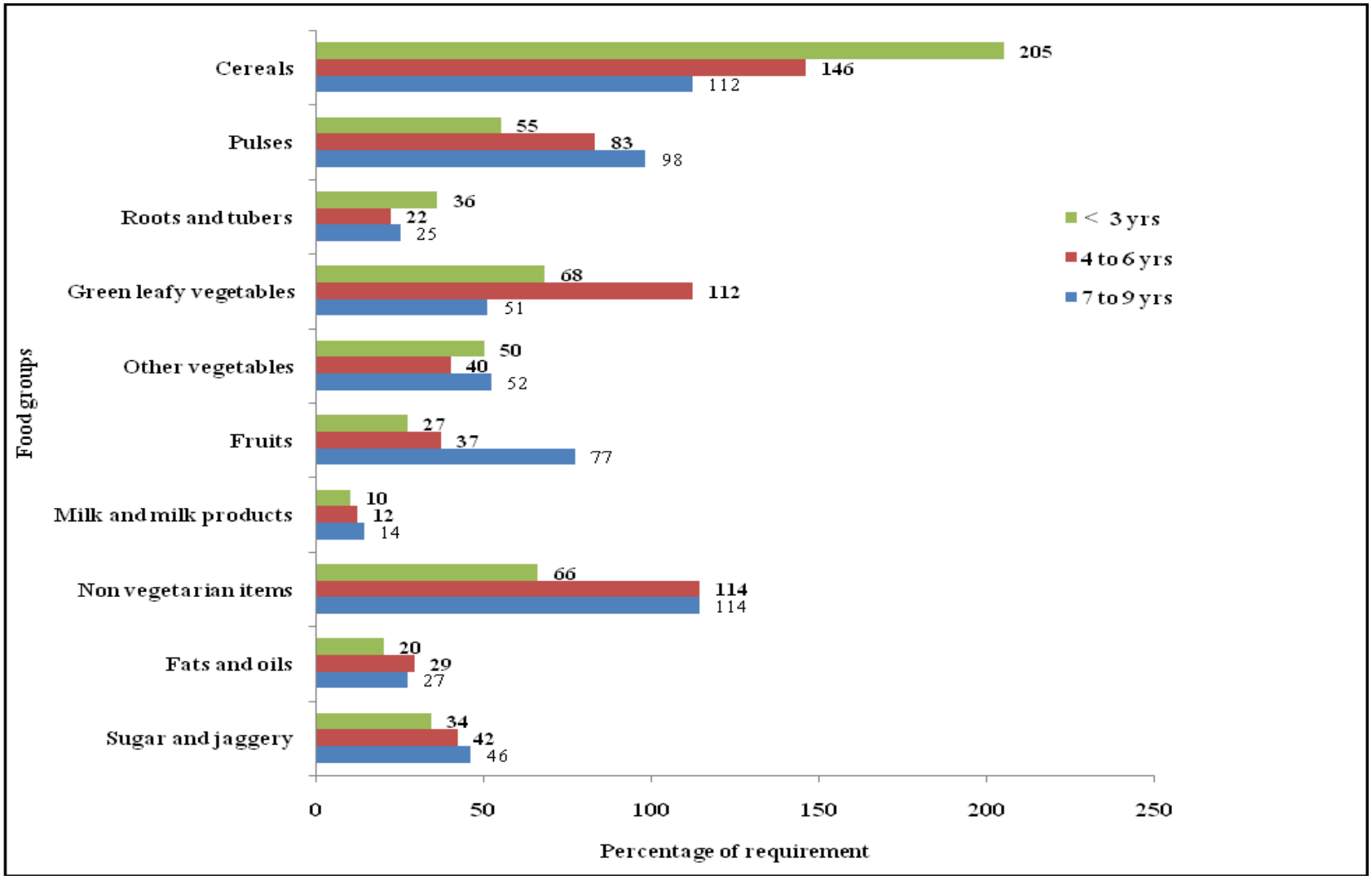


Fig. 18. Average daily intake of foods as percentage of requirement (< 9 years)

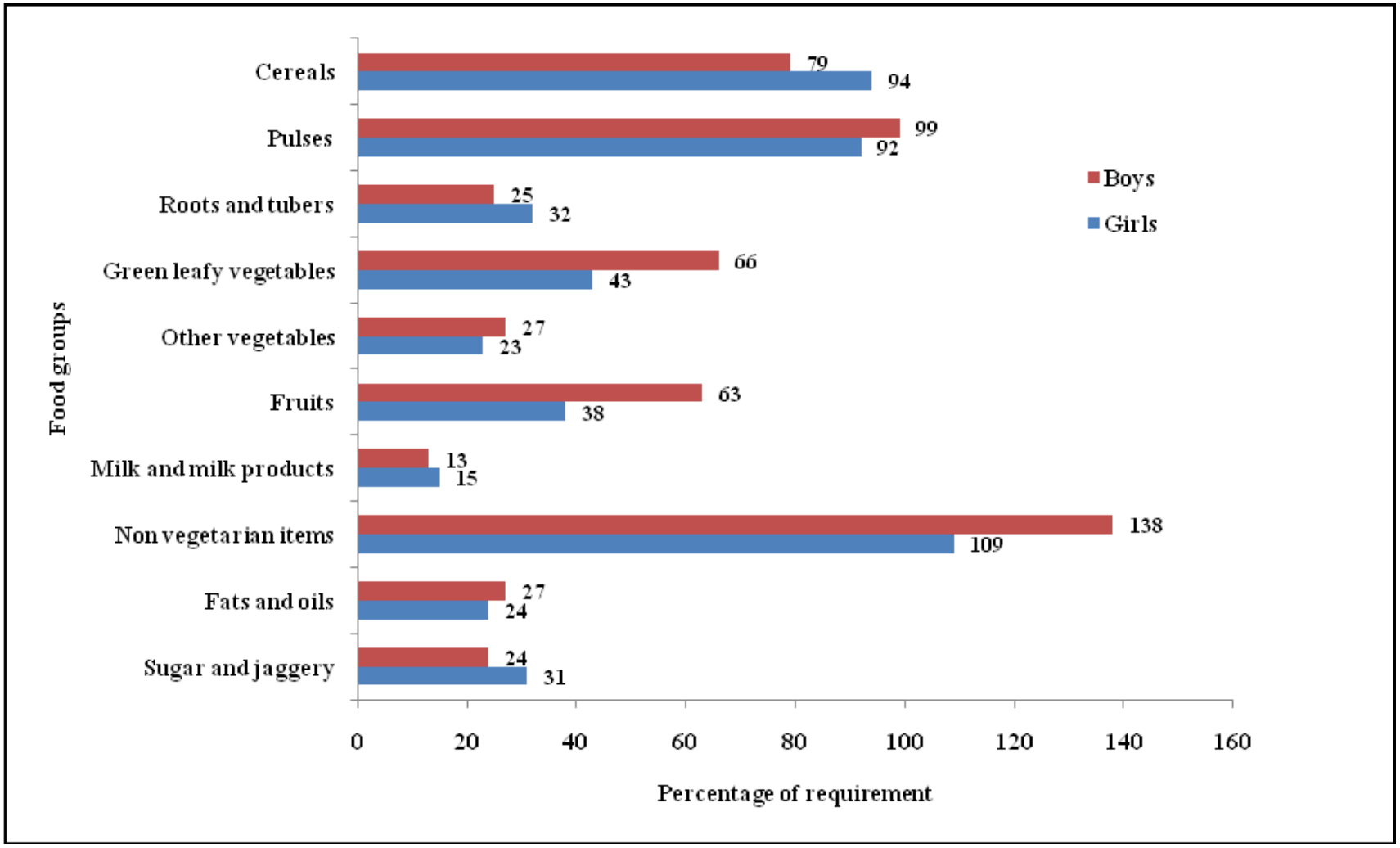


Fig. 19. Average daily intake of foods as percentage of requirement (10 to 12 years)

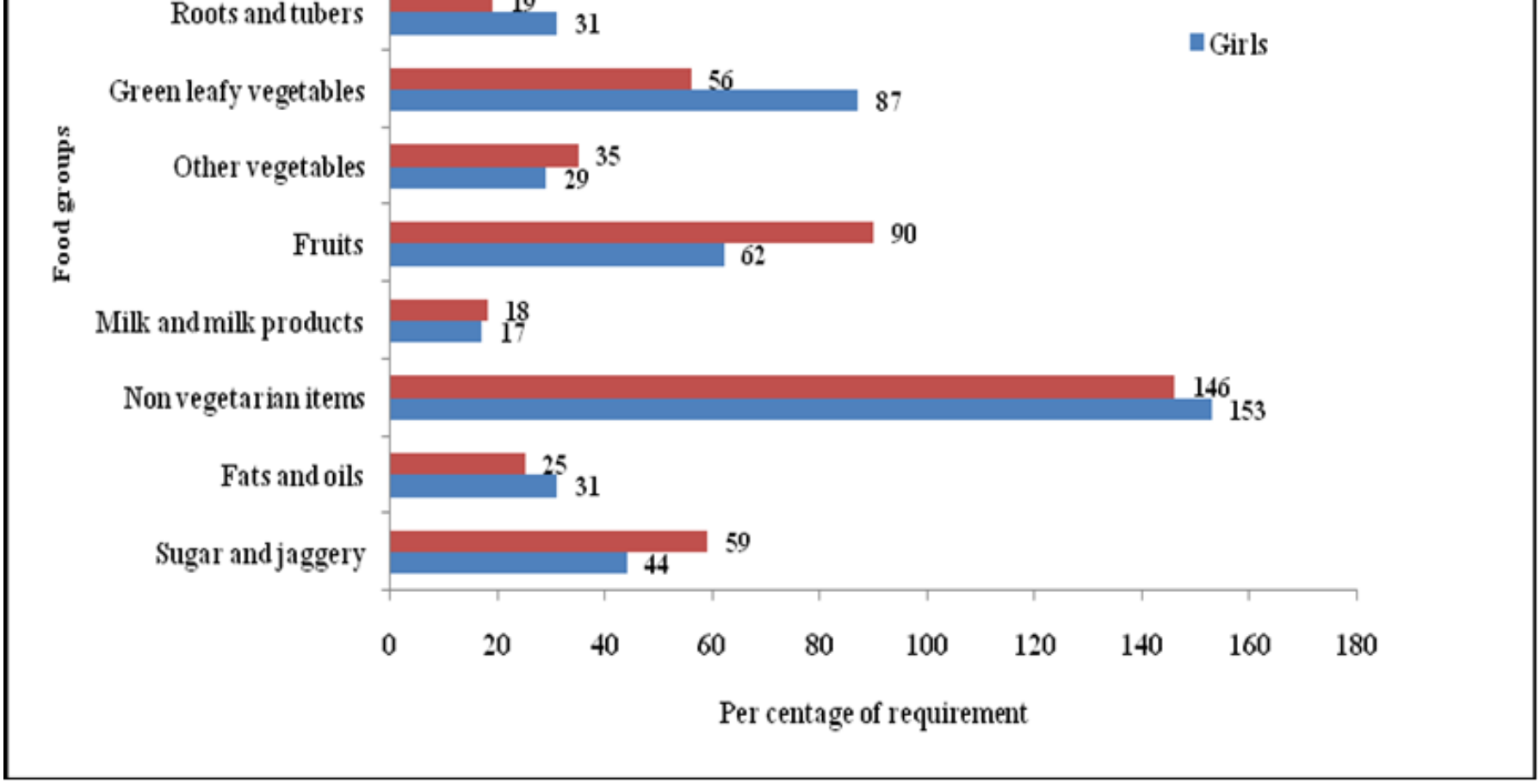


Fig. 20. Average daily intake of foods as percentage of requirement (13 to 15 years)

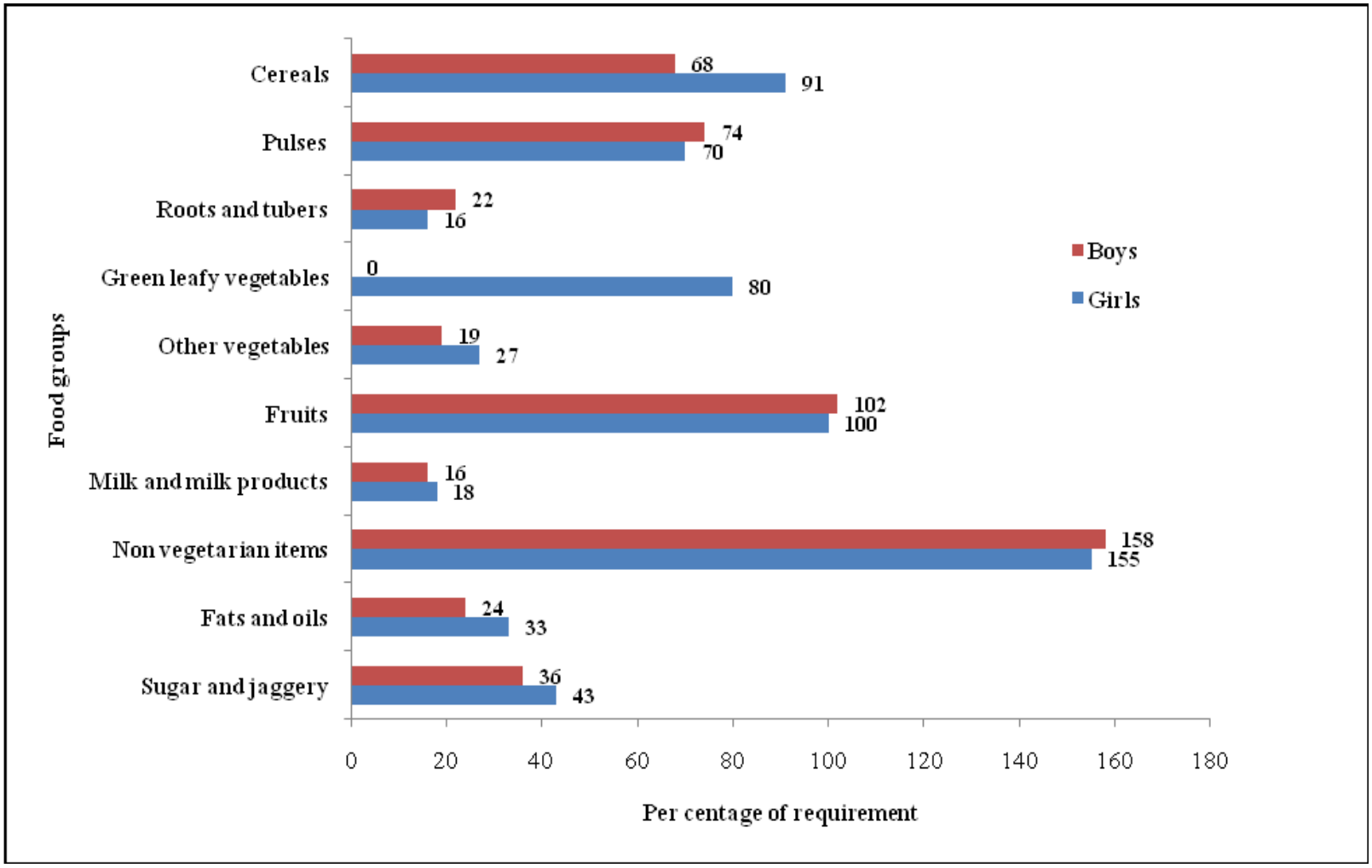


Fig. 21. Average daily intake of foods as percentage of requirement (16 to 17 years)

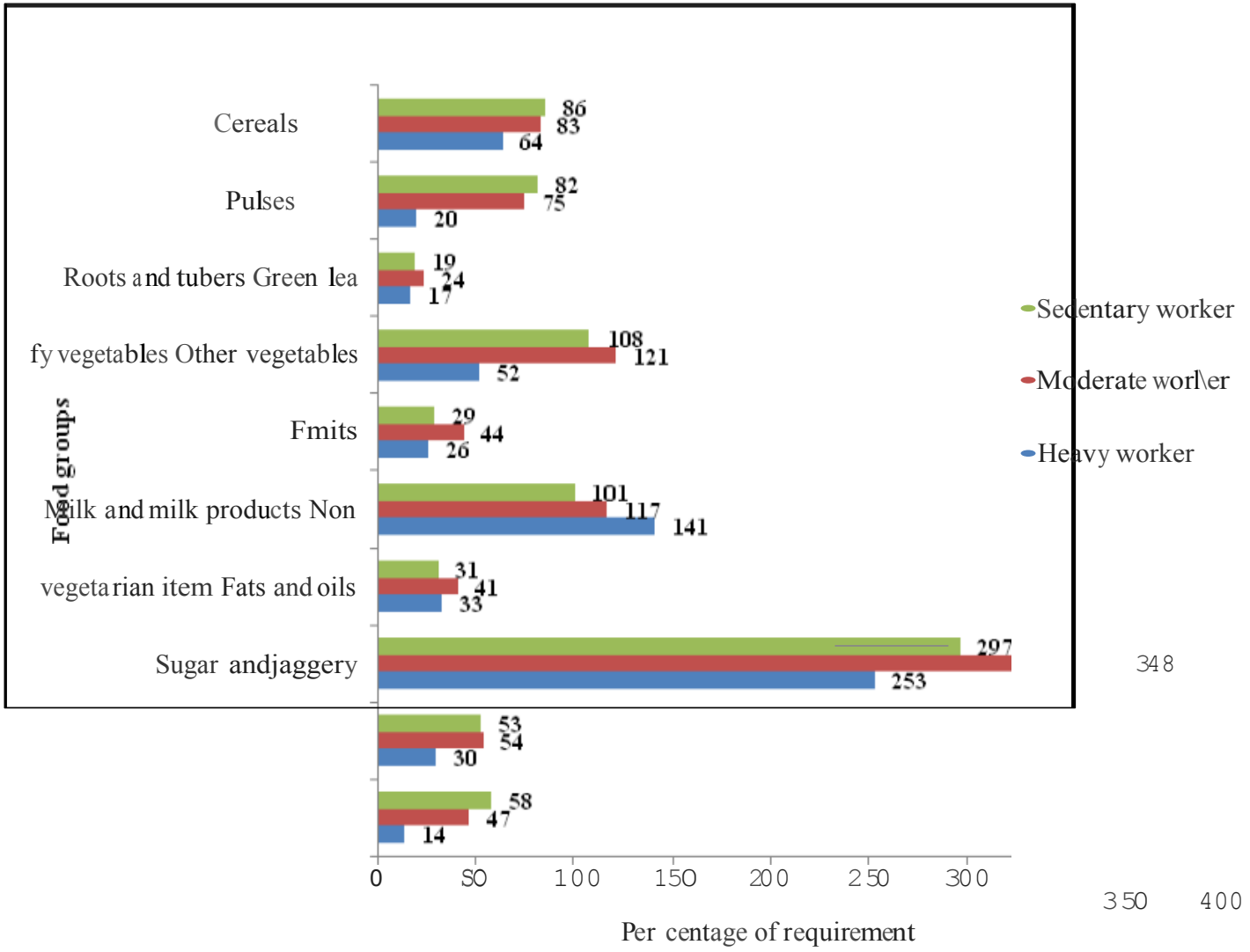


Fig. 22.Average daily intake offoods as percentage of requirement (adult men)

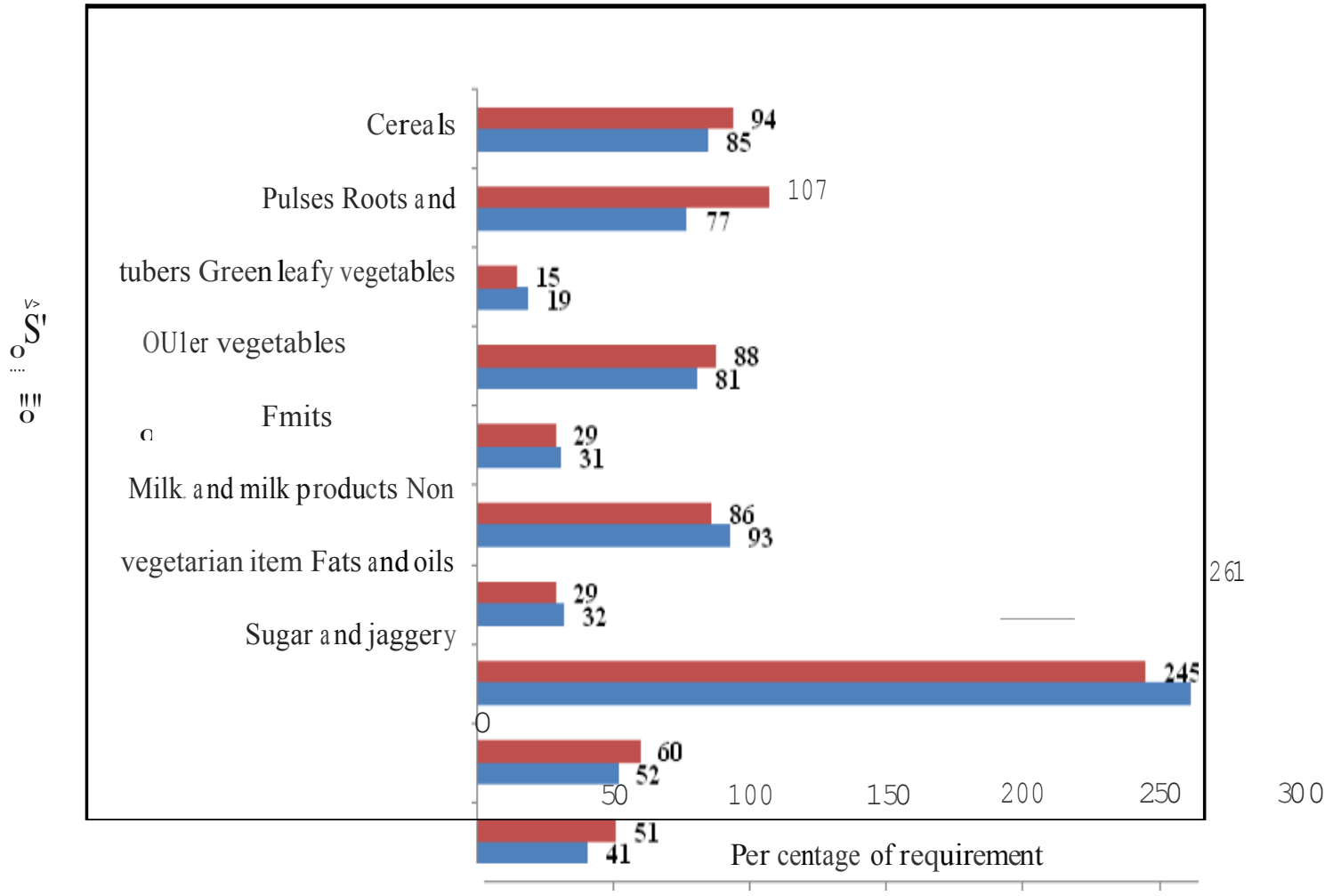


Fig.23.Average daily intake of foods as percentage of requireillent (adult women)

aged 10 to 12 years, the protein intake met 25 to 50 per cent of RDA. It was interesting to note that among 87 per cent of children below 10 years, the protein intake was found to be more than 75 per cent of RDA. However, the intake of calcium, iron, carotene and vitamin C among most of the family members including children provided less than 25 per cent of RDA.

It was also seen that none of the families consumed the required amount of macro as well as micronutrients. Thus, among the BPL families of Central Kerala more than 75 per cent of RDA of energy, protein and fat was met only by 11.75 per cent, 11 per cent and 22.5 per cent of the families respectively. The intake of energy, protein and fat was found to be in between 25 to 75 per cent of RDA respectively among 86.5 per cent, 80.25 per cent and 67.75 per cent of the families. The intake of calcium and iron was found to be below 50 per cent of RDA among 90.75 per cent and 92 per cent of the families respectively. The intake of carotene was also found to be below 25 per cent of RDA among 91.5 per cent of families. The intake of riboflavin was found to be below 75 per cent of RDA among all families and majority (65.75%) met less than 25 per cent of RDA. Thiamine intake met more than 50 per cent of RDA only among 62.75 per cent of the families.

Thus, gross nutritional inadequacy was noticed among majority of the families as well as family members in different age and sex categories. The studies conducted by NNMB (2006) in nine states of India including Kerala also indicated gross inadequacy of vitamin A, calcium, vitamin C and iron among different age groups including children below three years. Even, the intake of all macro nutrients was lower than the RDA among different age groups. In the families only 0.25 to 11.5 per cent met more than 100 per cent of RDA for energy, protein, fat, iron, carotene, thiamine, niacin and vitamin C. Thus, in the present study inadequacy of almost all food groups as well as most of the nutrients was noticed among different age groups as well as selected families.

5.4. Nutritional status of family members

Nutritional status of children, adolescents, adults and elderly were assessed using different anthropometric indices. Body weight and height of children upto 12 years were interpreted by comparing with the standard measurements for respective age groups and were categorised into different grades of nutritional status. Among

children below five years, head and chest circumferences as well as mid upper arm circumferences were also used to find out their nutritional status. In the case of adolescents, adults and elderly, body mass index was computed and interpreted using the classification suggested by WHO (2004) for Asian population.

Weight for age is the most sensitive index to assess the current nutritional status. The pattern of prevalence of malnutrition among children below six years interpreted on the basis of weight for age classification indicated that 60.51 per cent of children had different grades of malnutrition. The overall proportion of children with moderate to severe undernutrition was observed to be 22.69 per cent. These children can be considered as 'at risk' group from public health point of view. Though, the prevalence of different grades of malnutrition was almost equal among boys (60%) and girls (61%), moderate and severe grades of malnutrition was prevalent more among girls (27.12%) when compared to boys (18.33%). Anusha (2012) also indicated higher prevalence of moderate types of malnutrition among girls when compared to boys and severe malnutrition only among boys.

Height is an indicator of long term nutritional status and deficit in height is considered as a measure of chronic malnutrition. As a result, children may look apparently normal but when the height is compared with standard height for age considerable growth retardation may be evident. On the basis of height for age also, 52 per cent boys as well as 54 per cent girls had different grades of malnutrition. Here also severe stunting was observed more among girls (27.12%) when compared to boys (15%). However, marginal and moderate malnutrition were observed more among boys. Anusha (2012) also indicated height deficit among 50 per cent boys and 55 per cent girls. Aneena (2003) in her study among preschool children reported severe growth retardation more among boys (48%) than girls (43%) on the basis of height for age. Studies conducted by Banerjee and Anindita (2002), Sachithananthan and Chandrasekhar (2005), Rao *et al*. (2005) and Hari (2008) also reported different grades of malnutrition among preschool children. As observed in the present study, Rao *et al*. (2005) and Hari (2008) indicated the prevalence of malnutrition more among girls when compared to boys. Studies conducted by NNMB (2006) also indicated 22 per cent of preschool children below 5 years in Kerala as 'at risk' on the basis of weight for age classification. As observed in the present study, NNMB (2006) indicated more undernutrition and stunting on the basis of weight for age and height

for age among girls than boys in India as well as in Kerala. With respect to height for age also nearly 51.5 per cent of children below five years in India were stunted with the lowest percentage (32.8%) in Kerala to a maximum in Orissa (61.1%). NNMB (2006) observation also indicated higher percentage of stunting among girls when compared to boys in the below five year category in Kerala.

Mid Upper Arm Circumference is recognised as a good index of muscle development. It was found that 25 per cent boys and 16 per cent girls below three years had MUAC below 13.5cm. Among four to six year category, 2.78 per cent boys had a lower measurement. Contrary to this, normal MUAC measurements were observed among children by Anusha (2012).

The head/chest circumference ratio is a good indicator of the nutritional status of children in between six months to five years. On the basis of this index, 54.05 per cent boys and 76.92 per cent girls had normal nutritional status and altogether only 34 per cent children were categorised as malnourished with head/chest circumference ratio more than or equal to one. Anusha (2012) in her study also indicated malnutrition only among 25 per cent children on the basis of head /chest circumference ratio. However, in contrast to the present finding, Anusha (2012) indicated malnutrition on the basis of head/chest circumference ratio more among girls when compared to boys.

School age period is nutritionally important to build up body stores of nutrients required for rapid growth in adolescents. Malnutrition during this period will adversely affect school performance, body functions and physical growth. In the present study, the mean body weight and height of seven to nine year boys was found to be high when compared to girls while among 10 to 12 years, girls had better weight and height. Here also 60 and 55 per cent of children in the age group of 7 to 12 years were malnourished on the basis of weight for age and height for age classification. Underweight and stunting was found more among boys aged 7 to 12 years. Similar trend of better nutritional status among girls in the school age on the basis of weight for age and height for age classification was noticed by Sunita and Jain (2005), NNMB (2006), Anusha (2012), Kawade and Chandrakala (2012).

On the basis of weight and height measurements of children up to 12 years, only very few children had severe malnutrition indicating wasting and stunting.

Twenty eight per cent of children were found to be having normal nutritional status on the basis of these two measurements. Contradictory to these findings, Dutta *et al*. (2009), indicated normal nutritional status only among 10 to 11 per cent of children on the basis of weight for age and height for age classification. However, Chandran (2010) reported normal nutritional status among 52 per cent of children in Kerala on the basis of weight for age classification. Ten per cent of children with normal nutritional status on the basis of weight for age were found to be marginally malnourished on the basis height for age. However, severe stunting was observed only among 0.77 per cent of children who had normal weight for their age.

Though, rapid growth and maturation with many physical and mental changes take place during adolescence, it is considered as a vulnerable period as far as nutrition is considered. While comparing mean height and weight of adolescent boys and girls, it was seen that boys had better weight and height measurements when compared to girls. Forty five per cent of adolescents in the age group of 13 to 17 years had normal BMI with equal percentage among boys and girls. Almost similar findings with respect to nutritional status of adolescents was indicated by Patil *et al.* (2009), Adilakshmi *et al*. (2012), Poonam and Pandey (2012), Srilatha *et al.* (2012) in different parts of the country. About eight per cent of adolescent boys and girls had overweight or obesity. Studies conducted by Moradi *et al*. (2012), Aggarwal and Malhotra (2012) and Sudhakar *et al*. (2012) also indicated overweight and obesity among 21 per cent, 87 percent, 27 per cent of adolescents in Tirupati, New Delhi and Guragoan respectively. Contradictory to these findings, Paul (2001), Venkaiah *et al*. (2003), NNMB (2006) and Anusha (2012) observed high prevalence of under nutrition among adolescent boys.

In the case of adult men and women, the prevalence of undernutrition was found to be high among women (21.10%) when compared to men (8.18%). NNMB (2006) and Anusha (2012) also noticed slightly higher percentage of undernutrition among women. However, Udaya (1996), Smitha (1999) and Lawrence (2003) indicated almost similar results as observed in the present study among women agricultural labourers who reported 19 to 32 per cent chronic energy deficiency among women labourers. As observed in the present study, NNMB (2006) also indicated CED among 21.10 per cent of women in rural areas of Kerala. Mohapatra *et al*. (2001), Jyothi (2003) and Smitha (2003) reported higher percentage of CED in the

range of 43 to 53 per cent among women labourers. WHO (2004) suggested that among Asian population BMI more than 23kg/m^2 is a risk factor for coronary artery diseases. According to this, 35 per cent of adult men and 38 per cent of women were found to be having over weight or obesity. Parvathy and Begum (2007) noticed obesity among 30 per cent of women in low income families. Glawe *et al*. (2008), Latheef (2012), Naik and Prakash (2012), Dhipali and Rajeswari (2012) and Athulya (2012) also reported similar findings among women. Obesity was more predominant among women which could be due to the hormonal changes when reaching menopause.

With an improvement in life expectancy, care of the aged is also becoming very important. In the present study, the mean weight and height of elderly men was found to better when compared to women. Better nutritional status on the basis of BMI was found among elderly men when compared to women. Similar findings were reported by Anusha (2012) among elderly belonging to the agricultural labourer households. However, Ariappa *et al*. (2004) indicated high prevalence of CED among elderly men in rural India when compared to women.

In the case of elderly, 12.90 per cent men and 33 per cent women had a BMI above 23 kg/m^2 and could be considered as 'at risk' for coronary artery diseases. Lower body weight among women was also reported in the studies conducted by Anusha (2012).

An indepth study to assess the actual food and nutrient intake of women and preschool children conducted by one day weighment method of dietary survey during the three periods indicated a gross deficit in the intake of almost all food groups in the diet of women and preschool children during different periods. It was seen that among the different food groups, only the intake of cereals and non vegetarian items mainly fish met more than the RDA suggested among both groups.

Regarding the inclusion of different foods in the daily diet of women and children, it was seen that cereals and fats and oils were included in the diet of all women and preschool children during all the three periods on the days the weighment survey was conducted. Most of the subjects in the two groups included sugar or jaggery also in their diet. With respect to the inclusion of pulses, roots and tubers and other vegetables more than 50 per cent of the subjects did not include these essential

food items in their diet. The percentage varied from 25 to 82 per cent among women and children. Green leafy vegetables and fruits were included in the diet of only 5 to 11 per cent of women. Same trend was also observed in the dietary pattern of preschool children with respect to the inclusion of different food groups. Among the animal food stuffs fish was included in the diet by 70 to 75 per cent of women and preschool children. However, most of the subjects did not include milk and milk products in the diet. In concordance with the results of this study, Seshadrinath (1993), Shobha and Sheela (2004), Seralathan *et al*. (1993) also indicated deficit of all food groups in the diet of women. As observed in the study Lawrence (2003) and Anusha (2012) indicated high intake of flesh foods among women. In the case of preschool children also, the deficit in the intake of almost all food groups was observed by Aneena (2003) and Anusha (2012).

With respect to the nutritional quality of the diet, gross inadequacy was observed in the intake of all nutrients except niacin during the three periods in the diet of women and children. Different studies conducted by Udaya (1996), Smitha (1999), Jyothi (2003), Lawrence (2003), Narayana and Sathiya (2004), Yenagi *et al*. (2007) and Anusha (2012) also noticed lower intake of almost all nutrients in the diet of women. Gross deficit in the nutrient intake was observed in the diet of preschool children also in the studies conducted by Aneena (2003) and Anusha (2012). Same trend in the intake of food and nutrients was noticed in the recall method of dietary survey also among women and children. The deficit in the intake of micronutrients like provitamin A, vitamin C, iron and riboflavin was found to be more than 50 per cent of the RDA.

Clinical examination is the most effective measure to find out the nutritional deficiencies among individuals. The results of the clinical examination to find out the deficiency symptoms among the selected women and preschool children indicated nutritional deficiency symptoms only among 2 to 15 per cent women and 2 to 12 per cent of children. Most important manifestation was found to be dental caries among 15 per cent women and 12 per cent children. Different studies conducted by Udaya (1996), Smitha (1999), Lawrence (2003), Jyothi (2003) and Anusha (2012) also noticed dental caries as the most important clinical manifestation among women. Among preschool children also studies conducted by Jose (1998), Mathen (1998), Aneena (2003) and Anusha (2012) noticed dental caries. In the NNMB (2006) study,

though various deficiency symptoms like night blindness, conjunctival xerosis, bitot's spot, angular stomatitis, cheilosis, glossitis, koilonychia, spongy bleeding gums and dental fluorosis were not noticed in any of the women and preschool children in Kerala, highest per centage of dental caries (31.9%) was reported among women in Kerala. NNMB study also indicated dental caries among four per cent of preschool children.

Biochemical examination of blood for haemoglobin indicated mild form of anaemia among 40.82 per cent women and 31.71 per cent children. Moderate anaemia was noticed only among 12.24 per cent women. Nutritional anaemia has been reported as a major micronutrient deficiency among Indian women of reproductive age. NIN (2007) noticed 89.2 per cent prevalence of anaemia among non pregnant non lactating women in Kerala with 75.2 per cent prevalence in India. Studies conducted by Ranganathan (1996), Jyothi (2003), Deepa (2009) and Anusha (2012) also indicated haemoglobin level below 12 g/dl among women indicating anaemia among more than 85 per cent of women in Kerala. Compared to the previous studies the prevalence of anaemia was comparatively low among women in the BPL families of Central Kerala. Though NFHS 3 (2005) data indicated anaemia among 58.2 per cent of Indian women in the age group of 15 to 49 years, in Kerala the prevalence was reported to be only 32.7 per cent. However, among preschool children, the prevalence of mild anaemia was found to be comparatively low. Sixty eight per cent of children had a normal hemoglobin level. Clinical manifestations of severe anaemia like pale face and koilonychia were not detected among women and preschool children.

Other blood parameters like total protein, albumin and serum creatinine levels were found to be in the normal range among all women and preschool children indicating adequate protein nutritional status among the subjects. This is also confirmed in the protein intake of the subjects conducted through recall and weighment methods of dietary surveys in which about 50 to 75 per cent and above 75 per cent of RDA of protein was met by women and preschool children respectively. This might also be due to the adequate inclusion of fish in their diet. However, among five per cent of children, serum globulin levels was in the higher range leading to low serum albumin /globulin ratio which is indicative of infective or intestinal disease or liver or renal diseases.

5.5. Food and nutritional security of the families

The food security status of the families determined using USDA (2000) core module and MSSRF (2008) indicators were categorised into four groups. The categorisation was done for families with and without children. In the case of MSSRF (2008) indicators, the details pertaining to children in the age group of less than six years only were taken into consideration, where as in USDA (2000) module, children up to the age of 17 years were considered. On the basis of the USDA module, only 15.50 per cent of the families in the Central Zone of Kerala were found to be food secure. Food security was found to be high in families without children when compared to families with children. Thus, 85 per cent of the families in the Central Zone of Kerala were found to be food insecure with 43.75 percentage of families with food insecurity without hunger and 36 per cent with moderate hunger. Only 4.75 per cent had food insecurity with severe hunger. On the basis of MSSRF indicators also 80 per cent of families had food insecurity with 37.75 per cent families with mild food insecurity and 27.25 per cent with moderate food insecurity. Severe food insecurity was noticed in 15 per cent of families. As per MSSRF indicators also, only 19.75 per cent of families were categorised as food secure. Though, the food secure families with and without children was found to be equal (19%) as per MSSRF index, moderate food insecurity was found to be more in families with children. In the USDA module also, food insecurity with moderate hunger was noticed more among families with children. Studies conducted by Kigutha *et al*. (1998), Albert and Sanjur (2000), Nnakwe and Yegammia (2002), Nord *et al.* (2001), Lawrence (2003) and Anusha (2012) also indicated higher percentage of food insecurity in the households with children. Vijayan (2003) noticed food insecurity in all the households of agricultural labourers in Kerala. Vijayakumar *et al.* (2007) reported food insecurity with moderate hunger in Tamil Nadu. Subhashree (2012) noticed food insecurity among 43 per cent of families in Cochin. Gupta *et al.* (2012) noticed food insecurity with and without hunger among 23 to 49 per cent families in Delhi. Slightly higher percentage of food secure families noticed as per MSSRF indicators when compared to USDA core module might be due to the variations in the indicators used and due to the actual values for energy and iron intake and height of children taken to compute the food security status. Other factors like access to safe drinking water and the better access to toilet within premises might have also influenced the food security status of

families. The food security status of households using USDA module was determined through an interactive session which may not contain the realistic situation as the respondents may have their own way of response. When the food security status was measured using MSSRF indicators and USDA core module, almost similar trend was noticed with respect to food security status and thus it can be concluded that both measurements are synonymous for measuring food security.

In the case of nutritional security, only 16.25 per cent of the families were nutritionally secure. Here also better nutritional security was observed in the families without children. Different grades of nutritional security were more in families with children. In the case of nutritional security of the family members also, most of the family members in different age and sex categories obtained a nutritional score of 30 and below indicating nutritional insecurity among family members. When the nutritional security in any form was viewed, it was found that only 3.28 per cent of children in the age group of four to six years, 13.23 to 33.33 per cent of adult men, 4.06 to 7.54 per cent of adult women were nutritionally secure. Thus, the study indicated nutritional insecurity among different age groups and in the families.

When the food and nutritional security status obtained were cross tabulated, it was seen that though, 15.5 per cent of the families were food secure, majority (43.75%) were at least food insecure to a mild extent without hunger. The observations of nutritional security among the food insecure families were also found to be extremely rare.

From the impact of food security on the nutritional status of women and children, it was seen that in food secure families the chances of women having a healthy nutritional status is 74 per cent indicating that every 74 of the 100 families which are food secure are also nutritionally secure with respect to the nutritional status of women. The fact that 26 per cent of the families though food secure are nutritionally insecure indicated the lower amount of care given to women atleast in a small percentage families. This might be possibly due to the fact that these families are giving more emphasis on caring their children. This also indicated that nutritional security of women in these families is given least importance irrespective of the food security of the families. The positive correlation found between food security of the families and nutritional status of children indicated a healthy nutritional status based

on weight and height among children in families having food security. This also revealed the care imparted to children by the families.

Among the different factors affecting food security, family size was found to be the most important factor during all the three stages. The odds ratio for family size, income and expenditure on food was found to be significant for the first stage of transition from food insecurity with severe hunger to food insecurity with moderate hunger. In the second stage of transition from food insecurity with moderate hunger to food insecurity without hunger, family size, income, food expenditure and expenditure incurred for fish were found to be significant. During the final stage of transition i.e. food insecurity without hunger to a stage of food security, only family size was significant. Anusha (2012) in her study on the food security status of farm labour households of Kuttanad also indicated family size as the important factor influencing food security. However, Vijayaraghavan *et al*. (1998) observed low per capita income, high level of illiteracy, non ownership of land and lower agricultural production as the factors influencing food security. Albert and Sanjur (2000) indicated per capita monthly income, social class and number of children in households as important determinants of food security. Factors like income, family type, family size and location of residents were indicated by Prema (2001) as the factors having direct relationship with food security. Influence of large family size on food security was reported by Thimmayamma (1983), Yesoda (1990), VonBraun and Lorch (1991), Sikwela and Mpuzu (2008) and Anusha (2012). Dewalt *et al.* (1990), VonBraun and Lorch (1991), Viswanath (2001), Tarasuk (2001) and Sheikh (2007) reported the influence of household's income on food security.

SUMMARY

6. SUMMARY

The present study entitled **"Food and Nutritional Security Scenario of BPL Families of Central Zone of Kerala"** was undertaken with the objectives of assessing the extent and determinants of food and nutritional security among the BPL families of Central Kerala and to study the impact of food security on the nutritional status with special reference to women and preschool children. All the four districts of Central Zone of Kerala namely Thrissur, Ernakulam, Palakkad and Malappuram were selected for the study. From each of these districts, two blocks and from each block, one panchayat was selected randomly. Thus, eight blocks and eight panchayats were selected from Central Kerala. From each the selected panchayats, two wards were selected randomly. Thus, a total 16 wards were selected for the study. From each of the selected wards, 25 families belonging to BPL category were selected randomly from the records maintained by the concerned Taluk Rationing Officer of each district. Thus, 400 BPL families were selected from Central Zone of Kerala. To conduct the detailed study, a subsample comprising of 15 women in the age group of
25 to 35 years and 15 preschool children in the age group of 3 to 5 years were selected from each district comprising a total of 60 women and 60 preschool children from the Central Zone.

The food security of the selected families were assessed by the three criteria of food security namely access, availability and absorption. Access and availability were determined by assessing socioeconomic status, food consumption pattern, food purchasing pattern and food and nutritional adequacy of the families. Absorption was determined by assessing nutritional status of the family members. Overall food security was measured using the modified version of USDA (2000) and the index developed by MSSRF (2008). Nutritional security of the families was determined by taking into account the nutrient intake of family members.

The survey data was triangulated and supplemented with the help of key informants through a series of Participatory Rural Appraisal (PRA) sessions. Thirty key informants which comprised of 15 women and 15 preschool children taken as subsamples from each district were selected for conducting the PRA sessions.

Socioeconomic as well as food consumption pattern of the families were assessed using a pretested interview schedule. Food purchase inventory for a week was conducted for collecting details about food purchasing pattern of the families. Food adequacy of the families was determined by conducting one day recall survey. Food purchase inventory and one day recall survey were conducted thrice during March to May (summer season), June to August (rainy season) and November to January (winter season).

The nutritional status of the family members was determined by taking anthropometric measurements of all family members. To find out the actual food and nutrient intake, food weighment survey was conducted among subsamples. This was also repeated thrice during March to May (summer season), June to August (rainy season) and November to January (winter season). Clinical examination to find out the deficiency symptoms and biochemical examination of blood for haemoglobin, total protein, albumin, globulin and creatinine were conducted among women and preschool children.

Socioeconomic profile of the families revealed that 78 per cent of the families belonged to Hindu community and 39.5 per cent belonged to backward caste. Nuclear family system was noticed among 69.5 per cent of families. Majority of families (59.75%) had four to six members. Age and sex wise distribution of family members revealed that 48.85 per cent male and 47.43 per cent female members were in the age group of 20 to 49 years. Educational status of members above 18 years showed that 92.49 per cent male and 81.7 per cent female members were literate. About 51 per cent of the family members above 18 years were working as labourers on daily wages which comprised of 68.41 per cent male and 34.70 per cent female members. Regarding the educational and occupational status of the head of the family, it was found that 31.75 per cent had lower primary level education and 58 per cent were working as labourers on daily wages.

The monthly income of 72 per cent of the families varied from Rs.4001/- to Rs. 12,000. Details on possession of land revealed that only 56.25 per cent possessed land handed over by their ancestors. Majority of the families had no agricultural crops in their land. Only 33 per cent had domestic animals and 84.5 per cent did not earn any income from domestic animals. It was found that only 27.25 per cent had the

habit of saving money and saved in group insurance (82.57%), post office (10.09%) and private chitties (7.34%). Only 33 per cent availed loan mainly from bank and co operative society.

The monthly expenditure pattern of the families revealed that 75.50 per cent spent 16 to 50 per cent of their income for food. Majority of families did not spend money for house maintenance (94.75%), education (66.75%) and health (62.25%).

Housing conditions of the families revealed that majority had own houses built with brick as wall material and tiles as roofing and cement as flooring materials. Majority of the houses had two rooms with electricity and toilet facilities. Only 43.25 per cent had own well and rest depended on public tap and public well for drinking water.

Majority of adults had the habit of smoking, alcohol consumption, chewing tobacco, betel leaf etc. Health care facilities in the locality showed that all had proper facilities and 43.75 per cent depended on Primary Health Centre for medical aid. It was observed that 95.50 per cent of families did not indicate any serious health problems among the members. Majority of families (59.50%) received supplements from PHC.

Food consumption pattern of the families indicated three meal a day pattern among 97.50 per cent families and only 36.50 per cent planned their meal in advance. Majority kept regular time schedule for taking meal and did not include raw vegetables and fruits in their diet due to lack of money.

Food expenditure pattern of the families revealed that majority spent upto 10 per cent of their total expenditure incurred for foods to purchase cereals, pulses, fat, spices and condiments and sugar and jaggery. In the case of food purchase, it was found that more than 60 per cent of families purchased non vegetarian items, sugar and jaggery and fats and oils so as to meet above 75 per cent of requirement.

Cereals, pulses, other vegetables, fats and oils, spices, sugar and jaggery and fish were the most frequently used food items. Majority (95.75%) of the families did not face any problems with respect to availability and affordability of food. Preservation and storage practices followed in the families was pickling and storing food in air tight containers respectively.

Food adequacy of the families indicated that cereals, fats and oils sugar and jaggery were the food items consumed by majority of the families during all the three periods of study. Body building foods were included by 32 to 76 per cent of family members and protective foods were included in the diet of 12 per cent of the families. Nutritional adequacy of the families revealed that the intake of all nutrients was significantly lower than RDA among all age and sex categories except protein intake of children, fat intake of adult men engaged in heavy work, niacin intake of adolescent girls in the age group of 16 to 17 years and vitamin C intake of men and women engaged in sedentary activity. It was also seen that among the BPL families of Central Kerala only 22.5 per cent of the families consumed diet so as to meet above 75 per cent of RDA of nutrients. Inadequacy of almost all food groups as well as most of the nutrients was noticed among different age groups. Even, the intake of all macro nutrients was found to be lower than the RDA among most of the age groups.

Nutritional status of children below six years on the basis of weight for age indicated that 40 per cent boys and 38.98 per cent girls had normal nutritional status and 41.67 per cent boys and 33.90 per cent girls had grade I malnutrition. In the case of height for age classification, severe malnutrition was observed among 15 per cent boys and 27.12 per cent girls. It was found that only 25 per cent boys and 16 per cent girls below three years had a MUAC below 13.5cm. Among four to six years, only 2.78 per cent boys had a lower measurement. On the basis of head/chest circumference ratio 45.95 per cent boys and 23.08 per cent girls in the age group of six months to five years were found to be malnourished.

In the case of 7 to 12 year children, 2.83 to 29.79 per cent had different grades of malnutrition. On the basis of height for age classification, marginal malnutrition was observed among 25 per cent boys and 33.85 per cent girls. It was also seen that only 29.41 per cent boys and 26.61 per cent girls below 12 years had normal nutritional status on the basis of weight as well as height.

The nutritional status of adolescents on the basis of BMI revealed that 46.05 per cent of adolescents were undernourished. In the case of adults, only 8.18 per cent men and 21.10 per cent women were undernourished. Better nutritional status was observed among elderly men when compared to women.

Actual food intake of women indicated that the intake of all food groups except cereals, pulses, fruits and nonvegetarian foods were lower than the requirement during the three periods of the study. The nutrient intake was also found to be lower than RDA except niacin during all the three seasons. In the case of preschool children, the mean intake of roots and tubers, other vegetables, milk and milk products and fats and oils was found to be significantly lower than the requirement during the three periods of the study. The mean nutrient intake of preschool children was found to be lower than the RDA suggested for different nutrients during all the three periods except fat during winter season.

The important clinical manifestations observed among women were gingivitis, dental caries, loss of luster of hair and loss of luster of skin. Among children, mild angular stomatitis, marked dental caries, loss of luster of skin and hair were the important clinical manifestations.

Biochemical examination of blood for haemoglobin indicated mild anaemia among 40.82 per cent women and 31.71 per cent children. All women and children had normal levels of serum protein, serum albumin and serum creatinine. Serum globulin level was found to be slightly higher among 4.88 per cent children and hence a lower albumin-globulin ratio of less than 1.1:1.

Food security status of the family's interpreted using USDA (2000) core module indicated that only 15.50 per cent of families were food secure. Food insecurity was found to be high in families with children when compared to families without children. On the basis of MSSRF (2008) indicators also food insecurity was noticed among majority of the families. Moderate food insecurity was observed among 33.73 per cent of the families with children and 25.55 per cent of the families without children. On the basis of nutritional security score, only 16.25 per cent families were nutritionally secure and comprised of 13.25 per cent families with children and 17.03 per cent without children. Food and nutritional security status when taken together, it was seen that only very few families had food as well as nutritional security. Impact of food security on the nutritional status of women and preschool children revealed a positive impact of food security on the BMI of women. The odds of having a normal BMI when there is food security was found to be 74 per cent. The impact of food security on the nutritional status of preschool children was

also found to be significant. The most important factor influencing food security was found to be the size of the family followed by monthly income, food expenditure and expenditure on fish.

From this study it is clear that the problem of severe food insecurity exists only in a small population of BPL families of Central Kerala. Mild to moderate food insecurity is more prevalent in the studied population. Although they are spending major proportion of their income for purchase of food, their food intake pattern was found to be totally an unbalanced one with more importance for non vegetarian foods. Now a day's people are conscious about maintaining their health and they are aware about the role of food in maintaining health. But they are totally unaware about the importance of having a balanced diet. Socioeconomic factors and family size are the major factors influencing food choices and thus in turn food security. To improve the food and nutritional security of the BPL families the following points may be considered.

Majority of BPL families depend on PDS for food grains and they are not benefiting from it as we are envisaging. Monitoring of food distribution system should be channelised in an effective manner and it should reach the targeted population.

Although we have achieved self sufficiency in food grain production, post harvest loss is very high. To reduce the post harvest loss, storage facilities have to be improved even at block and panchayat level.

The health and nutritional programmes in our state for the vulnerable groups mainly focuses on supplementary nutrition and in eradication of nutrition deficiency related problems. Achieving food and nutritional security should become a part of such programmes.

Improving the income of families is also very important to achieve food security. For this self employment avenues for women can be encouraged.

Nutritional awareness programmes should become a part of all developmental activities. Importance of balanced diet and nutrition gardening in homesteads should be encouraged for achieving self sufficiency in case of vegetables and fruits.

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APPENDICES

APPENDIX 1

Interview schedule to elicit information on socioeconomic status of the families

1. Name of the respondent :
2. Address :
3. Place :
4. Block :
5. Panchayat :
6. Ward, House No: :
7. Type of family :
8. Religion/ Caste :
9. Monthly income of the family :
10. Educational and occupational status of family members :

Sl.No:	Age	Educational qualification	Occupation	Gross income/month

11. Do you have own land? : Yes / No

    If yes, total areas of land :

12. Do you have any agricultural crops within land?: Yes / No

    If yes, details

Sl. No.	Name of the crop	Net income per year

13. Do you have any domestic animal :Yes / No

    If yes, from where did you get it? : Purchased From government / From neighbours

14. Income from domestication of animals :

15. Do you have the habit of saving money? :Yes / No

If yes, give details

Sl.No.	Type of savings	Amount/year
1		
2		

16. Have you availed any loan? : Yes / No

If yes, give details

Sl. No.	Source of loan	Amount	Period			Purpose	Amount to be repaid per month
			ST	MT	LT		

17. Monthly expenditure pattern

Sl.No.	Items	Amount spent/month	Mode of payment	% total income
1	Food			
2	Clothing			
3	Kitchen equipments			
4	Maintenance of house			
5	Transport			
6	Recreation			
7	Education			
8	Electricity			
9	Health			
10	Fuel			
11	Repayment			
12	Rent			
13	Cattle feed			

18. Housing conditions

i)Type of house : Own / Rented

If rented, monthly rent for this house :

ii) Number of rooms : One / Two / Three or more

iii) Walls : Brick / Mud / Thatched

iv) Floor : Cement/ Tiled / Mud

v) Roof :Thatched / Tiled / Terraced

vi) Does the household utilise electricity? : Yes / No

vii) Do you have proper toilet facilities? : Yes / No

If yes, give details : Own / Public / Open area / Pit latrine

viii) Source of drinking water : Own well / Public tap / Public well / Pond / Neighbours / River / Rain water

ix) Mode of waste disposal :Properly disposed at home Improperly disposed at home / Improper disposal at outer surroundings

x) General sanitary condition :House surrounded by human and animal waste / House yard is clean

xi) Leisure time activities : Radio / Television / Newspaper/ Magazines

Others, specify

xii) Details of kitchen utensils : Pressure cooker / Mixie / Grinder

Others, specify

xiii)Fuel used for cooking : Gas stove / Kerosene / Electric heater / wood / Agricultural waste / Cow dung / Biogas

19. Personal Habits

i) Do you or any member of the family have the habit of : Alcohol consumption /smoking / Chewing tobacco/ Chewing pan / Chewing betel leaf

If yes, how often? : Daily / At least once in a week

20. Health Aspects

a) Do you have any health facilities in your locality? : Yes / No

If yes, specify : PHC / Private hospital /

Government hospital

b) Average distance to nearest hospital :

c) When you are ill, do you make use of the health facilities in the locality? : Yes / No

If no, give reasons : Lack of money / Too far away/ Family members do not allow

Others, specify :

d) If yes, purpose of visit to the health facility : Treatment of illness / Immunisation / accident / Birth control / Injection / Prenatal care

e) Do you have any health problems related to unhealthy habits? : Yes / No

If yes, give details :

f) Do you receive any vitamin or mineral supplements from the PHC or health centre : Yes / No

If yes, give details : Powders / Tablets / Tonics /

Others, Specify :

g) Frequency of receiving supplements :

21. Details on morbidity and mortality pattern

a) Have you or any member suffered from any illness during the last one year : Yes / No

Specify the illness : Fever / Cough / Cold / Diarrhoea / Dysentry Other conditions

b) Epidemic prevalent in the locality in the past one year : Measles / Chicken pox / Typhoid/ Whooping Cough/ Mumps

Others, specify :

c) Do you or any member used any deworming treatment during the past one year? : Yes / No

22. Immunisation given for children

a) Do you give any immunisation for your child? :Yes / No

b) If yes, give details (Name of immunisation and age at which it is given):

If no, give reasons

APPENDIX
II

Interview schedule to collect information on food consumption pattern of the families

1. Name of the respondent :
2. Place of survey :
3. Food habit : Veg/ Non-veg
4. Details of food expenditure

Sl. No	Food items	Place of purchase	Frequency of purchase	Cost / Month	% of total income
1	Cereals				
2	Pulses				
3	Green leafy vegetables				
4	Other vegetables				
5	Roots and tubers				
6	Fruits				
7	Fats and oils				
8	Spices and condiments				
9	Sugar and jaggery				
10	Milk and milk products				
11	Meat				
12	Fish				
13	Egg				
14	Others, specify				

5. Details of frequency of using various food items

Sl No	Food items	Daily	Weekly thrice	Weekly twice	Weekly once	Monthly twice	Monthly once	Occassio -nally	Never
1	Cereals								
2	Pulses								
3	Green leafy vegetables								
4	Other Vegetables								
5	Roots and Tubers								
6	Fruits								
7	Oils and fats								
8	Spices and Condiment								
9	Sugar and jaggery								
10	Milk and milk products								
11	Meat								
12	Fish								
13	Egg								
14	Others, specify								

6. Eating habits

i) Do you have the habit of taking food at regular time every day ?

: Often / Some times /

Never ii) Do you or any member usually skip breakfast?

:Yes / No

If yes, specify why? : Lack of money / Prefer fast food / Unawareness / Lack of time / Others, specify

iii) Do you include raw vegetables and fruits in your family diet? : Yes / No

If no, specify the reason :

If yes, frequency of consumption and details of food item :

iv) Which type of food do you eat regularly? : Ready to eat / Home made

If so, specify the reason : Convenience / Taste / Present trend / Cost / Health consideration

7. Details about meal pattern

i) Do you plan your meal in advance? : Yes / No

ii) Number of meal/day : One / Two/ Three

8. Coping strategies adopted during food crisis

i) Do you or any of your household experienced any kind of food crisis during the previous year? : Yes / No

ii)Do you have any problem with availability /affordability of food? : Yes/No

If yes, mention the period and the coping strategy adopted during the period : Reduce the number and amount of meals /Purchase lower quality foods / Purchase food items on credit / Borrowing from others / Selling assets

Others, specify :

ii) What are the strategies you have taken to feed children during food crisis :Give packed lunch supplied by private agencies / friends / School meal

Others, specify

Details regarding preservation and storage practices

9. Do you preserve any food at home? : Yes / No

10. Mention the preservation methods adopted to foods

Sl. No.	**Food items**	**Preservation method used**	**Duration of preservation**

11.Do you store any food items at home ? : Yes / No

If yes, give details

Sl.No.	**Food items**	**Storage method used**	**Duration of storage**

One day recall survey

Sl.No.	Meal time	Menu	Food item	Quantity (g)
1	Early morning			
2	Breakfast			
3	Lunch			
4	Evening tea			
5	Dinner			
6	Any other			

Food purchase inventory schedule

SI. No.	Name of item purchased	Quantity purchased (day)						
		1	2	3	4	5	6	7

APPENDIX - III

SCHEDULE FOR CLINICAL ASSESSMENT

1. Sex:
2. Age:
3. Height:
4. Weight:
5. General appearance: 1. Good
   2. Fair
   3. Poor
   4. Very poor

6. Eyes

   a) Conjuctiva

   i) Xerosis : 1. Absent, glistening and moist
   2. Slightly dry on exposure for a minute /lack of luster
   3. Conjunctiva dry and wrinkled
   4. Conjunctiva very dry and bitot's spots present

   ii) Pigmentation: 1. Normal colour
   2. Slight discolouration
   3. Moderate browning in patches
   4. Severe earthy discolouration

   iii) Discharge: 1. Absent
   2. Watery, excessive larchymation

   b) Cornea

   i) Xerosis: 1. Absent
   2. Slight dryness and diminished sensibility
   3. Haziness and diminished transparency
   4. Ulceration ii)

   Vascularisation: 1. Absent
   2. Corneal infection
   3. Vascularization of cornea

   iii) Folliculosis: 1. Absent
   2. A few granules

3. Lids covered with extensive granules

4. Hypertrophy

d) Functional

i) Night blindness: 1. Absent

2. Present

7. Mouth a)

Lips

i) Condition: 1. Normal

2. Angular stomatitis,mild

3. Angular stomatitis, marked

b)Tongue

i) Colour: 1. Normal

2. Pale but coated

3. Red

4. Red and raw ii)

Surface: 1. Normal

2. Fissured

3. Ulceration

4. Glazed and atropic

c) Buccal mucosa

i) Condition: 1. Normal

2. Bleeding and/or gingivitis

3. Pyorrhoea

4. Retracted d)

Gums Condition: 1. Normal

2. Bleeding

e) Teeth

i) Fluorosis: 1. Absent

2. Chalky teeth

3. Pitting of teeth

4. Mottled and discoloured teeth ii)

Caries: 1. Absent

2. Slight

3. Marked

8. Hair

i) Condition: 1. Normal

2. Loss of luster

3. Discoloured and dry

4. Spares and brittle

9. Skin

i) General appearance: 1.Normal

2. Loss of luster

3. Dry and rough or Crazy pavement

4. Hyperkeratosis, phrynoderma ii)

Elasticity: 1. Normal

2. Diminished

3. Wrinkled skin

10. Face: 1. Normal

2. Nasolabial seborrhea

3. Symmetrical suborbit pigmentation

4. Moon face

11. Oedema

i) Dstribution: 1. Absent

2. Oedema on dependent parts

3. Oedema on face and dependent parts

12. Bones

i) Condition: 1. Normal

2. Stigmata of past rickets

13. Alimentary

i) Appetite: 1. Normal

2. Anorexia

ii) Stools: 1. Normal evacuation

2. Diarrhoea iii)

Liver: 1. Not palpable

2. Palpable

iv) Spleen: 1. Not palpable

2. Palpable

APPENDIX - IV

Food security core module questionnaire

1. Stage 1. Which of these statements best describes the food eaten in your household in the last twelve month.
   a. We have enough of the kinds of food we want to eat.
   b. We have enough food but not always the kinds of food we want c. Some times we do not have enough to eat.
   d. Often we do not have enough to eat.

   1a. **if the answer is c or d in question No.1,**

   Why you don't always have enough to eat (mark all that apply)

   a) Not enough money for food

   b) Not enough time for shopping or cooking. c) Very difficult to go the market.

   d) On dieting

   e) Not able to cook or eat due to health problems.

   1b. **If the answer is 'b' in question No.1**

   Why you don't always have the kinds of food you have want to eat a) Not enough money for food.

   b) Kinds of food required are not available.

   c) Not enough time for shopping or cooking d) Too difficult to go to the market.

   e) On a special diet.

   For the following statements please put tick mark for the answers for the last 12 months.

2. We are worried whether our food would run out before we get money to buy more in the last 12 months.

   a) Often true b) Some times true c) Never true d) Refuses

3. The food we brought just didn't last and we didn't have money to get more in the last 12 months.

   a) Often true b) Some times true c) Never true d) Refuses

4. We could not afford to eat balanced meals in the last 12 months.

   a) Often true b) Some times true c) Never true d) Refuses

If the family is having children below 18 years ask

5. We relied on only a few kinds of low cost food to feed our children because we were running out of money to buy food.

a) Often true b) Some times true c) Never true d) Refuses

6. We could not feed our children balanced meal because we couldn't afford

that a) Often true b) Some times true c) Never

true d) Refuses

Stage. 2. If the answers for questions 2 to 6 is often true or sometimes true or the response is 'c' or 'd' to question no.1 then continue stage.2. Otherwise skip to end. If there are children below 18 in the household.

7. Our children were not eating because we just couldn't afford enough food in the last 12 months.

a) Often true b) Some times true c) Never true d) Refuses/ Don't know

8. In the last 12 months did you or other adults in your households ever cut the size of meals or skip meals because there wasn't enough money for food.

Yes/No

If yes, how often did this happen

a) Almost every month b) Some months but not every month c) Only 1 or 2 months d) Refused / Don't know.

9. In the last 12 months did you ever eat less than you felt you should because there wasn't enough money to buy food?

Yes/No/Refused / Don't know.

10) In the last 12 months, when you were hungry you didn't eat because you could not afford enough food

Yes/No/Refused / Don't know

11. In the last 12 months, did you loose weight because you didn't have enough money for food

Yes/No/Refused / Don't know

If the answer is yes to questions 7 to 11 please ask 12 to 16.

12. In the last 12 months, did you or other adults did not eat for a whole day because there wasn't enough money for food

Yes/No/Refused / Don't know

If yes, how often did this happen.

a)Almost every month b) Some months but not every month c) Only 1 or 2 months d)Refused / Don't know.

13. In the last 12 months, did you ever cut the size of children's meal because there was not enough money for food?

Yes/No/Refused / Don't know

14. In the last 12 months, did the children ever skip meal because there was not enough money for food?

Yes/No/Refused / Don't know

If yes, how often did this happen

a) Almost every month b) Some months but not every month c) Only 1 or 2 months d) Refused / Don't know.

15. In the last 12 months, was your child hungry because you just couldn't afford more food?

Yes/No/Refused / Don't know

16. In the last 12 months, did your child ever not eat for a whole day because there wasn't enough money for food?

Yes/No/Refused / Don't know

APPENDIX - V

Food security scale values and status levels corresponding to number of affirmative responses

Number of affirmative responses		Food security scale value	Food security status level	
(Out of 18) Households with children	(Out of 10) Households without children		Code	Food security status
0	0	0	0	Food secure
1	1	1		
		1.2		
2		1.8		
	2	2.2		
3		2.4	1	Food insecure without hunger
4		3		
	3	3		
5		3.4		
	4	3.7		
6		3.9		
7		4.3		
	5	4.4		
8		4.7	2	Food insecure with moderate hunger
	6	5		
9		5.1		
10		5.5		
	7	5.7		
11		5.9		
12		6.3		
	8	6.4		
13		6.6	3	Food insecure With severe hunger
14		7		
	9	7.2		
15		7.4		
	10	7.9		
16		8		
17		8.7		
18		9.3		

APPENDIX – VI

Food security scale values obtained for families with and without children

Family No. (with children)	Affirmative responses	code	scale value	Family No. (without children)	Affirmative responses	code	scale value
1	4	1	3	2	2	0	2.2
3	6	1	3.9	8	2	0	2.2
4	6	1	3.9	9	6	2	5
5	3	1	2.4	10	0	0	0
6	1	0	1	12	6	2	5
7	6	1	3.9	16	1	0	1.2
11	3	1	2.4	19	1	0	1.2
13	0	0	0	21	3	1	3
14	0	0	0	22	5	1	4.4
15	3	1	2.4	24	3	1	3
17	5	1	3.4	25	1	0	1.2
18	3	1	2.4	26	5	1	4.4
20	1	0	1	27	3	1	3
23	7	1	4.3	31	3	1	3
28	3	1	2.4	32	5	1	4.4
29	8	2	4.7	33	3	1	3
30	1	0	1	35	3	1	3
34	5	1	3.4	36	4	1	3.7
39	2	0	1.8	37	6	2	5
40	4	1	3	38	3	1	3
41	5	1	3.4	43	1	0	1.2
42	5	1	3.4	44	3	1	3
45	3	1	2.4	46	6	2	5
48	7	1	4.3	47	6	2	5
53	3	1	2.4	49	7	2	5.7
54	8	2	4.7	50	3	1	3
56	3	1	2.4	51	6	2	5
57	0	0	0	52	5	1	4.4
58	3	1	2.4	55	8	2	6.4

59	3	1	2.4	61	4	1	3.7
60	9	2	5.1	63	7	2	5.7
62	3	1	2.4	66	8	2	6.4
64	13	3	6.6	68	3	1	3
65	9	2	5.1	83	7	2	5.7
67	1	0	1	84	5	1	4.4
68	3	1	2.4	85	5	1	4.4
69	11	2	5.9	86	7	2	5.7
70	3	1	2.4	87	3	1	3
71	13	3	6.6	88	7	2	5.7
72	4	1	3	89	3	1	3
73	5	1	3.4	90	3	1	3
74	14	3	7	92	3	1	3
75	4	1	3	93	6	2	5
76	6	1	3.9	94	6	2	5
77	4	1	3	99	0	0	0
79	4	1	3	103	3	1	3
80	4	1	3	105	5	1	4.4
81	7	1	4.3	106	5	1	4.4
82	7	1	4.3	107	2	0	2.2
91	1	0	1	113	6	2	5
95	6	1	3.9	116	7	2	5.7
96	9	2	5.1	117	0	0	0
97	3	1	2.4	119	2	0	2.2
98	5	1	3.4	120	3	1	3
100	3	1	2.4	121	5	1	4.4
101	6	1	3.9	123	1	0	1.2
102	5	1	3.4	127	5	1	4.4
104	3	1	2.4	130	2	0	2.2
108	9	2	5.1	132	2	0	2.2
109	4	1	3	134	5	1	4.4
110	8	2	4.7	135	5	1	4.4
111	13	3	6.6	142	8	2	6.4
112	4	1	3	143	1	0	1.2
114	8	2	4.7	144	3	1	3

115	4	1	3	145	3	1	3
118	6	1	3.9	147	4	1	3.7
122	14	3	7	149	2	0	2.2
124	7	1	4.3	150	2	0	2.2
125	3	1	2.4	152	3	1	3
126	9	2	5.1	153	8	2	6.4
128	5	1	3.4	154	3	1	3
129	6	1	3.9	156	4	1	3.7
131	6	1	3.9	157	8	2	6.4
133	12	2	6.3	158	5	1	4.4
136	14	3	7	162	5	1	4.4
137	8	2	4.7	165	2	0	2.2
138	12	2	6.3	169	0	0	0
139	12	2	6.3	170	7	2	5.7
140	3	1	2.4	172	5	1	4.4
141	12	2	6.3	173	7	2	5.7
146	11	2	5.9	175	0	0	0
148	8	2	4.7	176	3	1	3
151	12	2	6.3	177	5	1	4.4
155	8	2	4.7	180	2	0	2.2
159	10	2	5.5	184	3	1	3
160	11	2	5.9	187	1	0	1.2
161	8	2	4.7	188	1	0	1.2
163	11	2	5.9	189	5	1	4.4
164	1	0	1	190	7	2	5.7
166	13	3	6.6	196	4	1	3.7
167	11	2	5.9	197	3	1	3
168	3	1	2.4	199	3	1	3
171	13	3	6.6	200	2	0	2.2
174	6	1	3.9	202	7	2	5.7
178	8	2	4.7	203	6	2	5
179	12	2	6.3	205	5	1	4.4
181	10	2	5.5	210	3	1	3
182	6	1	3.9	212	8	2	6.4
183	9	2	5.1	213	7	2	5.7

185	7	1	4.3	214	2	0	2.2
186	14	3	7	217	3	1	3
191	8	2	4.7	221	3	1	3
192	7	1	4.3	222	5	1	4.4
193	8	2	4.7	227	3	1	3
194	11	2	5.9	228	8	2	6.4
195	6	1	3.9	229	7	2	5.7
198	6	1	3.9	233	3	1	3
201	13	3	6.6	241	2	0	2.2
204	13	3	6.6	243	7	2	5.7
206	11	2	5.9	244	5	1	4.4
207	10	2	5.5	245	5	1	4.4
208	11	2	5.9	247	1	0	1.2
209	8	2	4.7	253	5	1	4.4
211	9	2	5.1	257	1	0	1.2
215	12	2	6.3	258	7	2	5.7
216	7	1	4.3	259	4	1	3.7
218	11	2	5.9	260	3	1	3
219	12	2	6.3	261	3	1	3
220	12	2	6.3	262	5	1	4.4
223	10	2	5.5	264	4	1	3.7
224	11	2	5.9	265	0	0	0
225	11	2	5.9	267	3	1	3
226	9	2	5.1	269	8	2	6.4
230	11	2	5.9	270	3	1	3
231	11	2	5.9	271	7	2	5.7
232	11	2	5.9	279	1	0	1.2
234	3	1	2.4	286	8	2	6.4
235	1	0	1	287	2	0	2.2
236	13	3	6.6	288	3	1	3
237	8	2	4.7	290	2	0	2.2
238	4	1	3	291	3	1	3
239	4	1	3	294	4	1	3.7
240	6	1	3.9	297	3	1	3
242	9	2	5.1	298	3	1	3

246	15	3	7.4	299	7	2	5.7
248	10	2	5.5	302	7	2	5.7
249	12	2	6.3	306	1	0	1.2
250	12	2	6.3	307	1	0	1.2
251	8	2	4.7	308	7	2	5.7
252	6	1	3.9	309	3	1	3
254	6	1	3.9	311	3	1	3
255	8	2	4.7	312	7	2	5.7
256	9	2	5.1	314	3	1	3
263	12	2	6.3	317	3	1	3
266	8	2	4.7	318	8	2	6.4
268	2	0	1.8	319	3	1	3
272	11	2	5.9	325	2	0	2.2
273	9	2	5.1	331	0	0	0
274	11	2	5.9	332	4	1	3.7
275	13	3	6.6	333	6	2	5
276	10	2	5.5	337	5	1	4.4
277	9	2	5.1	339	1	0	1.2
278	6	1	3.9	341	2	0	2.2
280	4	1	3	342	3	1	3
281	12	2	6.3	343	7	2	5.7
282	6	1	3.9	348	6	2	5
283	9	2	5.1	351	3	1	3
284	4	1	3	354	2	0	2.2
285	6	1	3.9	359	2	0	2.2
289	11	2	5.9	361	2	0	2.2
292	11	2	5.9	363	3	1	3
293	12	2	6.3	365	3	1	3
295	7	1	4.3	368	5	1	4.4
296	10	2	5.5	369	2	0	2.2
300	7	1	4.3	372	7	2	5.7
301	10	2	5.5	373	2	0	2.2
303	7	1	4.3	374	6	2	5
304	7	1	4.3	375	7	2	5.7
305	7	1	4.3	387	2	0	2.2

310	11	2	5.9	388	1	0	1.2
313	7	1	4.3	389	2	0	2.2
315	13	3	6.6	391	0	0	0
316	7	1	4.3	392	2	0	2.2
319	14	3	7	399	6	2	5
320	11	2	5.9	400	2	0	2.2
321	12	2	6.3				
322	4	1	3				
323	11	2	5.9				
324	10	2	5.5				
326	7	1	4.3				
327	10	2	5.5				
328	12	2	6.3				
329	10	2	5.5				
330	12	2	6.3				
334	10	2	5.5				
335	7	1	4.3				
336	2	0	1.8				
338	7	1	4.3				
340	12	2	6.3				
344	10	2	5.5				
345	3	1	2.4				
346	12	2	6.3				
347	11	2	5.9				
349	13	3	6.6				
350	3	1	2.4				
352	7	1	4.3				
353	4	1	3				
355	9	2	5.1				
356	7	1	4.3				
357	3	1	2.4				
358	7	1	4.3				
360	11	2	5.9				
362	12	2	6.3				
364	8	2	4.7				

366	12	2	6.3				
367	10	2	5.5				
370	4	1	3				
371	9	2	5.1				
376	10	2	5.5				
377	9	2	5.1				
378	12	2	6.3				
380	9	2	5.1				
381	5	1	3.4				
382	14	3	7				
383	5	1	3.4				
384	9	2	5.1				
385	3	1	2.4				
386	10	2	5.5				
390	12	2	6.3				
393	7	1	4.3				
394	6	1	3.9				
395	8	2	4.7				
396	4	1	3				
397	3	1	2.4				
398	13	3	6.6				

FOOD AND NUTRITIONAL SECURITY SCENARIO OF BPL FAMILIES OF CENTRAL ZONE OF KERALA

By

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ABSTRACT OF THE THESIS

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ABSTRACT

The study entitled **"Food and Nutritional Security Scenario of BPL Families of Central Zone of Kerala**" was undertaken to assess the extent and determinants of food and nutritional security among the BPL families of Central Kerala and to study the impact of food security on the nutritional status of women and preschool children. All the four districts of Central Zone of Kerala namely Thrissur, Ernakulam, Palakkad and Malappuram were selected for the study. A total of 400 BPL families comprising 100 families from each district formed the sample for the study. Detailed study on nutritional status of women and preschool children as well as Participatory Rural Appraisal (PRA) were conducted among 60 women in the age group of 25 to 35 years and 60 preschool children in the age group of 3 to 5 years.

The food security of the families was assessed by the three dimensions namely food access, availability and absorption of nutrients. Access and availability were assessed by the socioeconomic status, food consumption pattern and food purchasing pattern of the families. Absorption was determined by assessing the nutritional status of the family members. Overall food security of the families was measured using USDA (2000) module and MSSRF (2008) index. Nutritional security of the families and family members were determined from the intake of nutrients.

Nuclear family system with four to six members was observed among most of the families. Educational and occupational status indicated that most of the adult members were literate and working as labourers on daily wages. The monthly income of 72 per cent of families varied from Rs. 4001/- to 12,000/. Most of the families did not earn any income from domestic animals and 27.25 per cent had the habit of saving money. The monthly expenditure pattern of the families revealed that 76 per cent spent up to 50 per cent of their income for food. Most of the families had own houses built with bricks, tiled roofing and cement flooring. Electricity and toilet facilities were present in almost all houses. Health care facilities were found to be satisfactory and 82 per cent of families utilised the public health facilities available in their locality.

Three meal a day pattern was followed by 98 per cent of the families and they kept regular time schedule for taking meal. However, only 37 per cent planned their

meal in advance and only 48 per cent of families included raw fruits and vegetables in their diet.

Most frequently used food items were cereals, pulses, other vegetables, fats and oils, sugar and fish. Green leafy vegetables, roots and tubers, fruits, milk and milk products and eggs were used to a lesser extent. All families spent upto ten per cent of their food expenditure for the purchase of cereals. Fifty five to 61 per cent of the families spent 11 to 20 per cent of the monthly food expenses for the purchase of fish and other vegetables. The quantity of vegetables, fruits and milk and milk products purchased by majority of the families satisfied less than 25 per cent of the requirement. Gross inadequacy in the intake of all food groups except non vegetarian items was noticed among the family members. The intake of macro and micronutrients was also found to be lower than the recommended dietary allowances suggested by ICMR.

Different grades of malnutrition were noticed among children, adolescents and adult members. On the basis of anthropometric indicators, normal nutritional status was noticed only among 37 per cent children below 12 years, 45 per cent adolescents, 48 per cent adults and 55 per cent elderly. Gross deficit in the intake of certain food groups and nutrients was also noticed among women and preschool children. Mild form of nutritional anaemia was prevalent among 40.82 per cent women and 31.71 per cent preschool children. However, clinical signs of nutritional deficiencies were noticed only to a lesser extent among women and preschool children. The blood profile for serum protein, albumin, globulin and creatinine was also found to be in the normal range indicating adequacy in the protein status among women and preschool children.

The overall food and nutritional security was found to be below 20 per cent among the BPL families of Central Kerala. Families without children had better food and nutritional security. Comparatively, severe food and nutritional insecurity affected only a small proportion of the families. Mild to moderate forms of insecurity were more prevalent. Food security had a positive impact on the nutritional status of women and preschool children. Among the different factors affecting food security, family size was found to be the most important one.