VITAMIN A AND IRON NUTRITIONAL STATUS OF NUTRITIONALLY VULNERABLE SEGMENTS OF POPULATION SUBSISTING ON HORTICULTURE CROPS AND DAIRY FARMING IN EAST GODAVARI DISTRICT OF ANDHRA PRADESH

By

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THESIS SUBMITTED TO THE
ANDHRA PRADESH AGRICULTURAL UNIVERSITY
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN THE FACULTY OF HOME SCIENCE

DEPARTMENT OF FOOD AND NUTRITION
POST GRADUATE AND RESEARCH CENTRE
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CERTIFICATE

This is to certify that the thesis entitled, VITAMIN A AND IRON NUTRITIONAL STATUS OF NUTRITIONALLY VULNERABLE SEGMENETS OF POPULATION SUBSISTING ON HORTICULTURE CROPS AND DAIRY FARMING IN EAST GODAVARI DISTRICT OF ANDHRA PRADESH submitted in partial fulfilment of the requirements for the degree of DOCTOR OF PHILOSOPHY IN HOME SCIENCE of the Andhra Pradesh Agricultural University, Hyderabad, is a record of the bonafide research work carried out by Ms.M.ARUNA under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee.

No part of the thesis has been submitted for any other degree or diploma or has been Published. The published part has been fully acknowledged. All the assistance and help received during the course of investigations have been duly acknowledged by the author of the thesis.

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LIST OF SYMBOLS AND ABBREVIATIONS

NNAPP	:	National Nutrition Anaemia Profilaxis Programme
NNMB	:	National Nutrition Monitoring Bureau
ICDS	:	Integrated Child Development Scheme
ICMR	:	Indian Council of Medical Research
WHO	:	World Health Organisation
HPLC	:	High performance liquid chromotography
IUGR	:	Intra-uterine growth rate
gms	:	grams
IU	:	International unit
Hb	:	Haemoglobin
g/dl	:	grams/decilitre
mg	:	milligrams
ug	:	micrograms
ul	:	microlitre
MT	:	Million tonnes
lt	:	litres
kg	:	kilograms
et al.	:	et allii (and others)
Fe	:	Iron
TS	:	Transferrin saturation
TIBC	:	Total iron binding capacity
KAP	:	Knowledge attitude practices
RDI	:	Recommended dietary intake
ha	:	Hactares
%	:	percentage

ACKNOWLEDGEMENTS

First and foremost, I offer my obeisance to the Almighty God for having bestowed his grace on me to complete this task.

Gratitude one feels from the heart cannot be exactly expressed in words. Hence, I find myself crippled in expressing my deep sense of indebtedness to the honourable members of the Advisory Committee.

Feverntly and modestly, I extol the genuine cooperation, inspiration and affection offered to me by the Chairman of my Advisory Committee, ***Dr. (Mrs.) Vijaya Khader****, Professor and University Head, Department of Foods and Nutrition, Post Graduate and Research Centre (Home Science), Andhra Pradesh Agricultural University (APAU), Rajendranagar, for the shipshaping of the manuscript. The present work discloses her careful and seasonal criticism and meticulous attention to details. It is indeed a privilege for me to work under her unending inspiration and indomitable spirit.*

I express my deep sense of gratitude to an altruistic academecian endowed with intelligence and dedication to enlighten people ***Dr.(Mrs.) P.Geervani****, Ex-Chairman of the Advisory Committee and former Professor and Head, Department of Foods and Nutrition, Post Graduate and Research Centre (Home Science), Andhra Pradesh Agricultural University (APAU), Rajendranagar, presently working as Vice-Chancellor of Sri Padmavathi Mahila University, Tirupathi. It is she who assisted me in choosing the problem. She guided the work encouraging me to systamatic planning, accuracy, coherent thinking and critical evaluation. I am deeply indebted to Dr.(Mrs.) P.Geervani for her perspicacity and indefatigable in guiding me like a 'Lode star' at every stage of my research work.*

It is with profound sincerity that I acknowledge ***Dr.K.Vijaya Raghavan****, Deputy Director, National Institute of Nutrition, Indian Council of Medical*

Research, Jamai-Osmania, Hyderabad for his guidance at every stage, discrimination, sagacity, coupled with compassion and patience in extending his abiding interest to refine this thesis most explicitly.

I equally owe to **Dr.(Mrs.) P.Yasoda Devi**, Assistant Professor, Department of Foods and Nutrition, Post Graduate and Research Centre (Home Science), Andhra Pradesh Agricultural University (APAU), Rajendranagar, for her interest guidance and for the encouragement extended.

It is with profound sincerity that I acknowledge **Dr.Nageswara Rao**, Professor and University Head, Department of Statistics and Mathematics, APAU, Rajendranagar and **Dr.Satyanarayana**, Associate Professor, Incharge of Computer Centre, APAU, Rajendranagar for their valuable help in statistical evaluation of data.

I express my sincere and heartful gratitude to **Dr.(Mrs.) R.Manorama**, Assistant Professor, Department of Foods and Nutrition, P.G. and Research Centre, APAU, for extending her help in analysing samples in HPLC and also for her valuable guidance in the conduct of my research work.

I am grateful to **Mrs.Sumta Davra**, IAS, Sub-Collector, Rajahmundry for permitting me to utilise the services of Mandal Revenue Office of Kadiammandal. I have immense pleasure in thanking the staff of MRO office and respondents of my study for their cooperation throughout the study period.

I express my sincere thanks to **Mr.B.Potharaju** and **Mr. Krupadanam** for their technical help in collecting serum samples.

I am immensely thankful to all my friends especially **G.Nirmala, Swaroopa Rani, Vijaya Padma, P.Sasikala, D.Sharada, Mary, Vulgenia**

Khasein, Bindu Madhuri, Sreela Govindan, *for their help and also their stimulating companionships during the course of the study. I also wish to thank* ***Uma Nayak and Damayanthi*** *for their constant encouragement.*

I taken this opportunity to express my profound sense of love and gratitude to my brother ***K.H.Reddy*** *and sister-in-law, for providing accomodation, constant encouragement which is a source of inspiration to me.*

But for the love, affection and transemotional cooperation of my parents, sisters, brother-in-law, evils would have overpowered me and doctoral degree would have remained an unfulfilled dream even today. I am deeply indebted to them.

Mr.Sagar and staff of ***Sagar Computer*** *Centre, Premavathipet deserves the warmth of mother nature for their swift and flawless execution of thesis typing work.*

*I wish to thank Mr.C.***Peddi Reddy** *for the help rendered in taking out the final print.*

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DECLARATION

I, M.ARUNA hereby declare that the thesis entitled, **VITAMIN A AND IRON NUTRITIONAL STATUS OF NUTRITIONALLY VULNERABLE SEGMENETS OF POPULATION SUBSISTING ON HORTICULTURE CROPS AND DAIRY FARMING IN EAST GODAVARI DISTRICT OF ANDHRA PRADESH** submitted to Andhra Pradesh Agricultural University for the Degree of **DOCTOR OF PHILOSOPHY IN HOME SCIENCE** is the result of the original research work done by me. It is further declared that the thesis or any part thereof has not been published earlier in any manner.

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Degree for which it is submitted	:	**DOCTOR OF PHILOSOPHY**
Faculty	:	**HOME SCIENCE**
Major field of study	:	**FOODS AND NUTRITION**
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Year of submission	:	**1996**

ABSTRACT

Vitamin A and iron deficiency had long been a serious hazard to world community especially to children, pregnant and nursing mothers. The main reason for higher incidence of these two micronutrient deficiencies among vulnerable groups is lack of vitamin A and iron in the diet. Food based approach or dietary diversification has thus, a valuable role in contributing to over come vitamin A and iron deficiency anaemia. The advantage is that these encourage community to depend upon themselves and there will not be any more need for supplementary feeding programmes. Hence, an attempt has been made to assess whether horticultural production and dairying had any effect on the vitamin A and iron nutritional status of family.

Food and nutrient intake of pre-school, pregnant and lactating women showed that vegetables and fruits consumption by horticulture based families was found to be significantly ($P<0.01$) more. Whereas milk consumption was significantly higher in dairy dependant families than those of families with other crops. More frequent consumption of green leafy vegetables and fruits was observed in horticultural families which reflected on their micronutrient (Vitamin A, Iron) intake. Similarly, regular consumption of milk was observed in dairy based families. Eventhough the diets of children, pregnant and lactating women were found to be adequate with regard to cereals and other vegetables on the basis of RDA (1992), because of ignorance of mothers their diets are lacking in the intake of protective nutrients like vitamin A and iron.

The clinical and bio-chemical assessment revealed that children though exhibited signs of vitamin A and iron deficiency anaemia, the percentage is being higher in control group. Serum retinol levels and haemoglobin levels of children were significantly ($P<0.01$) better in horticultural families and families maintaining diary than those of control group. Serum vitamin A was found to have positive correlation with haemoglobin, protein and dietary vitamin A.

The anthropometric data revealed that children, pregnant and lactating women had better heights and weights in horticulture, dairy dependant families than the control group, though the differences between groups were not found to be different.

The study showed that the horticultural farming and dairying had a beneficial effect on the vitamin A and iron nutritional status of the families in East Godavari district of Andhra Pradesh.

CHAPTER - I

INTRODUCTION

INTRODUCTION

India is an agricultural country in which almost eighty five per cent of population depends on agriculture. It is the second most populous country in the world. With 2.4 per cent of World's land area, it supports 16 per cent of World's population. From 1981-91 the growth rate of population has declined from 2.2 per cent to 2.14 per cent. However, even if the growth rate is reduced to 1.6 per cent, the population may cross one billion mark by 2000 AD. The burgeoning population not only marginalises the achievements that the nation has made on the economic front but also does not allow the country to substantially enhance the food and nutrition security of the people.

It is extremely important, for ensuring household food security, in a low income country like India, that the growth rate of per capita income be substantial and its distribution among households is commensurate with prevailing disparities in incomes. The growth in per capita income in India has been marginal (Economic survey 1993-94). However, the modest growth rates in per capita income were not good enough to leave a strong impact on the food and nutritional well being of the poor households. But for the existence of extensive rural development programmes, backed with a massive public distribution system, the quality of life of the poor households could not have been maintained at the existing levels. The quantum jump in foodgrains production in 1988-89, when it reached the level of around 180 million tonnes against around 140-143 million tonnes high of previous two years has heaped to a certain extent in helping food security. Foodgrains production thereafter remained between 170 to 180 million tonnes during the next four years (Economic Survey, 1993-94).

The country has achieved self-sufficiency as far as the requirement of cereals are concerned. The daily per consumption unit intake of cereals has been more than recommended dietary intake of 460 gm/cu/day. The consumption of pulses, which is the most important source of protein in India's predominantly vegetarian society is, however, found to be less than RDI levels. The main reason for this is stagnating production of pulses and consequent decline in the per capita availability. Access to available pulses is further impaired due to their high cost (NNMB, 1988-90).

Dairy development fits most appropriately in the country's programme of increasing food production, rural employment and equitable distribution. It directly helps in increasing crop production through making funds available for the purchase of essential inputs e.g., seeds, fertilizers, pesticides, etc. Recognising the multipurpose role of dairying in rural economy in the recent past and to save the milk producers and consumers from exploitation by middleman both union and state governments have launched many developmental programmes. One such programme is 'Operation Flood' (The White revolution). During the past two decades there has been an unprecedented growth in the production of milk by two and half times to 54.9 million tonnes in 1990 (Chatterjee and Acharya, 1992). This increase was achieved largely through better pricing, organized marketing and appropriate farmer's organization. About 70 lakh farm families are benefiting from cooperative dairying. The per capita annual milk availability has been increased from 108 gm/day in 1966 to 178 gms/day in 1990-91. As milk supplies valuable proteins, and also of calcium, riboflavin besides some other nutrients the consumption and availability of these products is important.

Production, availability and consumption of other foodstuffs (apart from cereals and pulses) like vegetables, milk/milk products, fats/oils, roots/tubers etc., are very important to maintain nutritional status of population at household level. As most of India's population belong to vegetarian society, they consume mostly plant foods. Horticultural crop production and availability is necessary to maintain healthy status of population.

In India horticulture crops cover about only 6.8 per cent of the area and contribute to 18 per cent of India's gross agricultural output. India produces 28.39 million tonnes of fruits and 54.36 million tonnes of vegetables. Morethan 50 varieties of vegetable crops are grown in India. The estimated area under vegetable crops is four million hectares (Directorate of Horticulture, 1991-92), which is 2.85 per cent of the total cropped area. The production is about 45 million tonnes. Inspite of better production, there are still some of the deficiencies prevailing in the community.

Vitamins and minerals are essential nutrients which are not synthesised by the body atleast in adequate amounts and hence should be provided through diet. These nutrients are required in small quantities for carrying out the biological functions at optimal level and are called 'micronutrients'.

Though required in microquantities, they are of enormous health significance, taking part in a variety of biological functions such as regulating enzyme and hormone actions, gene expression, cellular proliferation and differentiation, growth and development, immune modulation etc. Indeed they are essential for the metabolism and utilisation of the macronutrients. Through their widespread effects on vital functions that influence human health, micronutrients have a significant impact on the social and economic progress of a nation.

Micronutrient deficiencies like that of vitamin A, iron and B-complex are an important public health problem in the country today. Food based approaches are encouraged to control the same. More than 2000 million people all over the world are reported to be deficient in one or more micronutrients (WHO, 1991). Among the various micronutrients, deficiencies of vitamin A, iodine and iron are found to be widely prevalent among people of developing nations. Serious health consequences due to the deficiencies of these micronutrients are recognised as problems of public health magnitude and have led to the global commitment for their control.

It has been recently estimated that atleast 40 million children in the world are vitamin A deficient. Every year about 250,000 pre-school children in the world are estimated to die of complications associated with vitamin A deficiency. These children mainly belong to 37 developing nations and more than 30 per cent of these children belong to South East Asian countries (ACC/SCN News, 1992). Vitamin A deficiency has been of public health importance in India. Shah (1982) estimated that 7.4 million children had non corneal and 0.22 million children had corneal xerophthalmia out of 92 million child population aged 1 to 5 years. It was further estimated that 52,500 children become blind and 110,000-132,000 become partially blind every year. Quoting an ICDS survey, he also reported the problem of blinding xerophthalmia to be highly prevalent particularly among children living in urban slums compared to rural areas. The prevalence of xerophthalmia identified by the presence of Bitot's spots was 1.8% in children aged between 1-5 years as reported by the National Nutrition Monitoring Bureau (NNMB) in the initial survey carried out during 1975-79. It was also found that 2 per cent of total blindness was contributed by vitamin A deficiency. A repeat survey conducted in 1988-90 revealed about 60 per cent decline in the prevalence of Bitot's spots while the contribution of vitamin A deficiency to blindness dropped to 0.04 per cent (Reddy et al., 1993). However, the prevalence of xerophthalmia still remains at the level of public health significance as per WHO criteria.

Vitamin A interacts with several other nutrients of which its interaction with zinc and iron are well defined. Zinc is found to be essential for mobilisation of vitamin A from liver and also influences the oxidation - reduction of vitamin A in the retina, testes and probably other tissues (Solomons and Russel, 1980). The association of vitamin A deficiency and iron deficiency anemia has been described by several workers (Hodges et al., 1978; Mejia et al., 1977) and has been shown that vitamin A could influence utilisation of iron

(Ram et al., 1977). This observation is of importance in communities where both the deficiencies are coexistant.

The biannual massive oral dose supplementation programme is a short term measure to prevent blindness due to vitamin A deficiency. The strategy which involved administration of 200,000 IU of vitamin A to children between 1-5 years, though in operation in India for over quarter of a century has not had any significant impact on blindness due to vitamin A deficiency. However, improving the diets of infants and children by incorporating vitamin A, and carotene rich foods appears to be a more rational and cost effective long term solution to control vitamin A deficiency (Vijayaraghavan et al., 1995). This requires intense research for developing or identify the ß-carotene rich horticultural plants that are easily cultivable. Innovative methods should be developed to educate the masses to grow these plants in their kitchen gardens and use them in their regular diets.

Nutritional anaemia due to iron deficiency is a global problem and it is estimated that 1.3 billion individuals all over the world are affected by iron deficiency anemia. The prevalence rates are however highest, being of the order of 30 per cent in developing countries compared to 8 per cent in industrialised world (ACC/SCN News, 1992). While iron deficiency occurs at any age and in both sexes, women in reproductive age group and young children are the most vulnerable segments of the population suffering from nutritional anaemia and its severe consequences. Iron deficiency anemia is shown to adversely affect the host resistance mechanisms thus increasing the susceptibility to infections. Epidemiological, experimental and clinical studies demonstrate a significant association between anemia and infection. Children with haemoglobin (Hb) levels less than 10 g/dl are found to have impaired cellular immune functions (Srikantia et al., 1976). Impaired physical work capacity has been demonstrated in labourers. Maternal morbidity, mortality, high incidence of low birth weight and fetal wastage are well known consequences of moderate to severe degrees of anemia during pregnancy (ACC/SCN News, 1992).

Large population surveys carried out in India indicate that anemia is prevalent in all age groups of the Indian population with the prevalence rates being higher in rural India compared to urban areas. The prevalence rates are extremely high in areas like Calcutta where hookworm infestation is very common (Working group on fortification of salt, 1982). The baseline information obtained from the evaluation of the National Anaemia Prophylaxis Programme showed that 87.5 per cent of the pregnant women suffer from anaemia.. Of these 37.6 per cent have Hb levels ranging between 7 and 9 g/dl while 13.1 per cent of the women suffer from severe anemia and have Hb level below 7 g/dl (Reddy et al., 1993).

There are two main approaches to control anemia:

1. To increase dietary iron intake by promoting consumption of foods rich in iron content and enhancing the bioavailability. Green leafy vegetables, fish and meat are rich sources of iron while ascorbic acid improves bio-availability.

2. The second approach is to provide non dietary iron either by fortifying a commonly used food commodity with iron or by providing iron in medicinal form. However, correction of anemia is not achieved through this programme and thus the usage of fortified salt acts as an adjunct to the distribution of iron folate tablets which are mainly meant for control of existing anaemia.

Foods from animal sources i.e., meat, eggs and milk provide large amounts of protein and essential amino acids. They are also valuable sources of micronutrients like vitamin A and iron, contributing greatly to protecting a large number of people from the serious consequences of micronutrient deficiencies. Significant amounts of vitamin A are found in eggs of domesticated animals as well as in milk, and liver is especially rich in the vitamin. The highest vitamin A content is found in sheep (20 mg per 100 g meat). While the meat of fowl also provides a valuable amount. Thus animal husbandry is more important to improve the availability of micronutrients, especially vitamin A and iron. The sale of animal products also provides valuable cash to poor farmers who can then meet their micronutrient requirements by purchasing plant sources.

Food based approach on dietary diversification has thus, a valuable role in contributing micronutrient deficiencies like vitamin A deficiency and iron deficiency anaemia. The advantage is that these encouraged community to depend upon themselves. There will not be any more need for supplementary feeding programmes. An attempt has been made to assess whether horticultural production and dairying had any effect on the nutritional status of family. Hence, "Vitamin A and iron nutritional status of Nutritionally vulnerable segments of population subsisting on horticulture crops and dairy farming in East Godavari district of Andhra Pradesh" has been studied, with the following objectives:

General objective

To assess and compare vitamin A and iron nutritional status (Hb) of pregnant women and pre-school children in families subsisting on horticulture crops and dairy farming.

Specific objectives

1(a) To assess the economic contribution of vegetable crops to the small and marginal farm families.

1(b) To assess the economic contribution of dairy farming to the small and marginal farming families.

2 To assess the food and nutrient intake in a subsample of marginal and small farm families subsisting on horticulture crops/dairy farming and compare with the families not subsisting on these farming systems.

3 To assess the economic value of foods consumed by the families including the foods produced and purchased by these families.

4 Frequency of consumption of vegetables and fruits by vulnerable segments.

5 To assess the vitamin A nutritional status of the pre-school children of the selected families by clinical assessment and 30 per cent of the sample by bio-chemical method.

6 To assess the iron nutritional status of pregnant women and pre-school children in the selected families by estimting haemoglobin level in blood.

7 To assess the growth of all pre-school children in the selected villages by height/weight profile over a period of one year.

8 To assess the KAP of 30 per cent of the selected farm women regarding the nutritional value of horticulture crops and dairy products and problem of vitamin A deficiency and anaemia.

CHAPTER - II

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The majority of the population in India live in rural areas and depend on agriculture for livelihood. A wide variety of vegetables and fruits are grown in tropical countries including India. India is the world's second largest producer of vegetables. Andhra Pradesh is one of the largest states in India in terms of production of cereals as well as horticulture crops. It is also one of the largest producers of milk in the country. Vegetables and fruits constitute an important crop and dietary items, as they provide, minerals, vitamins and roughages, the essentials of a balanced diet. Being one of the cheapest sources of natural foods, vegetables can admirably supplement the cereals. It has been realised that liberal consumption of vegetables can reduce the need of other foods like cereals to a certain extent.

Dairy farming is complementary to Agrifarm. Dairying has enormous potential to improve the socio-economic status of the large percentage of rural population. The milk production in India is mainly in the hands of small and marginal farmers and agricultural labour, who maintain livestock as a means to meet part of their family food requirements and to earn supplementary income (Kurivfen, 1987).

A review of situation with regard to Horticulture, Dairy production and dietary intake and nutritional status of rural population with reference to agriculture production has been reviewed under the following heads.

2.1 PREVALENCE OF VITAMIN A AND IRON DEFICIENCY ANAEMIA

2.1.1 Prevalence of Vitamin A deficiency

Vitamin A deficiency continues to be a significant health problem in many developing countries. Vijayaraghavan et al. (1990) reported that one in one thousand children develop acute corneal disease resulting in permanent blindness. Sommer et al. (1981) reported that, about 500,000 new cases of xerophithalmia, half of which lead to blindness that occur each year in India, Bangladesh, Phillippines and Indonesia and it also increases the risk of mortality by 4 to 12 times. In Indonesia the annual incidence of corneal disease has been reported to be 2-7 per 1000 children (Sommer, 1982). The prevalence of mild xerophthalmia ranges from 1-10 per cent in different parts of India (National Nutrition Monitoring Bureau, 1984). In 1987, Sommer et al. reported that about 40 million children in the world, under age of five are physilogically deficient in vitamin A, of these about 400,000 die each year and more than 2,50,000 become partially and completely blind. Katiyar et al. (1988) revealed that, the prevalence of vitamin A deficiency increased with increasing severity of protein-energy malnutrition and malnourished child had 1.7 times higher risk. Of developing xerophthalmia than a healthy one. The only conflicting report was that of Shukla (1983) who observed a decline in vitamin A deficiency signs with increasing severity of protein-energy malnutrition. This conflict could be attributed to the small sample size on which this study was based.

The Pan American Public Health Organization (PAHO) considers vitamin A deficiency, as a problem of 15 per cent of population has a serum vitamin A level <20 μ/dl (Chopra and Keny, 1970).

The world health organisation biochemical criterion of public health significance is a serum vitamin A level of <10 µg/dl in more than 5 per cent of the population at risk (WHO, 1976). KUmar and Siddhu (1976) reported that, serum vitamin A levels between 10-20 µg/dl is considered as low and deficient if it is less than 10 µg/dl.

International Vitamin A Consultative Group (1980) reported that plasma levels of vitamin A between 10-20 µg/dl considered as well below normal, <10 µg/dl as depletion and >30 µg/dl as normal.

Reddy et al. (1979) reported that childhood infections like measles, diarrhoea and respiratory infections depressed the serum vitamin A levels to 10-20 µg/dl and returned to normal (>20 µg/dl) after recovery. Bhaskaran et al. (1989), Gorgy (1990) suggested that measles depresses vitamin A levels significantly (<10 µg/dl).

Lie et al. (1993) reported that children suffering with diarrhoea and resporatory diseases are likely to become vitamin A deficient with serum vitamin A levels less than 20 µg/dl. Committee on infectious diseases (1993) reported that patients had little or no hepatic reserves of vitamin A when they are infected with measles. World Health Organisation, (1987) recognised children with serum vitamin A levels less than 10 µg/dl to be deficient in vitamin A.

2.1.2 Prevalence of anaemia in the world

Iron deficiency anaemia has caught the attention of scientists from various disciplines for many years throughout the world and it has enhanced tremendously during the last half of the century. Surveys on anaemia were conducted in different population groups in different countries of the world. Nutritional anaemia was prevalent in 20 per cent of US population and about 10-25 per cent of women suffered from anaemia in Europe. In the middle east about 20-25 per cent of pregnant women were found to be anaemic. In Africa about 15-25 per cent of women suffered from iron deficiency. In Asia more than 20 per cent of women and more than 40 per cent of pregnant women suffered from iron deficiency anaemia (Bengoa, 1974).

Herceberg et al. (1986) found that 43 per cent of women were anaemic in South Benin A high incidence (95%) of parasitic infection was observed among them.

Watan be et al. (1986) studied tha Hb levels of farmers in Japan and found that 3.7 per cent of new and 10 per cent of women were having Hb levels <11 g/dl.

Babiker et al. (1989) in a cross sectional study in Saudi found that the incidence of iron deficiency increased with age. At 5 to 6 months age only 3.3 per cent infants had iron deficiency and it increased with age from 9.3 to 12.7 per cent and reached 14.5 per cent in the oldest age group.

Recent reports (De Mayer et al., 1989) revealed that about 30 per cent of world's population are anaemic. Young children and pregnant women are the most affected with an estimated global prevalence of 43 per cent and 51 per cent respectively. Prevalence among school age children is 37 per cent, non pregnant women is 35 per cent and among adult males is 18 per cent. Africa and South Asia have the highest overall regional prevalence of anaemia in all groups is more than 40 per cent in both regions and is as high as 65 per cent in pregnant women in South Asia. In Latin America the prevalence of anaemia is lower ranging from 13 per cent in adult males to 30 per cent in pregnant women. In East Asia prevalence ranges from an estimated 11 per cent in adult males to 22 per cent in children of school age.

2.1.2.1 Prevalence of Anaemia in India

In India various population groups are affected from mild to moderate degrees of iron deficiency.

Agarious et al. (1986) reported that the prevalence of anaemia was 57 per cent and 55 per cent in urban slums and rural areas of Varanasi in India respectively. A nutritional survey conducted by Agarwal et al. (1987) in six districts of Bihar and Five of Uttar Pradesh revealed that 81 per cent of women in Bihar and 87 per cent in Uttar Pradesh were anaemic. Of these 30 per cent in Bihar and 36 per cent in Uttar Pradesh were moderate to severely anaemic.

Sood (1988) reported 20-95 per cent prevalence of anaemia in different segments of population. In Tamilnadu (ICMR 1988-89) prevalence was found to be 19 per cent in Urban and 33 per cent in rural areas. NIN (1988-89) reports that incidence of anaemia was highest in the age group of 2-3 years (57%) around, Hyderabad. In both urban and rural areas 10-20 per cent of adolescent girls (10-16 years) have poor iron stores.

Pushpa Durga et al. (1989) found that 25 per cent of expected mothers were apparently healthy and remaining 75 per cent showed signs of nutritional deficiency. However 93 per cent women suffered from anaemia.

Leela Raman (1990) studied prevalence of anaemia in adolescent girls around Hyderabad, and reported that 22.1 pere cent of girls in urban slums and 25.1 per cent in rural areas suffer from anaemia.

2.2 PRODUCTION AND CONSUMPTION PATTERN OF VEGETABLES AND FRUITS

2.2.1 Vegetable and fruit production in India and Andhra Pradesh

Horticulture covers a wide range of crops such as fruits, vegetables, coconut, cashewnut, spices and ornamental plants. Horticulture in dry and humid areas plays a crucial role in establishing ecological sound farming systems. The development of horticulture faces a number of constraints, such as shortage of quality planting material, lack of complementary development inputs such as credit and extension services, losses due to perishability, lack of suitable post-harvest technology and weak infrastructure. Various schemes are under implementation for the development of horticulture.

In a country marked by malnutrition leafy vegetables have an important role of "protective foods". In India, vegetables constitute 8 to 10 per cent of the total food intakes which is distressingly low compared to developed countries where it constitutes 45 per cent.

The estimated per capita consumption of vegetables in India is around 142 gm, while nutritionists advocate 284 gm in the balanced diet. The present level of production of 45 million tonnes of vegetables is not sufficient and there is need to augment the vegetable production (Narendra, 1992).

In Andhra Pradesh, the total area under vegetables is 1,44,526 hectares in 1991-92. Tomato accounted for the largest area of 41,415 hectares, followed by onion, brinjal 20,612 ha, 17,757 ha respectively. Then followed by beans 7,349 ha and other vegetables 10,271 hectares (Table 1).

Table 1: Important fruits, vegetable and flower crops of the state Andhra Pradesh with approximate area and estimated production for the year 1991-92

Crop	Area in hectares	Estimated production in tonnes
I. FRUITS		
Mango	207596	2491151
Orange and Batavia	30814	462210
Lemon and other citrus fruits	26306	394590
Banana	22164	--
Guava	5363	64356
Sapota	3776	45312
Grapes	2252	56300
Papaya	274	27400
Other fruits	3038	30380
Cashew nut	54144	50486
Other dry fruits	38	380
Coconut	63426	6237 lakh
Total	449191	3622566 & 6237 (lakh nuts)
II. Vegetables		
Tomato	41415	414150
Onion	20615	179350
Brinjal	17757	177570
Tapioca	13686	104013
Bhendi	13352	133520
Gourds	5771	46168
Beans	7349	58792
Greens	4540	27840
Cucumber	4363	43630
Sweet potato	2380	22372
Bottle gourd	786	6288
Cabbage	1010	10100
Potatoes	907	530
Peas	224	2240
Other vegetables	10271	102790
Total	144526	1335273
III. FLOWERS	4176	12528
Grand Total	997893	4970367 & 6237 (lakh nuts)

Source: Directorate of Horticulture consolidated data for the year 1991-92

Subramanyam (1983) indicated that the gross returns per hectare for tomato was Rs.18,289 in kharif and Rs.17,833 in rabi. It was Rs.17,501 for brinjal grown in rabi season. On the basis of input-output ratio, it was found that tomato followed by brinjal are profitable in kharif. Opposite was true in case of rabi season.

Divakar (1986) reported that the total cost of production per hectare of brinjal in kharif ranged from Rs.9,940 to Rs.13,722 from small to large farms. In case of tomato, the total cost of production was Rs.10,707 on small, Rs.12,483 on medium and Rs.11,604 on large farms. The gross income from tomato was observed to be Rs.15,216 whereas net income was Rs.3,695 over cost C and Rs.8,406 over prime costs. For every rupee investment an out turn of Rs.1.32 was realised.

The studies of Kiresur and Kumar (1988) revealed that, in general, vegetables had low cost of production, but received high prices. Cost of production was higher on potato compared to onion and brinjal. Profits were higher in case of onion followed by brinjal and potato. It was observed that tomato was the most profitable crop enterprise with a net profit of Rs.3,195 per acre followed by brinjal and onion.

Among the districts of Andhra Pradesh, East Godavari district accounted for largest area under horticultural crops followed by Kurnool (Table 2).

Table 2: Area under Horticulture crops (District wise)

District	Total vegetables (Hectares)	Total fruits (Hectares)
Srikakulam	4042	5328
Vizianagaram	3393	16727
Visakhapatnam	11331	15247
East Godavari	18623	29643
West Godavari	4378	36182
Krishna	6370	50864
Guntur	8955	10357
Prakasam	7697	6995
Nellore	2400	15053
COASTAL ANDHRA REGION	67196	186396
Kurnool	20881	5354
Anantapur	3861	19544
Cuddapah	4808	20553
Chittoor	1064	22535
RAYALASEEMA REGION	40150	67986

Source: Directorate of Horticulture consolidated data for the year 1991-92

2.2.2 *Consumption pattern of vegetables and fruits*

Many diet surveys have been carried out in India to assess the consumption pattern of foods in different parts of the country and in different segments of population.

Lalitha (1981) studied the influence of various factors affecting the food consumption pattern and nutritional status of children in families of agricultural labourers in Rajendranagar, Bapatla and Tirupathi campuses of the Agricultural University. Food consumption pattern showed that the intake of cereals and vegetables was more than the requirement in all the age groups in the three campuses but the intake of protective foods was below the recommended intake. The intake of calories, protein, calcium and iron were inadequate. Except niacin, the intake of ascorbic acid and other vitamins intake was below the requirement in the three regions.

Pushpamma et al. (1982) observed difference in the vegetable intake of different age groups in rural areas of Andhra Pradesh. Their data on vegetable intake of different age groups is presented in Table 3.

Table 3: Vegetable intake of population in rural areas of Andhra Pradesh, India

(g/day)

Vegetables	Pre-school age	School age	Adolescents	Adults	Elderly people
Vegetables (including roots and tubers)	17	37	56	46	62
Green leafy vegetables	1	5	4.5	4	6

Ramachander et al. (1983) reported that the popular vegetables in India vary in each zone but brinjal, yam, cucumber, chillies, leafy vegetables and okra were popular all over India. In the northern zone potatoes and tomatoes were the most popular. Snakegourd was popular in the Southern and Western zones. No difference in consumption of various vegetables was exhibited either between vegetarians and non-vegetarians or between people of rural or urban origin. There is no difference in consumption of different vegetables by people whose earning capacity is different. But miscellaneous vegetables, which are not the normal ones available in the market are consumed more by higher income groups. The major difference in consumption of different vegetables is between people originating from different zones.

Pushpamma et al. (1984) found that the quantity of vegetables consumed by rural families in Andhra Pradesh was inadequate and the frequency of consumption was also low. The percentage distribution of population by quantity of different vegetables consumed was as follows (Table 4).

The consumption of green leafy vegetables were especially inadequate. The consumption of all the vegetables were low when compared to the ICMR recommended allowances which is 125 g for leafy vegetables, 75 g for other vegetables and 100 g root vegetables/day.

Table 4: The percentage distribution of population by quantity of different vegetables consumed

Quantity (g)/day	Green leafy (%)	Non-leafy (%)	Roots (%)
Below 10	13	7	4
10 - 14	37	11	12
15 - 24	22	9	11
25 - 34	11	11	15
35 - 74	10	26	35
75 - 99	2	14	9
100 and above	5	22	14

Pathak and Goswami (1989) reported a study on food consumption pattern in rural areas of Assam. Findings revealed that the food consumption of the people of rural areas of Assam in terms of quality and quantity is not very low. Because of inequalities of income, poorer section do not possess the economic abilities to obtain food for nutritional adequacy.

Consumption pattern of vegetables in some states in India are reported by the National Nutrition Monitoring Bureau (1988-90) is presented in Table_5.

Table 5: Average consumption of vegetables (g/cu/day)

States	Leafy vegetables	Other vegetables	Roots & tubers
Kerala	9	65	63
Tamilnadu	12	50	40
Karnataka	10	22	31
Andhra Pradesh	7	40	29
Maharastra	13	55	32
Gujarath	4	60	52
Madhya Pradesh	19	49	33

Pingle and Sivakumar (1991) carried out a study and assessed the impact of mango orchards on the consumption of vit.A and prevalence of vitamin A deficiency in pre-school children in the tribal areas. The intakes of ß-carotene were low, almost all of them having an intake far below the recommended requirements. However, with the extensive development of mango orchards, the children were consuming mangoes in substantial amounts during the summer months. The intake of vitamin A per child on the average from these fruits during the season was 1,60,000 IU equivalent to 80 per cent of a massive vitamin A dose given to children during prophylactic programmes. This has probably resulted in building up of the liver stores of vitamin A helping to decrease the vitamin A deficiency in children of mango area in the wet season.

Srivastava and Dogra (1991) carried out a study on consumption of fruits and vegetables in rural Himachal Pradesh. Results revealed that high profitability from fruit has induced a 26.8 per cent shift of area from field crops and 22.6 per cent shift of area from barren and other wastelands in favour of fruit crops. Total consumption expenditure showed an increase overtime both at current and constant prices, which was also reflected in the expenditure on fruit and vegetables. In 1973/74 only 4.16 per cent of total expenditure was spent on fruit and vegetables, which at constant prices increased to 4.74 per cent by 1983-84.

The impact of vegetable farming on the nutritional status of vegetable growers and non vegetable growers was studied (Shantakumari, 1991). It was found, that for per capita /consumption unit the intake of vegetables, fats and oils, sugar and jaggery was significantly more in vegetable growers than non-vegetable growers. The intake of vegetables, fats and oils alone was significantly higher in 1-3 years age groups in vegetable growers than non-vegetable growers. For all food items except for other vegetables, milk and milk products, both vegetable growers and non-vegetable growers failed to meet the RDI. In women and pre-school children, the intake of cereals was also below RDI.

A survey was conducted among 80 households in a community in the Sahelian zone of Chad (Begin et al., 1992) to assess the relationship between household food consumption and individual nutritional status during the non-harvest and harvest seasons. Household consumption was measured by food weighment method over two consecutive days. Energy, protein, iron intake was adequate. Household vitamin A adequacy was a significant predictor of child weight for height and adult body mass index at the harvest season, even when energy adequacy was controlled for. The study shows that weak relationship between household dietary intake and individual nutritional status changed with the seasons and that both provided complementary information on household nutrition.

Singh and Mehta (1994) conducted a food consumption survey among 125 households, which represented the major castes and sub-caste groups, in a village in Hissar district, Haryana, India, in 1985-86 showed that nutrition is a major determinant of the village women's health status. Food intakes were below the recommended dietary allowances, in particular for women belonging to lower socio-economic strata. The consumption of green leafy vegetables was found to be far below the recommended intake for all the respondants. Poverty, lack of knowledge about the nutritive values of various foods, lack of quality foods, and traditional, social customs were identified as the major causes of malnutrition and undernutrition among the respondents.

2.3 PRODUCTION AND CONSUMPTION PATTERN OF DAIRY FOODS

2.3.1 Milk production in India and Andhra Pradesh

Indian Agriculture continues to be dominated by the belief that its base is crop production. Its importance is beyond dispute. Food grains fulfil the first basic need by providing calories for sustenance of the country's population. Having achieved a level of self-sufficiency in cereal production, base of farming needs to be broadened to enhance the quality in the dairy diet, as represented by animal proteins, the major source of which is milk. In the process, the economic well-being of farmers can also be secured. Various recent studies and data suggest that dairying has enormous potential to improve the socio-economic status of the large percentage of rural population.

Dairying directly helps in increasing crop production through making funds available for the purchase of essential inputs eg. seeds, fertilizers, pesticides etc. Milk production in India involves millions of small producers with little or no land, each of them raising one or two low-yielding, non-descript cows or buffaloes. They largely depend on crop residues and natural herbage for feeding their animals. The best milch breeds are found where agriculture has generally prospered and consequently crop residues are readily available. Such farm system generates higher incomes. without any serious environmental degradation.

Since 1980, the annual milk production has gone up by 70% to 54.9 million tonnes in 1990. This increase was achieved largely through better pricing, organized marketing and appropriate farmers organization. New initiatives proposed will lead to the emergency of modern dairying as a full fledged agri-business for enhancing human nutrition and generating mass employment, particularly in rural areas. Over 70 lakh farm families are benefiting from co-operative dairying (Chatterjee and Acharya, 1992).

Recently, the annual rate of growth in milk production has been encouraging from 4.5 per cent in the seventies to 5.7 per cent in the eighties. Currently India ranks as the worlds third largest milk producer after USSR (107.8 million tonnes) and USA (69.4 MT). The percapita annual milk availability has been on the increase in recent years from 39.4 kg (108 gm/day) in 1966 to 65 kg (178 gm/day) in 1990-91. The pattern of milk availability in urban and rural areas of the country is given in Table 6.

Table 6: Milk supply and availability in urban and rural areas in 1990-91

Group	Population million	Milk supply million tonnes	Milk supply million lt/day	Per capita gm/day
Urban areas				
Metrocities	38.0 (4.5%)	4.4	12.0 (8%)	317
Other areas	181.4 (21.5%)	13.7	37.5 (25%)	207
Rural areas				
In milkshed	270.0 (32%)	20.9	57.0 (38%)	212
Outside milkshed	354.5 (42%)	15.9	43.5 (29%)	123
All India	843.5 (100%)	54.9	150.0 (100%)	178

Source: Chatterjee and Acharya, 1992.

Singh (1980) collected data from 60 farmers who possessed dairy and found that dairying was profitable. The farmers were easily earning an additional one and half to two thousand rupees per year through integration of milk stock besides their earning from crop cultivation. Besides providing additional source of income, the milk stock provided a source of additional employment for the farm family.

Sohal and Singh (1986) in an impact study reported that the average/day milk production was 4 per cent higher in member households as compared to that of non member households.

Patel (1987) reported that milk cooperatives not only created certain positive impact on the economy of producers but also made them realise such impacts to a large extent.

Thirunavukkarasu et al. (1991) studied the impact of operation flood on the income and employment of rural poor. They have provided a strong emperical evidence that the programme was making a 'revolution' very quietly, but absolutely, the incremental income and employment generated by the rural poor as a result of the large positive distributional effect of this programme are quite considerable.

Impact of dairy cooperatives on income and employment of marginal and small farmers has been studied (Rajendra et al., 1992). The results showed an increase in income from dairying is Rs.830 (22.5%) in case of marginal farmers and Rs.1480 (22.5%) in the case of small farmers per annum. Dairy income as part of total income forms nearly 45 per cent in the case of marignal farmers and 38 per cent in the case of small farmers. Both marginal and small farmers have been able to get new (full-time and part-time) employment opportunities through dairying. More idle women in the families of both the categories of farmers have taken up dairying a part-time and full-time employment.

Mushtari Begum (1994) reported the impact of dairy development on protein and calorie intake of pre-school children. With the setting up of co-operatives, considerable amount of milk is being procured from rural areas. with consequent rise in income of some families. Hence, cooperative dairy development project has had a beneficial effect on rural income. But increased income by itself is not necessarily a good indicator of improved nutrition, since malnutrtion can result as much from faulty expenditure as from poverty. Cooperative dairying was associated with an improvement in the protein and calorie intake of preschool children. This seems to be dependent to some extent on the amount of milk produced by the family.

Usha and Singh (1982) also reported that the farm women devoted maximum time i.e. 19.52 per cent in bringing fodder and grass from the fields followed by 17.76, 16.44, 13.36, 8.76 and 7.34 per cent in chaff cutting, cleaning of cattleshed, miscellaneous work, feeding, milking and watering the animals respectively, on the basis of a total sample under study. They further reported that the overall women participation rate in dairy enterprise was as high as 65.49 per cent as against 31 and 35 per cent only for men and children, respectively.

Omprakash (1988) revealed that the farm women devotes the maximum time in home management activities i.e. 21.96 per cent, followed by 19.38, 8.33 and 5.33 per cent in dairying, agriculture and miscellaneous activities respectively on the basis of total respondents under study.

Ramachand et al. (1989) studied the extent of adoption of dairy innovations by farm women in Karnal district of Haryana state. They reported that the variables, namely, milk consumption, milk disposal, attitude towards dairy farming, knowledge of breeding, feeding, health care, management and overall dairy innovations were found to be positive and significantly correlated with their level of adoption of dairy innovations.

2.1.2 Consumption of milk and milk products

India's per capita availability during eighties had gone up significantly by 40 per cent. The minimum quantum of milk consumption recommended by the Nutritional Advisory Committee of the Indian Council of Medical Research (ICMR) is 210 gm/day (77 kg/year). The present per capita availability is 178 gm/day (65 kg/year) is lower than the world average of about 100 kg/year (Chatterjee and Acharya, 1992).

Thimmayamma (1982) studied the milk consumption pattern of different socio-economic groups. Socio-economic differences were found in the milk intake and on the intake of almost all the food items of preschool children. A decrease in cereal intake and an increase in the milk intake was the main feature in the upper income group followed by middle income groups while in low income group, the intake of milk was 50 per cent of RDA.

Saxena et al. (1984) studied the effect of milk supply to urban milk schemes on fluid milch consumption. About 1380 households were selected and of which 1080 were milk producers. Households were classified according to farm size as marginal (less than 1 hectare) small (1 to 2 ha), medium (2 to 4 ha) and large (> 4 ha). Per capita milk consumption was significantly correlated with income from diarying in all milk producer households except the large producers. Milk consumption was 1.5 to 2.0 times on non-commercial than commercial milk producer households, because the latter sold a large proportion of the milk they produced.

The consumption pattern of milk and milk products in urban areas of Rayalaseema region of A.P. was studied (Srinivasa Rao, 1986). The study was carried out among different income groups, dietary categories, family categories of various occupational activities. About 1199 families were interviewed. The per capita milk utilization per day in all liquid forms had a direct relationship with the monthly income of a family. The utilization of meat in the families seemed to have a depressing influence on the purchasing power of milk and per capita utilization as milk in all liquid forms. The non-vegetarians were found to be utilizing less milk, fermented milk and beverages than vegetarians. While the reverse trend was noticed in the case of milk utilisation in milk based hot drinks. The preferences to butter milk and curds was found to be decreasing while the preferences to ghee, ice-cream and skim milk powder was increasing with the increase in income. It was observed that a majority of the families under different income groups showed preferences to cowmilk than buffaloe milk.

Singh et al., (1989) studied the differences in consumption of milk in members and non-members of dairy cooperatives. The overall average in milk consumption per day, per household, per capita availability, per capita consumption were higher in member group than non-member group. Hezbun et al. (1990) studied the feeding habits and dietary intake of milk products by students in rural area of the metropolitan region of Chile, 73.1 per cent of 48 rural students in metropolitan region of chile consumed milk, but frequency of consumption was low and decreased with age from 4.9 times/week for 7-9 year olds to 3.2 times/week for 16-18 year old ($P<0.01$). Frequency of cheese and yoghurt consumption was 2-5 times/week.

Chauhan and Sharma (1990) studied the production, consumption and marketed surplus of milk in two villages of district Barielly (U.P.). Milk produced from 2 villages in the Barielly district (India). The households were classified into 5 household categories on the basis of landholding size (ranging from <2.5 to >7 acres). Average values were land owned 5.22 acres, operated area 6.46 acres, family size 7, milch animals 2.82, monthly income Rs.246.04, daily milk yield per animal 2.5 and 1.78 kg for cows and buffaloes respectively, milk production and consumption per household 7.66 and 5.43 kg respectively.

NSS (1994) carried out survey in rural and urban areas of different states in India and reported that the monthly per capita expenditure on all broad group of food items in the rural sector as compared to the urban sector was higher except the groups; milk and milk products, meat, fish and eggs, fruits and nuts and beverages and refreshments. The expenditure incurred on food in the rural sector is about 9 per cent more than that of urban sector.

2.4 FOOD AND NUTRIENT INTAKE OF FARM FAMILIES

2.4.1 Food and nutrient intake of pre-school children

A comparative study was conducted by Anuradha (1981) on food and nutrient intake and nutritional status of farm families of Nalgonda district in Andhra Pradesh, depending on Agriculture, Dairy and other sources of income. The results showed that in general, the cereal, vegetables and sugar intake was adequate, while the pulse, fat, fruit and leafy vegetable intake was inadequate in all the groups. The intake of all foods was higher in dairy group among all the groups and in all ages thereby indicating the impact of dairy on the food intake. Due to low intakes of pulses, leafy vegetables, fat, fruits and milk, the diet was in general deficient in energy, calcium, iron and B-complex vitamins.

A study on the food intake and nutritional status of 136 pre-school and 341 school age children living in the rural areas of three regions of Andhra Pradesh was carried out (Pushpamma et al., 1983). A three day weighment method was followed for conducting a diet survey. Food intake showed deficiency in all foods except cereals. The intake of vegetables for pre-schoolers in coastal region was 27 gm as against 30-50 gm of RDA (recommended dietary allowances) whereas green leafy vegetable intake was very low (1 gm) as against 40-50 gm of RDA. Milk and curds intake was 28 gm in pre-school children, whereas the RDA was 250-300 gm. Excepting for protein, the intake of all nutrients and energy was less than the recommended allowances for both the age groups. The nutrients which were most deficit were vitamin C, riboflavin and vitamin A in minerals calcium and iron.

Indira Bai et al. (1984) conducted a study on assessment of food and nutrient intake of twelve rural children. Results showed that most of the children consumed adequate amounts of protein, but intakes of calorie was low. Intake of thiamin, riboflavin and nicotinic acid was almost adequate, while those of iron, calcium and vitamin A was less than the recommended quantities.

Bhat and Saroj (1985) conducted a study on nutritional status of pre-school children in Gangwa village in Hissar. It was reported that the diet of children was deficient in protective nutrients.

Ramadevi (1986) reported that the intake of cereals and pulses was more while the intake of vegetables, fruits and milk was less in sorghum eating population. This resulted in higher intake of calories, protein, iron, thiamin and niacin. The diet of sorghum eating population was adequate with most of the nutrients except for calcium, carotene, riboflavin, ascorbic acid, while non-sorghum eating population adequately met fat, calcium and niacin, the intake of other nutrients was slightly below the RDA.

According to Rao (1987) socio-economic differences influenced the dietary pattern and nutrient adequacies of pre-school children in India. Consumption of protective foods and energy rich foods, sugar/ jaggery, oils/fats were found to increase with better socio-economic status. About 70-100 per cent of pre-schoolers were found to be adequate with regard to energy, protein and calcium intake. This percentage was found to decrease with a decrease in economic status. The intake of vitamins and minerals was found to be deficient in all age groups.

Food and nutrient intake of pre-school children of coastal India was studied by Madhyastha et al. (1988). The dietary pattern seemed to be the same in the normal and malnourished children. Intake of energy, minerals and B-complex vitamins was inadequate, iron being still less in the moderately malnourished. Fish consumption was presumed to be responsible for the absence of protein deficiency.

Repeat surveys carried out by NNMB (1988-90) reported that in none of the states, either in 1975-79 or in 1988-90, the mean intakes were closer to the ICMR suggested levels. However, a marginal increase in the consumption level of green leafy vegetables was observed in the states of Kerala, Tamilnadu, Karnataka and Madhya Pradesh during 1988-90 as compared to 1975-79 whereas a marginal decline in the consumption of other vegetables between two survey periods. The overall consumption of mild did not show much change between 1975-79 and 1988-90. The average consumption of milk in Gujarat showed a decline from 180ml to 139 ml but it was still higher than in other states.

Roberts et al. (1984) conducted a study on the dietary intake and anthropometric data of 48 children in age group (2-5 years) who were following a vegetarian diet. Mean intake of specific nutrients vitamin A, riboflavin and niacin was below two thirds of the recommended allowance. Whereas intake of iron of the two and three year old girls were 93 per cent of the allowance while all other groups exceeded the allowance for iron intake.

Another study by Pepping et al. (1989) on food intake of 26 Tanzanian children 4 to 9 years old, of whom 9 had xerophthalmic eye lesions (Bitot's spots), and the intakes were recorded during 4 days. The main staple foods were maize and sweet potatoes while sorghum and cassava were also used as staple foods. The intake of energy was rather low partly due to the bulkiness of the diet. Protein intake was above the recommended intake but derived mainly from vegetable sources. The intakes of retinol, beta-carotene, folic acid and iron were low in all children, especially those with xerophthalmia. Dried green leafy vegetables contributed about 20 per cent of the total beta-carotene intake during the survey period.

2.3.2 Food and nutrient intake of pregnant women and lactating women

Vijayalakshmi et al. (1988) studied the nutrition profile of selected expectant mothers of low, medium and high income groups living in urban slums of Hyderabad. It was found that low income mothers consumed more of starchy foods and very little of pulses, other vegetables fruits, milk and its products. Except for milk and its products the consumption of other foods was better among middle income groups. Subjects belonging to high income were found to have a satisfactory intake and as for some foods like fruits, milk and its products the intake was higher.

Latha and Verma (1989) studied the nutritional status and food practices of pregnant and lactating women belonging to low income group in Jodhpur. The study revealed that pregnant and lactating women consumed monotonous meal and subsisted mainly on cereals. Milk, pulses, roots and tubers and other vegetables were consumed in small amounts. The consumption of green leafy vegetables, fruits, nuts, egg and meat was completely absent from their diets. The profile of average nutrient intake clearly revealed that the diets were deficient in several important nutrients.

2.4 STUDIES ON FAMILY EXPENDITURE PATTERN IN RURAL FAMILIES

Geervani et al. (1982) reported the general expenditure pattern of 240 farm families from four villages in Nalgonda, Guntur and Kurnool districts were covered. The sample was classified into three groups depending on the sources of income. The per capita expenditure on food was almost the same while the expenditure on non-food items was more in families supported by additional sources of income.

Choudhury (1984) examined the pattern of consumption and income in rural India revealed by the marginal budget shares for broad groups of items such as cereals, total food and total non-food. It is found that marginal budget shares were influenced primarily by income and at the lowest level of average monthly per capita income of Rs.30,000, nearly 74.1 to 74.5 per cent of total income was spent on food, out of which the major share was on cereals alone (about 42.2 -44.4 per cent). The marginal budget share for cereals falls quickly as income rises.

Kesavan and Kalla (1985) reported the expenditure pattern of 639 rural and 511 urban households in six southern districts of Kerala. Expenditure pattern revealed that per capita monthly expenditure in rural and urban areas was Rs.80.1 and Rs.103.3, respectively. About 67.6 per cent and 65.25 per cent of total expenditure in rural and urban areas was on food items including 6.28 and 8.13 per cent on liquid milk and 1.1 and 2.1 per cent on milk products in respective areas.

Reddy (1986) studied the family expenditure pattern of rural households in Semiliguda block in Orissa. Results showed that the average annual family income was Rs.3,361. The expenditure pattern was heavily weighed in favour of food grains followed by clothing. There was little expenditure on items like education, travelling and medicine while 24.5 per cent is spent in other items like fuel, dwelling repairs, recreations, ceremonies and loan repayments.

The results of the survey conducted by Jaswinder and Sukhwanth (1987) in low socio-economic families of Faridkot district of Punjab revealed that the expenditure on food ranged from Rs.480-912 per month whereas the average expenditure on cereals, pulses, vegetables and fruits, milk and milk products, sugar and jaggery, nuts and oilseeds, condiments and spices and miscellaneous items was 27, 6.5, 16.2, 18.4, 6.8, 8.0, 6.0 and 10.5 per cent respectively.

The results of the survey conducted by Skawinska (1986) in Poland during the period 1984 indicated the highest income families spent almost twice as much on food as the lowest income families.

2.6 INTERVENTION STRATEGIES TO COMBAT VITAMIN A AND IRON DEFICIENCY

2.6.1 Studies on vitamin A nutritional status

Surveys in different parts of India have shown that about 5-10 per cent of children have clinical signs of vitamin A deficiency (Reddy et al 1991). A sizeable proportion of the children in the community suffer from sub-clinical vitamin A deficiency having serum retinol levels less than 20 μg/dl (Bhaskaram, et al. 1989).

2.6.1.1 Studies on Vitamin A and dietary supplementation studies

Supplementary programmes have been implemented in many countries including Bangladesh, India, Guatemala, the Phillippines, Srilanka, Tanzania and Thailand. Many supplementation studies have been conducted using synthetic vitamin A as a means of combating the hazards of deficiency of this vitamin A.

A study in Bangladesh showed that 6 monthly massive doses of pre-school age children with oral vitamin A (2,00,000 IU) along with 40 IU of vitamin E protected 63 per cent of children from corneal lesions. So, as a short-term measure to protect against corneal lesions, massive dosing with vitamin A at 6 monthly intervals preferably combined with other nutrition and health education programme is essential.

Studies related to vitamin A and iron particularly among vulnerable segments were reviewed below.

Vijayaraghavan et al. (1990) studied the effect of massive dose of vitamin A on morbidity and mortality in Indian children. Results revealed that risk of respiratory infections was higher in children with mild xerophthalmia than in children with normal eyes. Vitamin A supplementaton had no effect on morbidity status. Mortality rates were similar in the two (controlled and placebo) groups. It was highest in children who did not receive either vitamin A or placebo. The findings suggest that vitamin supplementation alone may not reduce child mortality.

Devadas and Saroja (1987) carried out a study in which supplementation of the diets of the preschool children in selected villages of Coimbatore district was done. The study reveals that the per cent absorption of ß-carotene from the above mentioned source was 78 μg, 78 μg, 79 μg respectively. A significant increase in serum ß-carotene 120, 127, 125 μg per 100 ml and serum retinol 36, 37, 41 μg per 100 ml was noticed respectively in those given papaya fruit, amaranth, leaves and carrots. The cost and nutritive value of the three supplements showed that papaya and amaranth were not only less costly, but also supply more of other nutrients besides ß-carotene.

Experiments were carried out to assess spirulina fusiformis, a blue-green algae, as a source of vitamin A in pre-school children (Annapurna et al., 1991). The absorption of total carotene and ß-carotene from a single dose of spirulina containing 1,200 μg of ß-carotene was examined in apparently healthy children aged 3 to 5 yrs. After stabilization on an almost carotene-free diet taken for 7 days, a bolus dose of spirulina was fed along with the meal. The effect of daily supplementation of either spirulina or of vitamin A for one month on serum retinol levels was also examined. The mean absorption of total carotene was found to be 72.3%, and that of ß-carotene 75.2%. Serum retinol showed a significant improvement in both the spirulina and vitamin A supplemented groups. The bioavailability of carotene from spirulina is thus comparable to that from other sources such as carrots and green leafy vegetables, thus suggesting the potential use of this algae as a dietary source of provitamin A.

A study was carried out on bio-availability of ß-carotene in RPO in school children aged seven to nine years with marginal vitamin A deficiency through supplementary feeding of RPO snacks. Twenty four children belonging to low-socio-economic group and studying in government aided schools were selected and were assigned to two experimental groups. The first group belonged to RPO group and the other to vitamin A group. The modified relative dose response test was performed at the begining of the experiment to assess their vitamin A status (Rukmini, 1994).

The first group of children were supplemented with RDA of ß-carotene (2400 μg) through 'Suji halwa' made in RPO, daily for two months, 8 g of RPO was added per piece of suji halwa supplied to each child and similarly, the second group was supplemented with RDA of vitamin A (600 μg) in the form of synthetic vitamin A palmitate drops added orally, followed by piece of 'Suji halwa' made with GNO. After two months of supplementation, the MRDR test was repeated to assess the magnitude of improvement in the status.

The results of the study showed an increase in serum vitamin A levels from 0.86±0.14 to 1.89±0.23 μmol/l in RPO group and 0.74±0.12 to 1.94±0.24 μmol/l in control group who were fed with 600 μg of vitamin A orally. Thus it was concluded that supplementary foods made with RPO has a significant impact on vitamin A status of children.

A cross sectional study, a follow up study, and an intervention trials were carried out to investigate the association between mild vitamin A deficiency and the occurence of diarrhea and respiratory diseases by Bloem et al. (1990) during March, 1985 to July, 1986. Cross sectional analysis of data was performed for 1,772 children, aged 1-8 years. Of the examined children, 28.9 per cent had a history of diarrhea, 11.5 per cent had a history of respiratory disease, 38.4 per cent of children with a history of respiratory disease also had a history of diarrhea. Children with diarrhea and respiratory disease had a significantly smaller mid upper arm circumference (15.0 cm; 14.8 cm, respectively) and significantly lower levels of retinol (0.70; 0.59 μmol/lit respectively) and retinol binding protein (26; 22.9 mg/l respectively) and significantly higher levels of transferrin (1.08; 1.04 μg/l respectively). There was significant negative association of diarrhea and respiratory disease with retinol (0.4641 and 0.2171 μmol/lit respectively).

In the follow up study by the same investigator in 146 children 3 months after, it was reported that, children with a deficient serum retinol level (< 0.35

μmol/lit) had a four-fold greater risk of respiratory disease than children with adequate levels. No relation was found for diarrhea. The intervention trial carried out in 166 children of age 1-5 years showed that during 2 months of follow up after administration of oral vitamin A (200000 IU), the control group (aged 3-5 years) had a higher incidence of respiratory disease (2.9 times) as well as diarrhea (3.1 times). Between 2 and 4 months, a significantly higher incidence of respiratory disease (2.5 times) could be observed in children aged 1-2 years. This study also supports earlier reports on a greater risk of respiratory disease and of diarrhea in mild vitamin A deficiency.

A community based study was carried out in 20 villages in 2 different agro-climatic regions in Andhra pradesh during 1990-93 (Vijayaraghavan et al., 1995) to assess the feasibility of the strategy of homegardening coupled with nutrition education to promote production and consumption of carotene rich foods, and to determine the impact on the knowledge and dietary practices of mothers of pre-school children and vitamin A deficiency. Two thousand three hundred and forty five households were distributed seeds/seedlings. Of some seasonal and perennial green leafy vegetables and yellow/orange vegetables in three rounds after obtaining the baseline information.

The results reveal that it is feasible to motivate the rural households to raise home gardens to increase production of carotene rich foods, provided the inputs like seeds and seedlings, pest control measures etc. are made available simultaneous education campaign resulted in greater awareness about the dietary cause of vitamin A deficiency and appreciation of the role of diet in its prevention. It appeared that the prevalence of Bitot's spots was influenced by the frequency and quantities of consumption of ß-carotene rich foods.

Promoting home gardening to control vitamin A deficiency in north eastern Thailand was carried out by Attig et al. (1993). The results showed that the behavioural and vitamin A status objectives had been achieved. Overall, the intervention area manifested a significant improvement in scores for knowledge, compared with the control area, as well as improvement of vitamin A nutritional status. Fat and vitamin A intake in the intervention area also showed statistically significant increases among pregnant women (from 201 RE in 1989 to 428 RE in 1991) and among lactating mothers (from 269 RE in 1989 to 476 RE in 1991) no increases were evident in the control district.

STUDIES IN ABROAD

Hussey and Klein (1990) conducted a randomized double-blind, placebo-controlled study in South African children, who were younger than 13 years old and without obvious clinical signs of malnutrition, resulted in significantly lower complication rates and mortality among children who had received large doses of vitamin A (400,000 IU) at the time of hospitalization. They concluded that, the differences in mortality and morbidity were more striking in infants younger than 2 years of age. Similar results were observed by Barclay et al. (1987), Daulaire (1989), West et al. (1991) and Constoudis et al. (1992). However, supplementation of vitamin A showed no significant effect on reduction in morbidity and mortality.

A group of 134 school children aged 3-9 years, with signs of conjunctival xerosis, from the rural area of the Sakorn Nakhon province in Northeast Thailand were selected for a controlled study on the short term effect (2 wk/c) of a single, oral high dose of vitamin A on iron metabolism (Martin et al., 1991). After collection of the baseline data, children within villages were randomly assigned to receive the capsules (n=65) or serve as control subjects (n=69). Two weeks after supplementation significant increases of retinol, retinol binding, protein, haemoglobin, haemotocrit, serum iron, and saturation of transferrin were found in the supplemented group. Ferritin concentrations did not change significantly. These short-term changes completely exclude seasonal effects and change in morbidity. This study provides further evidence of a causual association between vitamin A and iron metabolism.

Oral dose of ß-carotene 0 mg, 15 mg, 30 mg on plasma response was studied (Canfield et al., 1991) in 51 Guatemalan children aged 8-15years with mean fasting plasma retinol concentrations of 1.72u mol ß-carotene was given along with a chocolate drink containing 8.4 g fat blood sampling was performed at different intervals upto 48 hour circulating retinol concentrations remained relatively constant. The maximum inreases in plasma ß-carotene after the 30 and 15 mg doses for all subjects occured at 24 hour and were 0.29 and 0.23 μmol/l, respectively. Time of maximum increase for individuals varied and average maxima over the 48 hour period for individuals were 0.13 and 0.26 μmol/l for the 15 and 30 mg treatment groups, respectively. Increased plasma ß-carotene concentrations were not predicted by recent intake of dietary vitamin A, fasting plasma concentrations, or anthropometric measurements.

Lisa et al. (1991) assessed the risk factors for xerophthalmia in 466 subjects 38 per cent with night blindness (XN). 60 per cent with Bitots spots (X1B), 2% with corneal xerophthalmia (X_2 or X_3) under age 6 year and their village age sex matched control subjects during a community trial. Socio-economic status and hygiene standards were lowest for households of xerophthalmic children and highest for non study households in the trial population, with values for control households lying in between (P<0.01) by linear trend). Risk of xerophthalmia increased with less frequent consumption of dark green leaves, yellow fruits or egg during weaning, adjusted for current intake and present age (odds ratio (or) = 3.5). Exclusion of these same foods from the current diet (except for mango and papaya in older children) was associated with a two to ninefold excess risk of xerophthalmia adjusted for weaning influences. Xerophthalmic children aged <3 years were generally at higher risk of dietary imbalance than were older children. Xerophthalmia associated with a chronic, infrequent consumption of key vitamin A foods from weaning through early childhood.

Narul Islam et al. (1991) studied the incidence of nightblindness due to vitamin A deficiency amongst children under six years of age in a coastal area of Bangladesh. The risk factors involved in the incidence (about 4.1%) were critically analyzed and it was found that the nature of occupation of the head of the household (eg.fishing vs day labouring) was a very strong contributing factor. In addition, lack of nutritional knowledge and the consequent indifference to dietary vitamin A intake were stronger determinants than factors like formal educational level and family landholding.

Ignatius et al. (1992) examined 4000 pre-school children in west Java, Indonesia for xerophthalmia and weighed and measured at 3 months (mo) intervals from March 1977 to December 1978. Children recovering from xerophthalmia over a 3 mo interval gained an average of 124 g (95% CI 42-206). Moreover 3 mo than normal children. Their height gain was similar to normal childrens. Children who developed xerophthalmia during a 3 mo period gained 199 g (95% CI 114-313) less and grew 0.28 cm (95% CI 0.12, 0.44) less than their normal peers. Children with chronic xerophthalmia gained 120 g (95% CI 49-191) less and grew 0.21 cm (95% CI 0.05-0.37) less than normal children. These data suggests that linear and ponderal growth is adversely affected by chronic and incident xerophthalmia, but the catch-up ponderal growth is experienced by children recovering from xerophthalmia.

2.6.2 Studies on iron nutritional status

Anaemia is a major public health problem in many parts of the world, including the developed countries. Nutritional anaemia is a condition in which the Hb concentration, the haemotocrit or the number of red cells is lower than normal as a result of a deficiency of one or more essential nutrients regardless of the cause of such deficiency. The level of Hb, below which anaemia can be considered to occur differs according to age, sex and physiological status (WHO, 1968).

Simmons et al. (1982) conducted an island wide survey in Jamaica and their results indicated that anaemia is a serious public health problem in that region. 61.6 per cent of pregnant women had haemoglobin levels <11 g/dl and 58.7 per cent of lactating women had Hb levels <12 g/dl.

A review of World wide prevalence of anaemia indicates that about 25 per cent of World's population (13,000 million people) is anaemic of them 90 per cent belong to the developing countries of the World (Carriers, 1986).

Leh-Chii Chwang et al. (1988) carried out a study on iron supplementation and physical growth of rural Indonesian children. The effect of oral iron supplementation on blood Fe levels and physical growth in 119 rural Indonesian school children was assessed in this double-blind study. The children were classified into anaemic and normal groups according to their initial haemoglobin and transferrin saturation levels and were randomly assigned to either Fe or Placebo tratment for 12 week. Haemotological, anthropometric and morbidity data were collected before and after the treatment period. Before treatment anaemic subjects were smaller and had higher morbidity than normal subjects. Treatment with 10 mg ferrous sulfate g^{-1}, d^{-1} for 12 weeks resulted in a significant improvement in anaemic subjects haematological status, growth velocity and level of morbidity.

One hundred and eighty two children under 5 years of age in a slum area were investigated for anaemia in relation to nutritional status and dietary history (Malin and Stones, 1988). The prevalence was significantly greater among partially weaned children consuming a mixed diet of breast milk and solids (73 per cent) compared to those who were fully weaned (30 per cent). The under 5 year age group were more anaemic, thinner and less accessible to health workers than children aged 3-5 year. They were also unlikely to be weaned before the age of one year suggesting the need for specific health programme directed at this age group.

Vijayaraghavan and Brahmam (1989) evaluated the National Nutritional anaemia prophylatic programme (NNAPP) in Andhra Pradesh especially on pregnant women, lactating mothers and children under 12 years of age. They found that about 64 per cent of beneficiaries who had reportedly consumed the folifer tablets received less than 30 tablets as against the stipulated 100 tablets per beneficiary and there was no impact of folifer distribution on the haemoglobin status of pregnant women. However the prevalence of anaemia was less (83%) in those who had consumed 25 tablets or less (93%). Finally they concluded that the NNAPP in Andhra pradesh has not achieved the objective due to short supplies, poor coverage inadequate-consumption by the beneficiary and lack of effective health education.

Adequate vitamin A in pregnancy is a must to prevent intra-uterine growth retardation (Tyler et al., 1991).

A study in Guatemala to find the relationship between type I IUGR and Cord serum levels of vitamin A revealed that with increased birth weight, the cord vitamin A levels increased. Also, vitamin A levels in the cord blood of the smallest type IUGR babies were significantly lower than levels in the smallest type II IUGR babies vitamin A levels and birth weight were positively associated only among type I IUGR babies who had vitamin A levels in lowest quartile than did babies of birth weight (Nancee et al., 1990).

Nagi et al. (1991) studied the nutritional status of anaemic and non-anaemic young Punjabi women, 90 women 16-20 years old from Punjab Agricultural University girls hostel, Ludhiana were selected to assess their nutritional status. The subjects were classified into three groups based on their haemoglobin and food habits i.e., anaemic vegetarians (AV), anaemic non-vegetarians (ANV) and non anaemic (NA) group. The average haemoglobin concentrations of AV, ANV and NA groups were 10.4 g, 0.11, 10.7 g 0.13 and 12.5 g 0.10 g/100 ml respectively. The average packed cell volume in all the groups was within the normal range while the mean corpuscular haemoglobin concentration value was significantly higher in the NA group compared to the other groups. The mean daily energy and iron intakes was inadequate while the intake of protein, calcium, phosphorus and ascorbic acid was sufficient in all groups as compared to RDA. The clinical symptoms of anaemia and vitamin B-complex deficiency were observed in all the groups but the incidence was higher in AV and ANV groups as compared to NA group.

In Bangladesh, a study revealed that breast milk was the major source of retinol in young children.

2.6.3 Relation between vitamin A and Iron

Hematological effect of supplementing anaemic children with vitamin A alone and in combination with iron was studied (Luis and Franscisco 1988). Ninety-nine anaemic children aged 1-8 year were divided into four groups. Each group was supplemented for 2 months with vitamin A, iron, Vitamin A plus Fe, or a placebo-clinical, hematological and Fe bio-chemical evaluations were performed at the beginning and end of the study. Vitamin A supplementation produced significant elevations in the serum levels of retinol, blood haemoglobin, haematocrit, erythrocytes, serum Fe and per cent transferrin saturation (% TS) and had no effect on total Fe binding capacity (TIBC) or serum ferritin. Fe supplementation did not affect serum retinol. However, it improved hematological and Fe nutrition indicators including TIBC and serum ferritin. The simulteneous administration of vitamin A and Fe resulted in a better response of serum Fe and per cent TS than when the supplement consisted only of vitamin A or Fe alone. Vitamin A benefits hematological condition and Fe metabolism.

Rohit et al. (1980) studied pattern of weight gain in pregnancy in 476 women, Baroda. The results revealed that the prepregnant maternal weight and total weight gain have a significant impact on birth weight. Age and parity do not have any direct effect on birth weights are also higher. Maternal height also influences birth weight. The incidence of low birth weight babies increases as maternal weight gain decreased.

Studies on healthy male volunteers revealed no improvement in Hb, hematocrit and RBC by medical dose of iron during vitamin A deficiency. In another study by Hodges et al. (1978), their anaemia was ameliorated only when vitamin A was given in addition to iron supplements. Further investigations revealed that chronic vitamin A deficiency in rats was related to anaemia inspite of adequate stores of iron in the liver (Mejia et al., 1979). Mejia and Arroyave

(1982) suggested that vitamin A fortification has favourable effect on iron metabolism and iron nutritional status. Vijayalakshmi and Devadas (1987) reported a high haemoglobin value for the group supplemented with iron along with vitamin A.

A cross-sectional study of the prevalence of iron and vitamin A deficiency in normal pregnant women in West Java, Indonesia was carried out (Djoko Suharno et al., 1992). Of the 318 women studied, 49.4% were anaemic and according to multiple criteria, 43.5% had iron-deficiency anaemia, 22.3% had iron-deficient erythropoiesis, and 6.6% had iron depletion. Serum retinol values revealed that 2.5% of the pregnant women were vitamin A deficient and 31% had marginal vitamin A status. The relative dose response test carried out on 45 women showed that 4 (8.9%) had deficient vitamin A liver stores. After gestational stage parity, and subdistrict were adjusted for, serum retinol concentrations were significantly positively associated ($P<0.01$) with haemoglobin concentrations, haemotocrit and serum iron concentrations. The sub-optimal vitamin A status associated with nutritional deficiency anaemia suggests that pregnant women in the area should be supplemented not only with iron but also with vitamin A.

Martin et al. (1989) investigated the association between vitamin A and iron metabolism through a cross-sectional study and an intervention trial. The cross-sectional analysis was carried out in 1060 children aged 1-8 year. Multiple regression analysis was used to adjust for effects of age, gender, indices of the protein nutritional status, and infections. Retinol levels were significantly associated with hematocrit, serum, Fe, transferrin, ferritin and saturation of transferrin (% ST). To obtain further evidence as to whether this observed association is a casual one, an intervention trial was carried out. After collection of the baseline data of 300 children, 166 children with a haemoglobin concentration <7.5 m.mol/l were selected. A random sub sample of 78 children received vitamin A capsules; the other children surved as control subjects. Two months after supplementation significant differences, adjusted for age, were found for retinol, retinol-binding protein, serum Fe and per cent transferrin between the supplemented and the control group. After 4 months none of the indices were found to be significantly different between the supplemented and the control group. Periodic massive dose of vitamin A may plays a role in improving the Fe status.

2.7 KNOWLEDGE, ATTITUDE AND PRACTICES OF RURAL FAMILIES

The nutrition awareness of working women in Hyderabad was assessed by Jyothi (1980). It was found that a majority of the working women were unaware of basic facts on foods. These women thought that the only function of food was to supply energy to work or to maintain good health. The consumption of protective foods among these women was below the ICMR recommended allowances. they did not know about the importance and quantity of certain protective foods that should be included in the diet of pregnant women. Very few women knew that pregnant women and lactating women should consume more food than normal women, but they did not know the quantity or quality of foods to be included. Only 32 per cent of the respondents indicated that the colostrum was good to health. They considered breast milk to be good for infant nutrition and contain all vitamins in required amount.

A study carried out by Seghal et al. (1989) in a labour community in Bhiwandi district showed that majority of mothers (94%) considered milk as a very good food item for children. Whereas middle income groups (90%) mentioned that milk as well as basan are good food items for children. About 9 per cent of the low income group mothers did not feed their infants with milk and 83.5 per cent of middle income group mothers considered milk as cold causing food.

A study in Bangladesh showed that 6 monthly massive doses of pre-school age children with oral vitamin A (2,00,000IU) along with 40 IU of vitamin E protected 63 per cent of children from corneal lesions. So, as a short-term measure to protect against corneal lesions, massive dosing with vitamin A at 6 monthly intervals preferably combined with other nutrition and health education programme is essential.

Mahesh et al. (1991) studied the relation of childhood malnutrition to parental education and mothers nutrition related Knowledge Attitude Practices (KAP). Study revealed that better KAP in relation to 16 of these 37 questions was not associated with better nutritional status. Seven questions were found to have only a weak association. The remaining 14 questions were identified as important for a nutrition education programme. No significant association was found between mothers' KAP and educational level. It is concluded that maternal education and KAP are significantly and independently associated with children's nutritional status. The content areas of knowledge, attitudes and practices associated with nutritional status pertain to nutritional requirements of children, nutritional value of foods, immunisation, hygiene, oral rehydration and diarrhoea significantly.

A comparative nutritional studies on malnutrition and child mortality among pre-schoolers in selected urban and rural areas of Guntur district (Vijaya Khader et al., 1993a) in which nutritional awareness of mothers was also presented. Results of this report reveal that a majority of the rural mothers had food fads and falacies like egg and pulses are heat producing foods, pregnant women should not eat papaya etc., eventhough majority of them know the importance of colostrum and weaning foods, they were ignored to introduce them to their children. Majority of the urban mothers were undecided for the same questions and a few of them don't have any food fads and falacies.

2.8 ANTHROPOMETRIC STUDIES

Anthropometry is concerned with the measurement of variations of physical dimensions and gross compositions of human body at different age levels and degrees of nutrition. The selected body measurement can therefore give a clear indication of growth through height and weight and number of other indices. Studies in these lines have been briefly reviewed below:

Agarwal et al. (1983) studied the weight pattern of pre-school children in rural area of Delhi. It was indicated that 61.4 per cent of the children were less than the lower limits of normal when weight/age was taken as criteria. On the other hand 4.7 per cent of them were in the upper limits of normal as measured by 50th percentile of Harvard standard.

Maya and Rao (1983) conducted a study on nutritional status and the associated factors of pre-schoolers. It was found that the children who were either normal or with grade II malnutrition had better educated parents and higher per capita income than those with moderate or severe forms of malnutrition.

Steinhoff et al. (1986) reported the nutritional state of 1223 pre-school children from a rural area in Tamilnadu. Altogether 45 per cent of children were under weight (low weight for age), 51 per cent were stunted (low height for age) and 21 per cent were in wasted (low weight for height). The rates of severe malnutrition using any of the above criteria were low; only 9.6 per cent of the children were wasted and stunted.

Tyagi and Kaur (1986) conducted a cross-sectional study of nutritional status in a sample of pre-school children, 66 girls of 4 to 5 years old were selected in Hissar, Haryana. Weight, height and mid arm circumference were measured. Data revealed that half the children were normal and the rest were on the first or second degree of malnutrition. In another study, the children from higher income group had a better nutritional state than data of the adolescent boys and girls were very close to the regional values but were lesser than of the high income group of Andhra Pradesh.

Nutritional status of 100 rural pre-school children (1-5 years) from Hissar was assessed by Kakkar et al. (1987) using anthropometry. It was observed that boys were taller and heavier than girls in all age groups. It was also found that only 18 per cent of children had normal weight for age, while 4 per cent were found to be suffering from severe malnutrition.

Ragimol et al. (1988) assessed the malnutrition by anthropometry by comparing two age independent criteria of pre-schoolers of 1-5 years. The per cent prevalence of grade I malnutrition was more under one year age and less in 4-5 year age group. Grade II malnutrition was prevalent mostly in children of 1-3 and 3-4 years age groups. Severe malnutrition was found in the age group of 3-5 years.

Nutritional status of rural children of 0-5 years from Saudi Arabia was examined by Abdullah et al. (1982). Results revealed that only 39.2 per cent had normal body weight for age, 76.3 per cent had normal body weight for height and 23.7 per cent had body weight for height less than 90 per cent of standard and were considered to be wasted.

An attempt has been made to study the nutritional status and the impact of agro-economic and socio-demographic indictors on PEM among pre-school children of the backward communities in and around Hyderabad city (Krishna et al., 1991). The results show that considerable proportion of children were found with severe and mild forms of malnutrition. Prevalence of mild and severe malnutrition increases with age. Degree of malnutrition was apparent more among female children than in male children. Anthropometric measurements and indices were lower than those of well to do children. Weight for height (%) and weight/height were found well correlated. Weight (%) and height (%) were also well correlated. Degree of retardation in height or weight increased with age. Height (%) with weight for height (%) or weight/height^2 was found to be best for use in place of weight (%) alone.

Vijayakhader et al (1993b) studied the quantum of malnutrition through anthropometric assessment i.e., height, weight, head and chest circumference among the selected pre-school children from rural areas of Tenali division in Guntur district of Andhra Pradesh. The analysis revealed that the anthropometric parameters were below the standard values. Severe forms of malnutrition was observed more in the 3-4 year age group children. Most of the female children were normal in all age groups.

CHAPTER - III

MATERIALS AND METHODS

MATERIALS AND METHODS

The present research work was aimed to study the vitamin A and iron nutritional status of vulnerable segments in the households subsisting on horticulture crops and dairy farming in East Godavari district of Andhra Pradesh. This chapter deals with methods and techniques used in the study and the details are presented under the following sub-heads.

3.1 Selection of Districts and villages

3.2 Criteria for selection of the sample

3.3 Development of schedules

3.4 Collection of data

3.5 Assessment of Nutritional status

3.5.1 Diet survey

3.5.2 Anthropometric measurements

3.5.3 Clinical assessment

3.6 Bio-chemical assesment

3.6.1 Serum vitamin A estimation by High Performance Liquid Chromatography (HPLC)

3.6.2 Estimation of Haemoglobin

3.7 Statistical analysis

3.1 SELECTION OF DISTRICTS AND VILLAGES

The data given by Bureau of Economics and Statistics (1990-1991) showed that East Godavari District has more area under cultivation and production of vegetables and fruits in Andhra Pradesh. The districts fulfilled the criteria of the study, in that it had besides milk producers of about 6,256 (NDDB 1992), small and marginal farmers as well. East Godavari district was thus, selected for the study.

Selection of State: Andhra Pradesh state had been selected purposively as the investigator hails from the state.

Selection of district: East Godavari district had been selected as it is agriculturally progressive predominant in horticulture, dairy enterprises.

Selection of mandals: Out of 56 mandals in East Godavari district, Kadiam had been selected randomly.

Selection of villages: Six villages namely Dami Reddy Palle, Veeravaram, Kadiapu Savaram, Vemagiri, Kadiapu lanka, Burrilanka have been selected randomly.

From each of the selected villages, twenty five families depending on horticulture crops, twentyfive families depending on dairy as main source of income and thirteen families cultivating crops other than horticultural crops were selected using the following criteria.

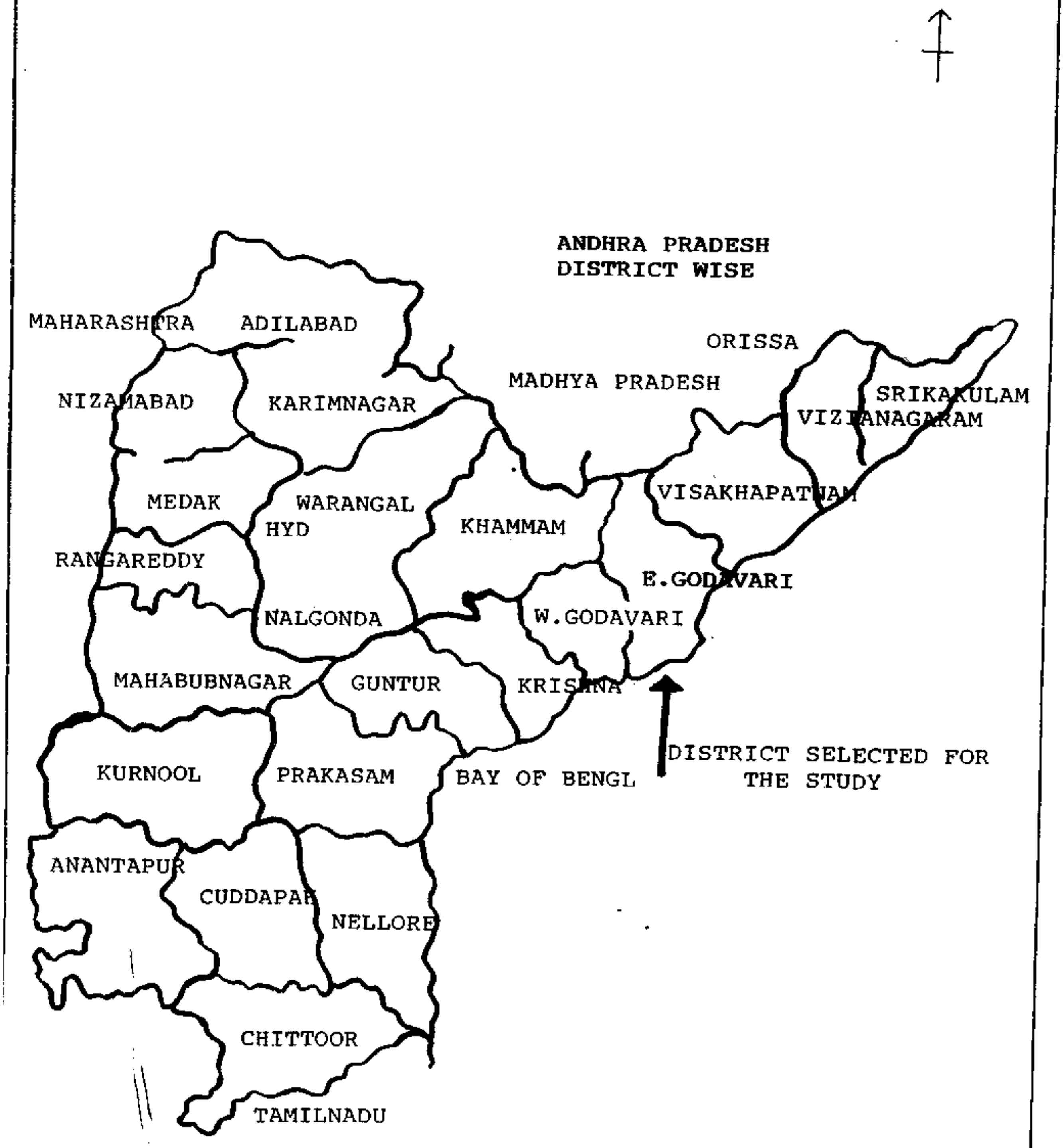


Fig.1: MAP SHOWING SELECTED DISTRICT FOR THE STUDY IN ANDHRA PRADESH

·ADIYAM MANDAL

VEMAGIRI
VEERAVARAM
DAMIREDDY PALLE
KADIAPU SAVARAM
KADIAPU LANKA
BURRI LANKA

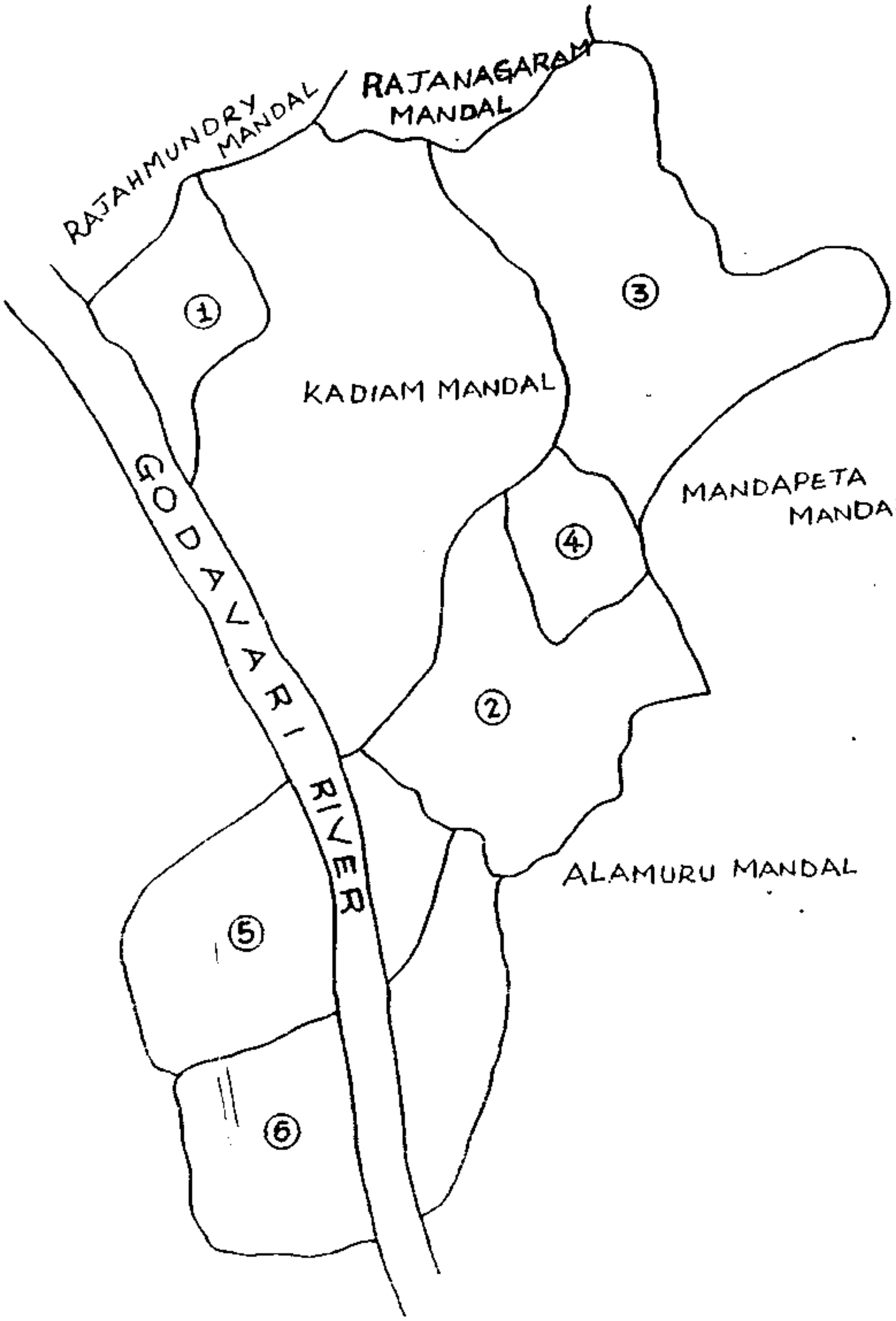


Fig.1: MAP SHOWING SELECTED VILLAGES IN KADIAM MANDAL, EAST GODAVARI DISTRICT

3.2 CRITERIA FOR SELECTION OF THE SAMPLE

The criteria for selection of sample was farm size, size of the dairy and income. Families having lessthan 2.5 acres of land were considered as marginal and those having 2.5 acres to 5 acres were considered as small farmers. The small and marginal farmers with horticultural crops are considered (Group I). Families having similar landholdings but also having milch animals and selling atleast 3-5 l of milk per day were included in the dairying group (Group II). Third group comprised of agriculture families having similar land holdings but also having additional source of monthly income ranging from Rs.500-1000. Families having either pre-school children pregnant and lactating women were selected randomly for the study. On the whole, 63 families from each village were covered making the total sample size of 378 for the district. Due to non availability of the respondents 3 households were not included for the study.

3.3 DEVELOPMENT OF SCHEDULE

In order to collect information from the families under study having horticulture and other crops and those having dairy, a separate schedule was prepared and pretested. Broadly, the survey schedule consisted of three main parts (A,B & C). Part A included information regarding the families depending on horticultural crop and families with other sources of income, whereas part B covered information about families depending on dairy and part C dealt with the assessment of nutritional status of pre-school, pregnant and lactating women.

Part A: It is divided into 4 main sections as detailed below:

Section I: This section consisted of general information about family size, such as composition, age, sex, educational status, daily activity of the family members, income, number of pre-school children, pregnant and lactating women, major occupation of main wage earner and housewife, Cash income of household and involvement of children in occupational activity and number of hours spent in the occupational activity (Appendix-I).

Section II: Section II dealt with the information on production and marketing of horticultural produce.

Section III: Data with respect to consumption of own produce by the households, purchased quantities, frequency of consumption of vitamin A and iron rich sources were given in section III.

Section IV: This last section dealt with the particulars about Food and non-food expenditure of families.

PART B: It is divided into 3 sections as detailed below.

Section I: General information was recorded in section I of part A. Whereas the details regarding type and number of animals, total milk yield, amount of milk sold and retained, income earned per day, place of selling milk, quantity of byproducts sold and income from byproducts are recorded in this Section.

Section II: The information regarding consumption of milk and milk products and frequency of consumption by family members is given in section II.

Section III: Provided particulars about Food and non-food expenditure of families.

PART C: Dealt with the assessment of nutritional status of pregnant and lactating women and children of 1-6 years of age. The technique followed for assessing the nutritional status were diet survey, anthropometric measurements, clinical examination for nutritional deficiencies.

1. Nutrition knowledge: Knowledge is one of the important components of behaviour and plays an important role in the covert as well as overt behaviour of an individual. So a schedule had been developed on the general nutrition, diet during pre-school age, nutritional deficiency diseases, health and hygiene etc. (Appendix II).

For the present study, the test developed by Usha Rani and Chittemma Rao (1992) was used to test the nutrition knowledge of mothers. The scores obtained for each item were summed up and classified into different categories with a class interval of 25 as follows:

S.No.	Nutrition knowledge scores
1.	0-25
2.	26-50
3.	51-75
4.	76-100

2. Attitude towards nutrition: Various aspects of nutrition and health identified in knowledge test formed the base for collection of items in the attitude scale. The acceptance or rejection of each item would imply a different degree of favourable or unfavourable attitude towards that particular statement. 32 items both positive and negative statements representing the attitude of mothers of the experimental group of children towards nutrition and health were collected and framed into a schedule.

The scoring of the statement is done as follows.

	Scores for Agree	Scores for Disagree	Do not know/ uncertain
Positive of favourable statement	3	1	2
Negative or Unfavourable statement	1	3	2

After preparation of the schedule, it was pre-tested in one of the villages of Kadiam mandal of East Godavari district. After careful pre-testing the schedule was restructured, as per the changes. The final schedule used for the survey is given in the appendix II.

3.4 COLLECTION OF DATA

The households were visited thrice prior to the actual collection of data. During preliminary visits, they were explained about the purpose of visit and during the visits close rapport was established with the families. They were selected based on their cooperation.

Information about village population, number of small and marginal farmers, number of households was collected from Mandal Revenue Office of Kadiam (Table 7). Then the required number of families with pre-schoolers or pregnant or lactating women were selected.

Information on the data as per the schedule was obtained from each family personally. For each family the time taken for collecting the information ranged from one to one and half an hour.

Table 7: Kadiam mandal statistics

Name of the village	Total No. of house-holds	Total popu-lation	No. of farmers depending on horticulture crops	
			*S.F.	*M.F.
Dami Reddy Palle	523	2365	32	193
Veeravaram	875	3843	389	54
Pottilanka	1025	4666		
Kadiapu Savaram	744	3486	1722	240
Vemagiri	2628	11195	61	85
Burrilanka	1102	4594	1722	240
Kadiapulanka	1857	8126		

* S.F. - Small farmers ; M.F. - Marginal farmers
Source : Mandal Statistics (1993-94) from Adangal, Government of Andhra Pradesh

During the subsequent visits to the families, the nutritional status of pregnant and lactating women and children enlisted was assessed.

3.5 ASSESSMENT OF NUTRITIONAL STATUS

3.5.1 *Diet survey*

Diet survey was conducted in the selected sample by 24 hr recall method. The method was employed by using a set of standardized vessels as it is an accepted technique for assessing daily dietary intakes in rural areas (Appendix-III).

The recall method involved exhibiting the different size vessels to the respondents (who generally cook and serve food to the family members), collecting information regarding the foods consumed during the previous day and estimating the quantities using the set of standardized diet survey cups. Food left over from the previous day and consumed on the day of the survey was recorded. Foods consumed outside the house were also noted down. The individual food intake of pre-schoolers, pregnant and lactating women was recorded. The nutrient intake of the individual per day was calculated from a standard food composition table (Gopalan et al., 1992). The individual consumption of food items of raw ingredients was calculated from the total volume of cooked food, and the volume of cooked food consumed by pre-schoolers, pregnant and lactating women of the family. The raw and cooked volume was converted to raw weights using the conversion factor calculated as below:

$$\text{Amount of raw foods consumed by the individual} = \frac{\text{Total raw weight of food}}{\text{Total cooked volume}} \times \text{Cooked volume consumed by the individual}$$

The food intakes of only pre-school children, pregnant, and lactating women were taken because they are the most vulnerable sections of population.

3.5.2 Anthropometric measurements

Anthropometric measurements namely weight and height were considered for assessment of nutritional status using standard methods (Appendix-IV).

Weight: The Salter's scale was hung at suitable height. The child was helped to wear the knicker (with minimum clothing) which was hooked to the balance. The weight was noted down accurately to the nearest 0.5 kg.

Height: In case of preschool children, a vertical measuring rod, marked in centimeters was used for measuring the height. The individuals were made to stand on a flat surface with feet parallel and back of head touching the upright. The head was held comfortably erect and the arms hanging at sides in a natural manner. Then the head piece, which is a metal bar was gently lowered touching the hair and making contact with the top of the head. The height of the individual was measured accurately to the nearest 0.1 cm.

3.5.3 Clinical assessment

Clinical assessment was done as a part of nutritional assessment.

A schedule in which clinical signs of vitamin A and iron nutritional deficiencies were listed was used to assess the clinical status of the vulnerable groups (Appendix-IV).

3.6 BIO-CHEMICAL ASSESSMENT

3.6.1 Vitamin A estimation by High performance liquid chromatography

Vitamin A nutritional status was assessed by taking blood samples by venipuncture and separating serum by using microcentrifuge tube.

3.6.1.1 Collection and preservation of blood samples

Blood samples (1 ml intravenously) were collected from children in heparinized bottles. The glassware used was thoroughly washed with nitric acid and glass distilled water and dried. All precautions were taken to avoid contamination and exposure to sunlight. Serum was separated and stored at -20°C for estimation of vitamin A. Estimation of vitamin A from serum samples was done by high performance liquid chromatography (HPLC) method (E-Siong, 1991). The HPLC system used was Shimadzu LC-6A, with a UV detector SPD-6A; isocratic pump LC-6A, simpak column, CLC-ODS(M) C18, 25 cms x 4.5 mm, injection valve, SCL-6A system controller and CR-6A recorder. The principle of the procedure is as follows:

3.6.1.2 Principle :

Vitamin A is extracted with a suitable organic solvent after precipitation of the protein with ethanol. An aliquot of the organic phase which is evaporated under nitrogen and redissolved in mobile phase is injected into a reversed phase HPLC column, followed by an eluting solvent of suitable plarity. A reversed phase column has a non-polar stationary phase with a polar mobile phase. Retinol is detected at 326 nm using a sensitive UV detector. An internal standard (Retinyl acetate) is used to account for processing losses.

3.6.1.3 Reagents used

Absolute ethanol	(100%)
Retinyl acetate	Standard sigma Chem. Co.,
Retinol standard	K.St. Louis, U.S.A.
Hexane	HPLC grade
Methanol	HPLC grade
Water	HPLC grade

3.6.1.4 Procedure

Serum sample of 100 μl, ethanol 80 μl of and 20 μl of the internal standard solution in ethanol (0.04 to 0.06 μg of retinyl acetate/ml) were taken into a glass test tube and mixed vigorously on a vortex mixure for 30 seconds. To this 1000 μl hexane was added and the contents were mixed vigorously for 60 seconds on a vortex mixer, until the bottom layer was thoroughly extracted. The contents were centrifuged at a rate of 2000 rpm for 5 minutes and 500-700 μl of the upper hexane layer was carefully transferred to a small test tube and evaporated under nitrogen. The residue was dissolved in 50 μl of methanol. The test tube was gently swirled and tapped to enhance the complete solubility of the lipid residue. An aliquot of 20 μl of the solution was injected in HPLC and eluted with filtered methanol; water (98:2).

3.6.2.1 Chromotographic conditions

Column ---> 25cm x 4.6m, Shim Pak (ch-18, CLS-ODS(M))
Methanol/water (98:2 by volume).

Flow rate ---> 2.0 ml/min

Detector wavelength ---> 326nm for retinol

Detection sensitivity ---> 0.01 AUFS

Temparature ---> Ambient

Elution time

Retinol ---> 2.2 minutes
Internal standard ---> 3.0 minutes

3.6.2.2 Preparation of standard retinol and retinyl acetate stock solution

A stock standard solution of retinol and retinyl acetate solution were prepared by dissolving about 1 mg of the pure standards in 10 ml of ethanol, determining the concentration in a dilution of an aliquot in ethanol by use of E% 1 cm at 326 nm as 1845 and 1560, and then the stock standard was diluted approximately with ethanol.

By use of an internal standard. losses due to incomplete extraction, inaccurate aliquots or oxidation were automatically corrected. Provided that the internal standard has physical and chemical properties sufficiently similar to retinol, was suitably separated from retinol on HPLC, does not coincide with other 326 nm absorbing material in serum and not converted to retinol under the assay conditions.

A precisely known amount of internal standard added to the aliquot of plasma was analysed. By determining the relative extraction efficiency and detector response of retinol and the internal standard, a standard curve was fashioned in which the ratio of peak heights (or areas) were plotted against the retinol concentration in plasma.

A standard curve was prepared by adding varying amounts of retinol to a fixed amount (i.e., 50 mg) of internal standard on a final volume of 50 μl of eluting solvent, the solvent was injected into HPLC under assay conditions, the peak height was measured and peak height ratio was calculated.

The peak height ratio was then plotted as the abscissa with a plasma retinol concentration (for a 100 ul plasma aliquot) as the ordinate (Appendix-V).

3.6.2.3 Tabulation of data

After estimating the vitamin A from the blood samples, children were grouped according to their serum vitamin A levels into deficient (<10 μg/dl), low (10-20 μg/dl) and normal (>20 μg/dl) vitamin A levels (Kumar and Siddhu, 1976). The data collected from the respondents were coded, tabulated, analysed and presented in the form of tables in order to make the findings meaningful.

3.6.3 Estimation of haemoglobin1

Haemoglobin is a good indicator of iron deficiency. Hb estimation in pre-schoolers was done with a finger prick blood sample by Cyanmeth-haemoglobin method (Cartwright, 1958). The screening of the population was done by using the World Health Organisation (1968) cut-offs. Normal levels of Hb for different age groups as follows :

Age group	Cut-offs for anaemia (g/dl)
a) Children aged 6 months to 6 yrs	11
b) Children aged 6-14 yrs	12
c) Adult male	13
d) Adult female	12
e) Adult female pregnant	11

The anaemic persons were those who had Hb levels less than WHO standard for age.

3.6.3.1 Collection of blood sample

Each haemoglobin (Hb) pipette was calibrated before use. Blood was obtained from finger tip by pricking the skin with a sharp sterile lancet after cleaning the finger tip with alcohol. Before drawing blood into the pipette, precautions of avoiding applying undue pressure and squeezing the finger tip to collect blood drops was taken. The blood was then transferred onto Whatman

No.1 filter paper. The filter paper was dried and labelled and brought to the laboratory for estimation of Hb.

3.6.3.2 Estimation of Hb in the blood sample by cyanmethaemoglobin method

Principle : In this method the blood is treated with a dilute solution containing potassium ferricyanide and potassium cyanide at a slightly alkaline pH. The ferricyanide oxidizes the iron present in the haemoglobin and converts the later to methemoglobin. The cyanide reacts to form stable cyanmethaemoglobin, which has an absorption peak near 540 nm. The cyanmethaemoglobin method measures all haemoglobin derivatives in the blood.

Reagents : Drabkins diluent solution

Sodium bicarbonate	- 1 g
Potassium cyanide	- 0.05 g
Potassium ferricyanide	- 0.2 g
Distilled water to make	- 1000 ml

This solution was discarded whenever it formed a precipitate on the bottom of the storage bottle. The solution was preserved in a dark brown bottle and under cold storage. Its preparation and handling was done with great care.

Procedure

1. 5 ml of Drabkin's diluent solvent solution was measured into a dry test tube from a pipette with suction bulb.

2. The blood stained portion of filter paper was cut out and transferred into the test tube containing drabkin's reagent.
3. After 30 min. when entire blood was extracted into Drabkin's reagent the colour intensity is measured in spectronic-20 at 540 nm using a green filter.
4. 5 ml of diluent solution was used as blank.

The blood sample collected on the filter paper was analysed within 3 days, since low values can be obtained at a later period due to problems of destruction of haemoglobin.

3.7 STATISTICAL ANALYSIS

The following statistical tools were used to analyse and interpret the data.

3.7.1 Arithmetic mean

The arithmetic mean is the quotient that results when the sum of all items in a series is divided by the number of items. The formula in terms of symbol is

$$\bar{X} = \frac{x_i}{n}$$

where

$\bar{X}$ = *The Arithmetic Mean*

x_i = The sum of items

N = The number of items

3.7.2 Standard deviation (SD)

The S.D. was computed by arriving at difference of each item in the series from the arithmetic mean (X), squaring this difference (X2) and summing all squared differences and dividing it by the number of items (N) and finding the square root.

$$\sigma = \sqrt{\frac{1}{n}\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)}$$

where

σ = Standard deviation

X^2 = Sum of squared deviations from mean

n = Number of items

3.7.3 Coefficient of correlation (r)

It was calculated to test the relationship between each of the independent variables and each dependent variable. The formula uses as follows.

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x^2)}{n}\right)\left(\sum y^2 - \frac{(\sum y^2)}{n}\right)}}$$

Where

r = Coefficient of correlation

Σxy = Sum of Products of pairs

Σx = Sum of first sample

Σy = Sum of second sample

n = Sample size

3.7.4 Chi-square test

The chi-square test was applied to contingency tables to know the significant relationship between the variables. The formula is given below:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Where,

O = Observed frequency

E = Expected frequency

The computed values were then compared with the table values at one and five per cent levels of significance.

3.7.5 One way analysis

One way analysis has been carried out to see the difference between the food and nutrient intake among three groups and students 't' test was applied to see the significant difference between groups.

3.7.6 'Z' Test

It is done if population are normal and sample are drawn independently and at ramdom. The sizes of samples may be small or lage.

$\mu_1 = \mu_2$

Where μ_1, μ_2 are the population means for the first and second populations respectively.

$$Z = \frac{|\overline{x_1} - \overline{x_2}|}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$\overline{x_1}, \overline{x_2}$ = *Means of first and second sample*

S_1, S_2 = S.D of first and second sample

n_1, n_2 = Size of the samples.

3.7.7 Proportionate analysis

Proportionate analysis has been carried out for frequency of consumption of vegetable and fruits between groups.

CHAPTER - IV

RESULTS

RESULTS

The present study was carried out on 375 families for comparing vitamin A and Iron nutritional status of pre-school children, pregnant and lactating women in East Godavari district of Andhra Pradesh, which is well known for its horticulture and dairy development programme over a decade. Based on the strategy adopted in materials and methods, the collected data was analysed statistically and tabulated under the following subheadings.

4.1 General information

4.2 Economic contribution (income to the families) of crops and dairy

4.3 Food intake and nutritional status

4.4 Economic value of foods consumed including the foods produced and purchased

4.5 Frequency of consumption of vitamin A and iron rich foods by vulnerable groups

4.6 Vitamin A nutritional status of preschool children

4.7 Haemoglobin status of pre-school children, pregnant and lactating women

4.8 Knowledge of mothers regarding nutritional value of available products and problem of vitamin A deficiency and anaemia

The households in the study represented the following three groups :

Group I - The families deriving income through horticultural crops only, (Plate 1 and 2).

HORTICULTURAL CROPS
CULTIVATED BY FARM FAMILIES (GROUP I)

HORTICULTURAL CROPS






Group II - Families deriving income from dairy and Agriculture (Plate 3)

Group III -the control group whose income was from other sources, other than horticulture and dairying

For convenience these groups will be referred henceforth as Group I, II and III in the following pages.

4.1 GENERAL INFORMATION OF FAMILIES

Information regarding composition of families selected is summarised in Table 8.

Table 8: Age wise distribution of family members

Age wise distribution of family members	Group I N=150*	Group II N=150	Group III N=75
1-5 years	171 (18.5)	137 (16.5)	65 (14.5)
6-12 years	196 (21.3)	160 (19.3)	130 (28.9)
13-20 years	239 (25.9)	210 (25.3)	110 (24.5)
> 20 years	316 (34.3)	322 (38.9)	144 (32.1)
Total	922	829	449
Average family size	6.0	5.5	5.7

Figures in parentheses represent percentage
*N - Number of families studied in each group

The family size was 6.0, 5.5 and 5.7 in horticulture, dairy based and other families respectively. There was difference in family size between the groups.

4.1.1 Educational Status

The educational status of the head of household is presented in Table 9.

Table 9: Per cent distribution of head of household according to educational level

Educational level	Group I	Group II	Group III
Illiterate	57.3 (86)	45.4 (68)	58.7 (44)
Neoliterate	9.3 (14)	11.3 (17)	14.7 (11)
Primary	26.7 (40)	35.3 (53)	16.0 (12)
Secondary	4.7 (7)	6.7 (10)	8.0 (6)
Above secondary	2.0 (3)	1.3 (2)	2.6 (2)

Figures in parenthesis represent number of members

The per cent literates was higher in group II followed by I and III. Among literates also majority of heads of households received education upto primary level, the percentage being higher (35.3%) in dairy households and lower (16.0%) in families with other crops. The percentage of heads receiving primary education is high in Group II families. Only 6-10 per cent in the three groups were educated beyond primary level.

4.1.2 Occupational Status

Occupational status of head of households and women is presented in Table 10 and Fig.2.

Table10: Distribution of population according to occupation Of household members in three groups of families.

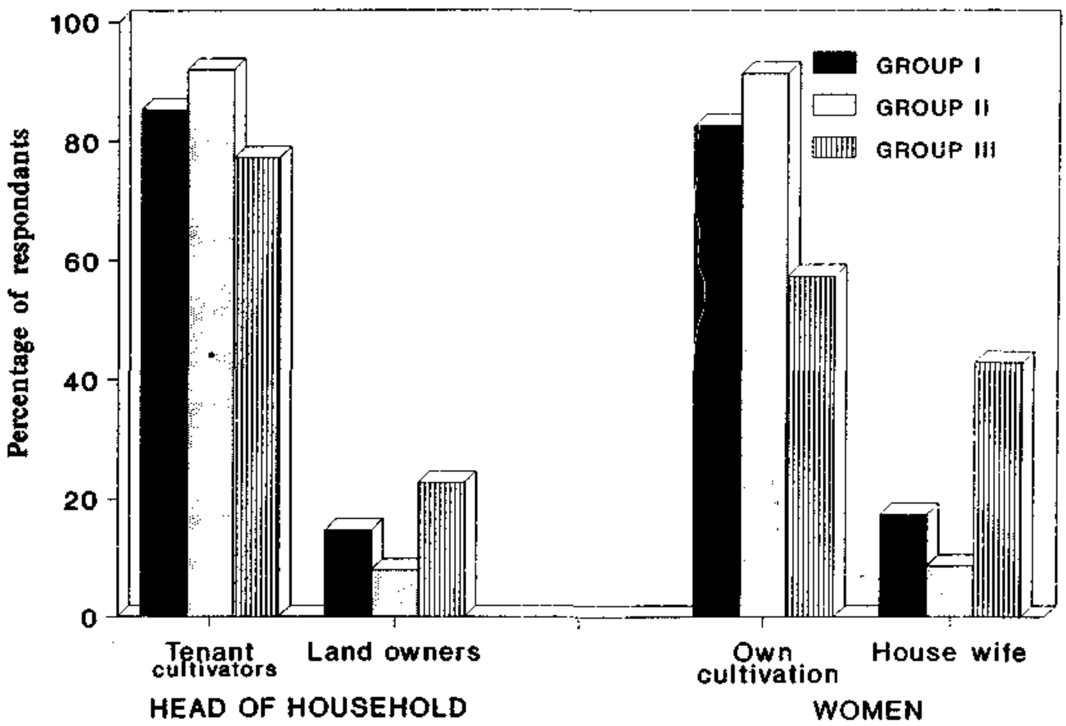
Occupation	Group I	Group II	Group III
Head of Household			
Tenant cultivators	128(85.3)	138(92.0)	58(77.3)
Land owner	22(14.7)	12(8.0)	17(22.7)
Women			
Own cultivation/ dairy	124(82.7)	137(91.3)	43(57.3)
House wife	26(17.3)	13(8.7)	32(42.7)

Figures in parenthesis represent percentage
Group I - occupied in cultivating horticultural crops
Group II-Involved mostly in dairying besides agriculture
Group III- Involved in agriculture alone

A majority of heads of the families in Group I (85.3%) and group III (77.3%) were tenant cultivators and the rest were land owners. Whereas in group II (92.0%) were involved in dairying and also tenent cultivators and remaining (8%) were land owners. possessing one or two animals and selling milk every day.

With regard to women more than 50 per cent of them were involved in their respective family occupation. The percentage of women occupied is being higher in group II (91.3%) than group I (82.6%) and group III (57.3%).

Fig.2 Percent distribution of family members *according to occupation*



4.1.3 Land holdings

Distribution of households according to land area is presented in Table 11 and Fig.3.

Table 11: Distribution of households according to land area

Land Area (acres)	Group I	Group II	Group III
< 1	60 (40.0)	73 (48.7)	35 (46.7)
1 - 2	68 (45.3)	65 (43.3)	23 (30.7)
> 2	22 (14.7)	12 (8.0)	17 (22.6)

Figures in parenthesis represent percentage

Majority of farmers in Group I (85.3%), in Group II (92%), and in Group III (77.4%) were marginal farmers having less than one acre and 1-2 acres of land. Only 14.7 per cent in group I and 8 per cent in group II were small farmers having morethan 2 acres of land and percentage of small farmers being high in group III (22.7%) when compared to the other two group.

4.1.4 Income

Households were distributed according to annual income range, presented in Table 12 and Fig.4.

Fig 3. Distribution of households according to land area

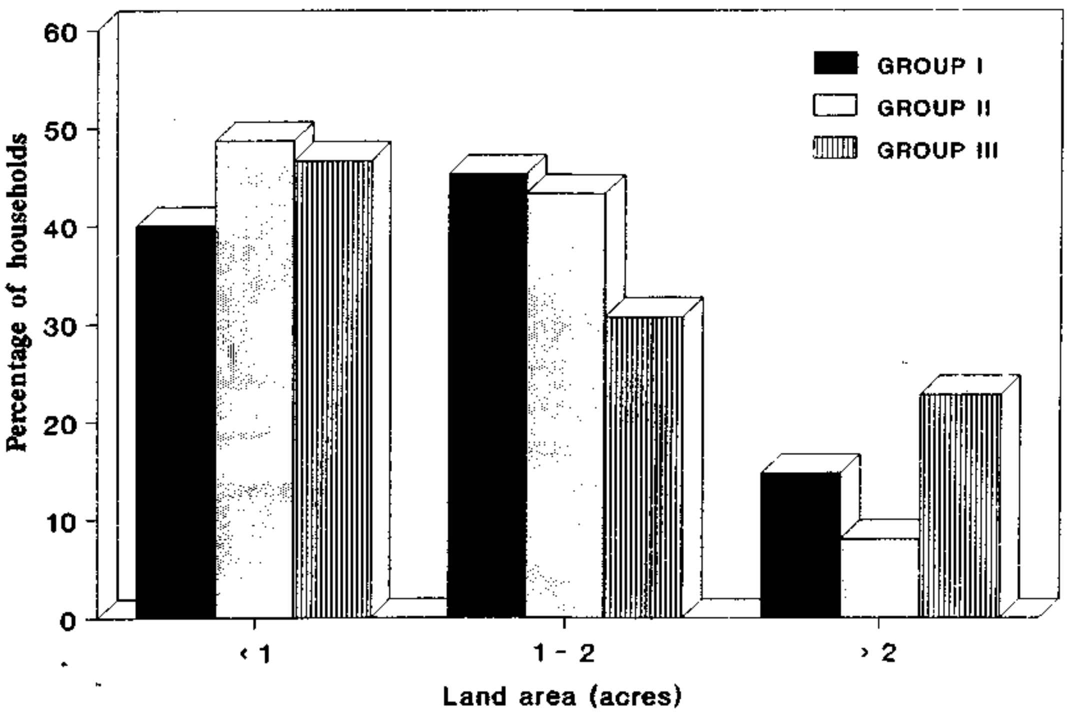


Table 12: Distribution of households according to annual income

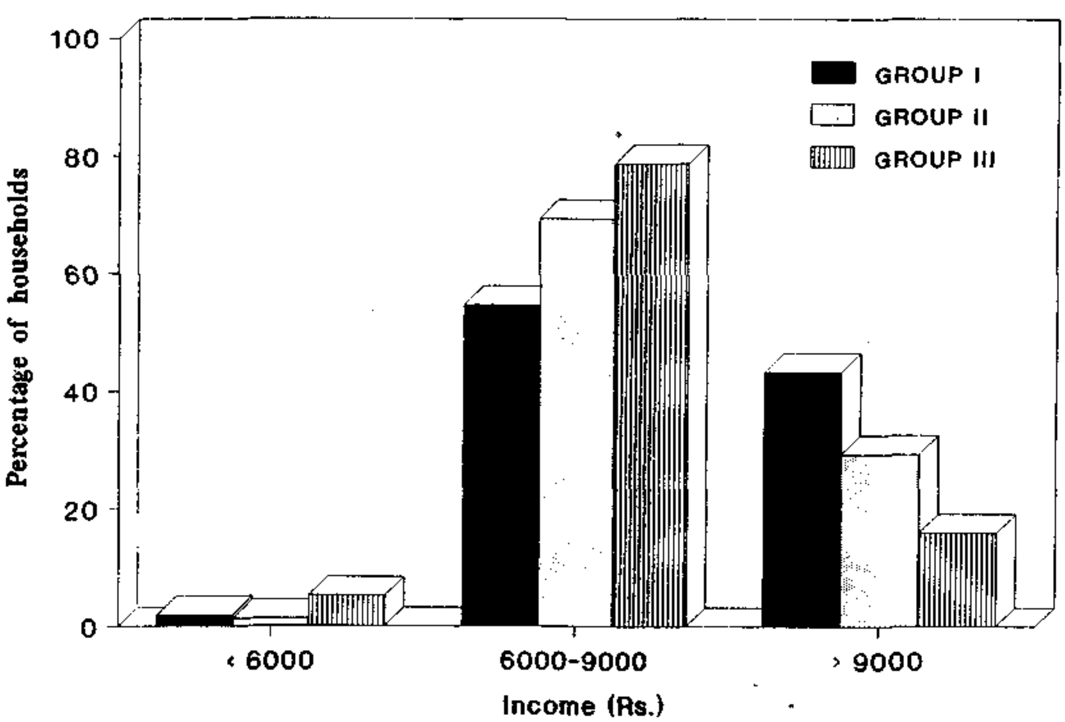
Annual income (Rs.)	Group I	Group II	Group III
< 6000	3 (2.0)	2 (1.3)	4 (5.3)
6000 - 9000	82 (54.7)	104 (69.4)	59 (78.7)
> 9000	65 (43.3)	44 (29.3)	12 (16.0)

Figures in parenthesis represent percentage

The annual income of Group I families shows that 54.7per cent were earning medium income (i.e. Rs.6000-9000) followed by 43 per cent earning high income (Rs.>9000). In group II families 69.4 per cent were earning medium income and 29.3 per cent high income. In control group 78.7 per cent and 16.0 per cent of families were earning medium and high income. Percentage of families with high income were more (43.3%) in group I when compared to Group II (28.3%) and group III (16.0%).

Income of group III population is contributed both by agricultural crops such as paddy, minor crops fodder crops and business/trading. The mean income for the group III families ranged from Rs.540/- to Rs.874/-. The source of income of third group varied and expenditure was also variable. So the net income was calculated and pooled in Table 12 along with the other two groups.

Fig.4 Distribution of households according to annual income (Rs.)



4.1.5 Food and non-food expenditure pattern of families

By and large expenditure on food was comparable between the three groups.

Table 13: Monthly food and non-food expenditure among three groups of families

Expenditure	Monthly per capita expenditure (Rs.)		
	Group I	Group II	Group III
Food	56.55	60.72	56.37
Non-food	44.20	45.60	46.80

From the Table 13 it is clear that the expenditure on food items is higher in all the three groups than on non food items. Except in dairy dependant families (Group II) whose expenditure is slightly higher on food items than horticulture families (Group I) and families with other crops (Group III).

The per capita expenditure on different food items is classified in Table 13 and is shown in Fig.5. Some items were purchased whereas some items like cereals, vegetables and fruits, were produced. The cost of home produced products was estimated from the quantity consumed in order to arrive at the expenditure of these items.

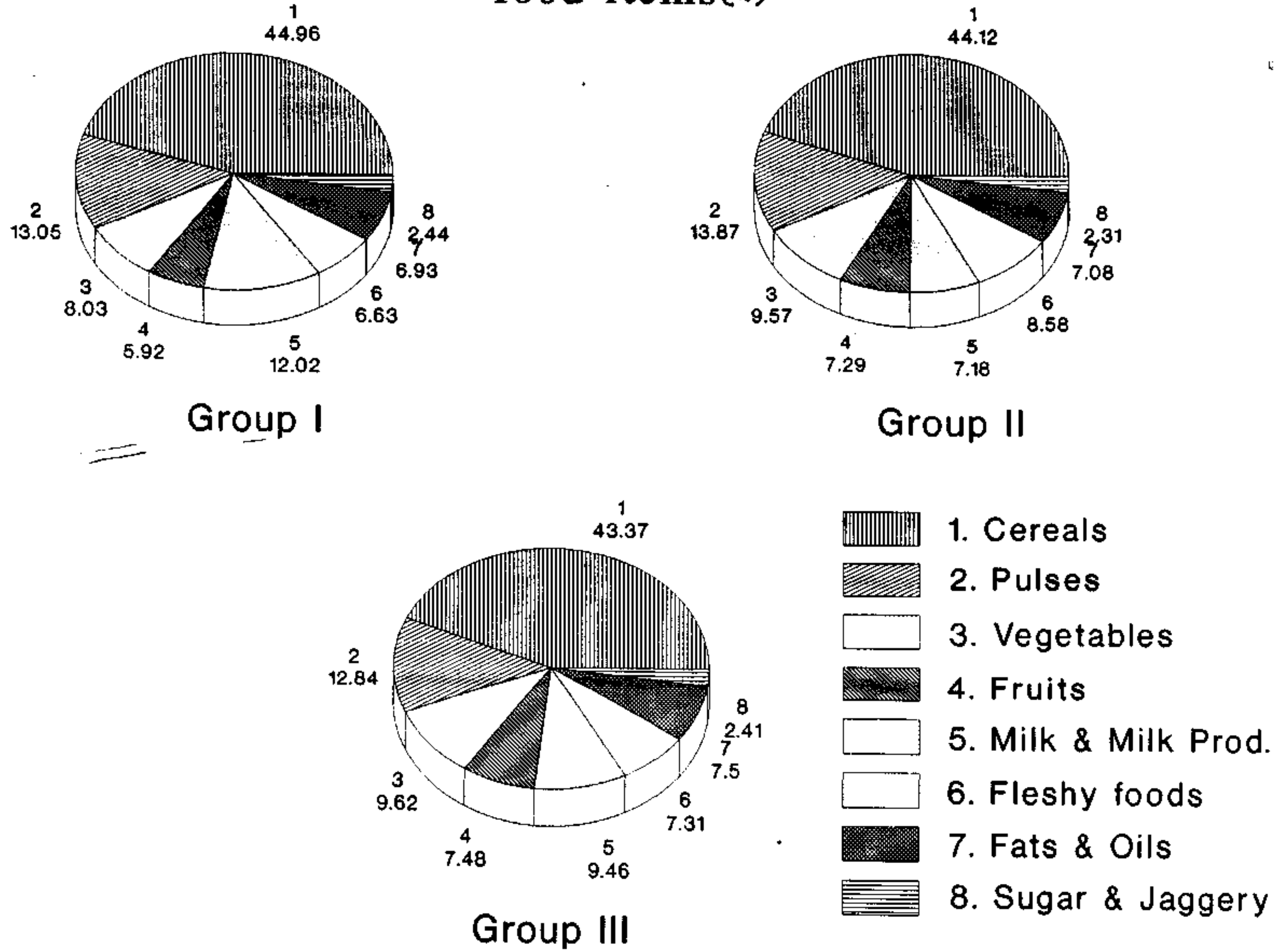
Table 14 shows the mean household food expenditure of Group I and Group II and Group III families.

Table 14: Monthly per capita expenditure on different food items (Rs.)

Foods	Group I	Group II	Group III
Cereals	25.43	26.79	24.45
Pulses	7.38	8.42	7.24
Vegetables	4.54	5.81	5.42
Fruits	3.35	4.43	4.22
Milk & milk products	6.80	4.36	5.33
Fleshy foods	3.75	5.21	4.12
Fats and oils	3.92	4.30	4.23
Sugar & jaggery	1.38	1.40	1.36
Total	56.55	60.72	56.37

The expenditure on cereals and pulses was more in second group than in other groups, but no significant difference was observed. In group III and group II there was an upward trend in expenditure on vegetables and fruits compared to group I. Group II is spending least on milk and milk products when compared to other two groups. The expenditure on fleshy foods is somewhat higher in group II families. Whereas the expenditure on fats and oils, sugar and jaggery is almost similar in three groups. In the total expenditure on food there was not much difference between the groups.

food items(%)


1
44.96
2
13.05
3
8.03
4
5.92
5
12.02
6
6.63
7
6.93
8
2.44
Group I
1
44.12
2
13.87
3
9.57
4
7.29
5
7.18
6
8.58
7
7.08
8
2.31
Group II
1
43.37
2
12.84
3
9.62
4
7.48
5
9.46
6
7.31
7
7.5
8
2.41
Group III
1. Cereals
2. Pulses
3. Vegetables
4. Fruits
5. Milk & Milk Prod.
6. Fleshy foods
7. Fats & Oils
8. Sugar & Jaggery

4.2 ECONOMIC CONTRIBUTION (INCOME TO THE FAMILIES) OF CROPS AND DAIRY

4.2.1 Economic contribution of vegetable crops:

Information regarding type of vegetables and fruit crops grown were collected from Group I families and presented in Table 15a and 15b.

The details regarding different vegetable crops grown and the average yield per year, quantity sold per year and income earned per year per crop is given in the Table 15a.

Table 15a: Distribution of households according to type of crops raised

S.No.	Crops	Percentage of families growing	Average yield per year (kg)	Quantity sold/yr. (kg)	Rate/ quintal (Rs.)	Total income earned (Rs.)
	GLV					
1.	Amaranth - Amaranth gangeticus	7.3	903.6±430.4	840.9±409.2	200	1682
2.	Spinach - Spinacea olesacea	6.6	425.0±209.1	400.0±205.4	200	1600
3.	Coriander - Coriander sativum	1.3	1110.0±295.0	800.0±282.8	200	1600
4.	Gogu - Hibiscus subclarifa	8.6	658.1±265.6	607.6±272.2	277	1683
5.	Cabbage - Brassica oleracea	12.0	1472.3±2255.1	931.66±739.3	400	3727
	Other vegetables					
1.	Tomato - Lycopersicon esculentum	20.0	883.8±645.9	806.66±651.22	700	5647
2.	Cluster beans - Cyamopsis tetragonaloba	1.3	812.5±724.7	700.0±707.1	375	2625
3.	Chillies - Capsicum annum	8.6	1246.15±757.6	1215.0±749.3	800	9723
4.	Yam - Typhonium trilobatum	5.9	1171.11±479.7	1088.8±478.13	400	4355
5.	Brinjal - Solanum melongia	46.0	1322.75±707.35	1209.4±697.0	165	1996
6.	Ladies finger - Abelmoschus esculentum	21.9	1108.2±733.3	1033.33±723.56	400	4133
7.	Ridge gourd - Luffa acutangula	18.7	1100.0±735.1	995.71±697.03	400	3983
8.	Broad beans - Vicia faba	17.3	1368.07±599.9	1281.5±592.5	400	5126
9.	Cauliflower	2.0	4137.5±2944.0	4000.0±2943.9	180	7200
10.	Potato, Colacacia, Pumpkin, Kovai	0.6	1817.5±1606.88	1715.0±1524.8	425	7289

About ten vegetable crops and five green leafy vegetable crops were grown. Out of them green chillies, ladies finger and brinjal were grown twice a year and other crops were grown only once a year.

One third of the families (46.0%) were growing brinjal followed by ladies finger (21.9%), tomatoes (20.0%), Ridge gourd (18.7%), Broad beans (17.3%). A small number of farmers i.e. 0.6%-2% were growing cauliflower, cluster beans, potato, colacasia, pumpkin, kovai. Among green leafy vegetables most of the selected farmers were growing cabbage(12.0%), followed by gogu (8.6%), Amaranth (7.3%), spinach (6.6%) and coriander (1.3%). Four green leafy vegetables were grown by less than 10 per cent of families. Out of 5 green leafy vegetables 4 are grown twice a year.

The reasons for taking up vegetable cultivation by Group I families were because of family tradition (80%) and due to their own interest and also due to the availability of regular irrigation to crops.

The yield was marignally better in the villages. Most of the quantity was sold in the market. Maximum income per annum was earned from chillies/crop which was about Rs.9723. Income from cauliflower was about Rs.7200/- whereas from tomato crop farmers are deriving returns Rs.5647. From Brinjal crop the income was Rs.1996, eventhough the mean income is less from brinjal crop, majority of the farmers (46%) (Table 15a) were growing brinjal because it had regular ready market in the local area.

The mean income earned from GLV was Rs.3727 from cabbage followed by gogu, amaranth, spinach and coriander. Cabbage is cultivated once in a year by the farmers and immediately after cabbage they are cultivating other vegetables and floriculture for regular income.

With regard to the marketing of the vegetables, 90.7 per cent of farmers sold the produce in the local market because of the proximity of the wholesale market. Whereas 9.3 per cent were selling the produce in the market closest to the urban town.

4.2.2 Economic contribution of fruit crops

Fruit crops grown and mean income earned was presented in Table 15b.

Table 15b: Types of fruit crops grown by Group I families

S.No.	Crops	Percentage of families growing	Average yield/yr (kg)	Quantity sold/yr (kg)	Rate/ Quintal (Rs.)	Total income earned/yr/ crop (Rs.)
1.	Mango - Mangifera Indica	3.3	2440.0±2441.5	2440.0±2041.5	500	12,200
2.	Papaya - Carica papaya	2.5	862.5±243.08	800.0±163.2	325	2600
3.	Sapota - Manilkara adhres	1.3	3890.0±2550.3	3750.0±2529.9	250	9375
4.	Banana - Mura Indica	16.6	739.9±469.6	714.8±466.3	1500	10,722
5.	Guava - Psidium Gujava	8.6	3316.6±2886.3	3137.6±2848.5	300	9413

± S.D.

The major fruit crops grown were mangoes, plantain, sapota and guava. These were grown mostly by a small percentage of small and marginal farmers.

The mean income from mango crop was Rs.12,200/- which is high. From the remaining crops the income ranges from Rs.2600/- (papaya crop) to Rs.9413 Guava crop. Income generated from fruit crops was high when compared to vegetable crops.

4.2.3 Information on Dairy : Income and expenditure on Dairy

Details of milk production, quantity of milk sold and income earned from dairy, from Group II families are presented in Table 16.

Table 16: Details of milk production, quantity of milk sold and income earned from dairy (Group II), according to dairy size, milk yield and quantity sold, income earned by Group II families

	Particulars	
1.	Total number of milch animals	383.0
2.	Average number of animals per household	3.0
3.	Total milk yield l / day	1886.0
4.	Average milk yield l / animal/day	4.85
5.	Average quantity sold l /day	4.45
6.	Average income earned Rs. /day	27.6
7.	Quantity of milk retained l / day/family	0.474

The total milk yield obtained from 383 animals was 1886 lt/day. The average number of animals per household was three for both small and marginal farmers. The average milk yield was about 5 lts per day of which 4.45 lts. was sold per day. The quantity of milk retained was about 0.474 lts per day in families of Group II.

The mean total income and during study year and the mean income derived from dairy previous to study year was presented in Table 17.

Table 17: Mean total income from Dairy for previous year and during study period.

Items sold	Previous year (1992)		Study period (1993)	
	Rs./month	Rs/year	Rs./month	Rs/year
Milk	847	10164	828	9936
Milk products	194	2212	165	1887
Livestock	-	940	-	739
Manure	-	164	-	149
		13480		12711

The total income per month per family from milk alone was estimated as Rs.828/-. Most of the income was from sale of milk. Particulars regarding mean income from dairy previous year shows that income was high when compared to study year. In both the years the main source of income was from sale of milk only.

4.2.4 Expenditure

The mean expenditure on dairy Rs.3,463 including cost of feed, medical treatment of animals, labour and miscellaneous expenditure etc. The total profit per family was Rs.6,540 per year.

4.2.5 Management of Dairy

Particulars regarding the members involved in the management of dairy is shown in Table 18.(PLATE 2)

Table 18: Percentage of family members participating in the management of dairy (Group II)

Family members	Dairy (Group II)	
	No. of HH	%
Head of family	48	32
House wife with the help of servant	78	52
Any other (or) old people	23	16.3

In a majority of the households women (52%) were involved in dairy activities such as milching, cleaning and feeding. Only 32 per cent of household men were involved in the dairy activity apart from farm activity.

MAINTANANCE OF DAIRY BY FARM FAMILIES (GROUP II)

4.3. FOOD INTAKE AND NUTRITIONAL STATUS

4.3.1 The Food and Nutrient intake of 1-3 years and 4-6 years children

The food and nutrient intake of 1 to 3 years children are given in Table 19 and in Figures 6a and 6b.

Table:19 Mean food intake of 1-3 and 4-6 years children in three groups of families.

Foods	1-3 years children				4-6 years children			
	RDA*	Group I	Group II	Group III	RDA*	Group I	Group II	Group III
Cereals	175	164.5^{a} (94.0)	156.0^{a} (89.1)	169.6^{a} (96.9)	270	226.8^{a} (84.0)	233.5^{a} (86.5)	212.1^{a} (78.6)
Pulses	35	20.2^{a} (57.7)	24.5^{a} (70.0)	20.8^{a} (59.4)	35	25.0^{a} (71.4)	26.8^{a} (76.6)	23.7^{c} (67.7)
GLV	40	24.1^{a} (60.3)	13.3^{bc} (33.3)	13.1^{c} (32.8)	50	23.4^{a} (46.8)	16.8^{b} (33.6)	13.8 (27.6)
Other vegetables	30	35.1^{a} (117.0)	25.2^{a} (84.0)	25.0^{a} (83.7)	50	38.5^{a} (77.0)	29.1^{a} (58.2)	27.2^{a} (54.4)
Milk & milk products	300	124.5^{a} (41.5)	187.0^{b} (62.3)	96.6^{ca} (32.2)	250	154.8^{a} (61.9)	226.6^{b} (90.6)	170.7[illegible] (68.3)
Fats & oils	15	12.9^{a} (86.0)	12.9^{a} (86.0)	12.5^{a} (83.3)	25	13.5^{a} (54.0)	12.3^{b} (49.2)	13.8^{a} (55.2)

*ICMR (1992)
Figures in parentheses represent percentage of requirement met
Figures carrying the same superscripts are not significant between the groups
Figures carrying different superscripts are significantly different (P<0.01) between the groups

In all the three groups the intake of cereals, pulses, fats and oils was adequate. There was no significant difference between the three groups in the intake of cereals, pulses, fats and oils. Intake of green leafy vegetables, other vegetables, milk and milk products was not satisfactory in all the three groups.

Between the groups, the consumption of milk and milk products in group II was higher ($P<0.05$). There is no significant differece between group I and group III children in the intake of milk and milk products. The vegetable

Fig.6(a) Mean food intake of 1-3 years children

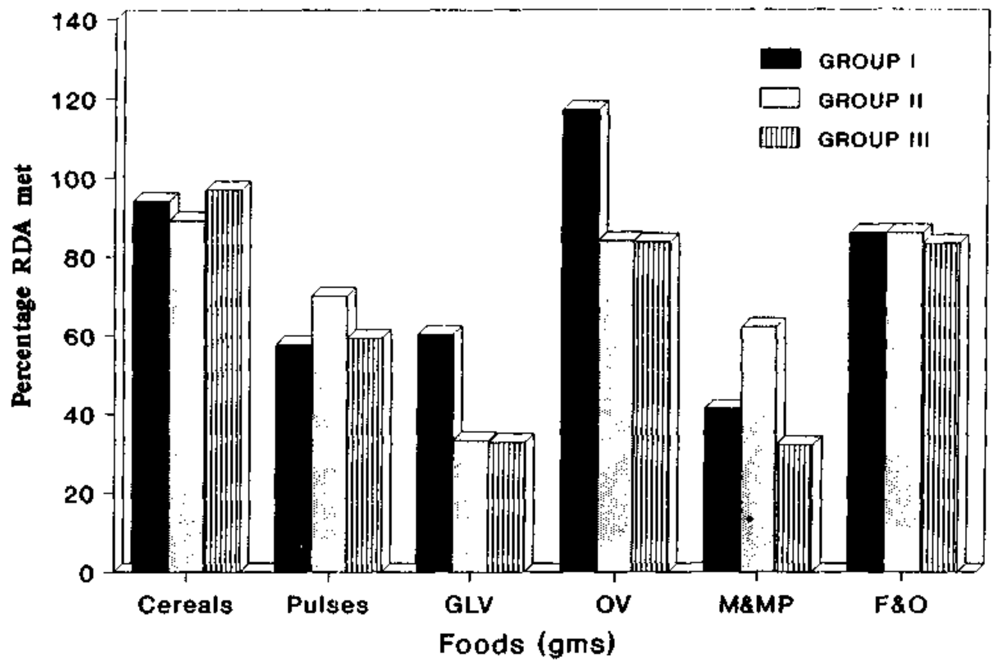
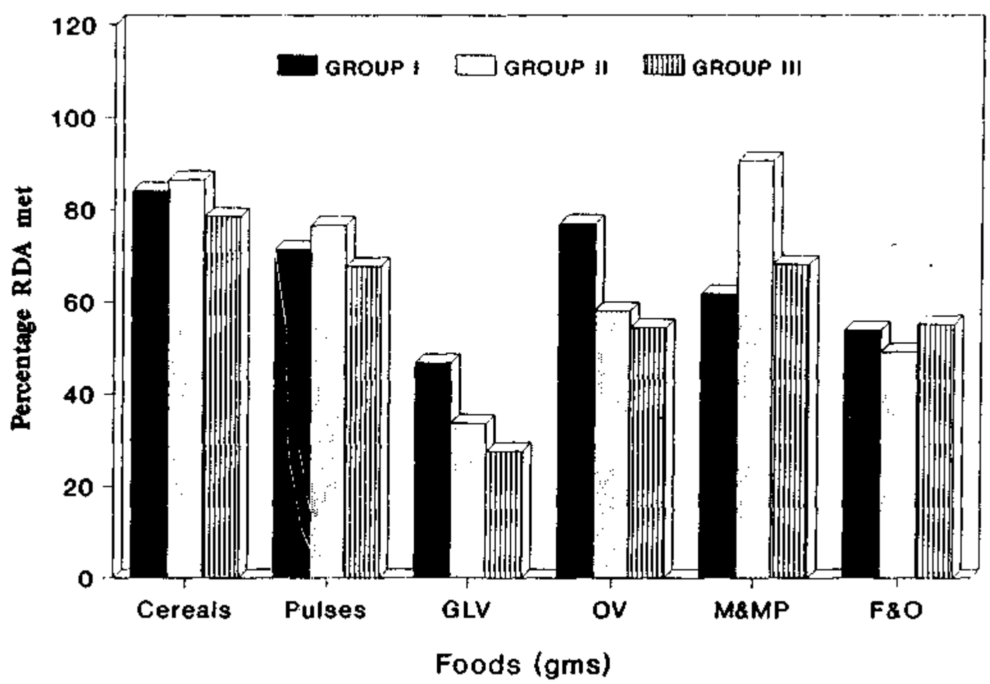


Fig.6(b) Mean food intake of 4-6 years children



consumption in group I, though it was inadequate was significantly (P<0.05) greater than group II and group III.

The diets of the three groups fell short of all foods except cereals and pulses. Intake of greens was less than RDA in all the groups, the mean intake of which was higher in group I than in the other two groups. Consumption of other vegetables was below 50 per cent RDA.

Nutrient intake of the pre-school children (1-3 years and 4-6 years) is presented in Table 20 and Fig.7a and 7b.

Table20: Mean nutrient intake of 1-3 and 4-6 years children in three groups of families

	1-3 years children				4-6 years children			
Foods	RDA*	Group I	Group II	Group III	RDA*	Group I	Group II	Group III
Energy (K.cal)	1240	1048.3^{a} (84.5)	995.2^{a} (80.3)	1008.6^{a} (81.3)	1690	1258.6^{a} (74.5)	1310.3^{a} (77.5)	1118.6^{a} (66.2)
Protein (gm)	22	25.2^{a} (114.5)	26.3^{a} (119.5)	24.4^{a} (110.9)	30	31.2^{a} (104.0)	34.2^{a} (114.0)	27.4^{c} (91.3)
Calcium (mg)	400	368.5^{a} (92.1)	504.1^{b} (126.0)	289.3^{ca} (72.3)	400	436.2^{a} (109.1)	468.0^{b} (117.0)	287.5^{c} (71.8)
Iron (mg)	12	6.8^{a} (56.7)	5.1^{b} (42.5)	5.7^{ab} (47.5)	18	7.8^{a} (43.3)	6.35^{b} (35.3)	6.48^{ca} (36.0)
Vitamin A (µg)	1600	258.5^{a} (64.6)	191.5^{bc} (47.9)	162.7^{c} (40.7)	400	235.05^{a} (58.8)	199.95^{ac} (49.9)	157.1^{c} (39.3)

*ICMR (1989)
Figures in parentheses represent percentage of requirement met.
Figures carrying the same superscripts are not significant between the groups.
Figures carrying different superscript are significantly different (P<0.01) between the groups.

Of all the nutrients, the intake of iron was most inadequate in all the three groups. In group I, the intake of iron was significantly (P<0.01) more than

Fig.7(a) Mean nutrient intake of 1-3 years children

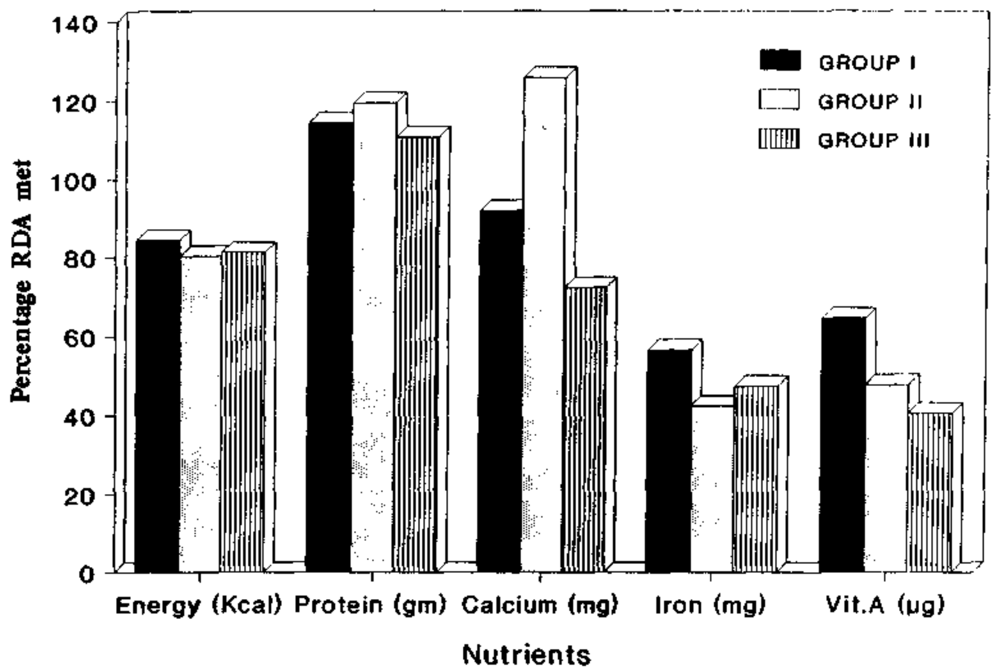
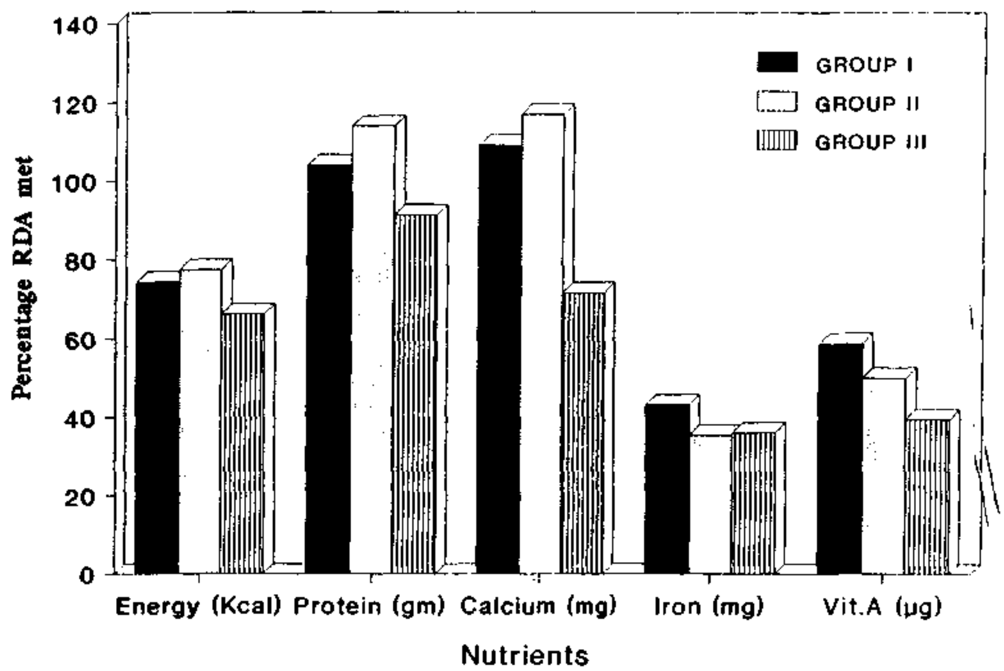


Fig.7(b) Mean nutrient intake of 4-6 years children



in group II and III. There was no significant difference in the intake of calories and proteins. Protein intake was adequate in all the three groups. Intake of vitamin A was below the RDA in all the groups. Only in group I the intake was higher when compared to other two groups. Calcium intake of group II was significantly higher than other groups.

The diets of all the age groups children were meeting RDA with regard to calories and protein. The protein intake in group I and II was significantly (P<0.05) more than group III.

The calcium intake was adequate in all the three groups. The iron intake was deficient in the three groups and the intake was significantly (P<0.01) higher in group I and group III. The intake of vitamin A was fell short by about less than 50 per cent in all the three groups and the intake of vitamin A is significantly (P<0.01) higher in group I when compared to group II and III.

When food intake of the children in all the three groups was compared with RDA, only 39.3 per cent, 37.5 per cent, 39.1 per cent in Group I, II and III, respectively were found to meet the RDA of cereals. In the case of pulse, the RDA met was 25 per cent, 33.3 per cent, 23.9 per cent respectively (Table 21a).

Table 21a: Percentage of children meeting RDA of food intake among the three groups

Group	Age group	Number	Cereals	Pulses	Green leafy vegetables	Other vegetables	M & MP
I	1-3	26	57.7	15.4	19.2	76.9	3.8
	4-6	30	23.3	33.3	6.6	56.7	16.7
	Total	56	39.3	25.0	12.5	66.1	10.7
II	1-3	26	50.0	30.8	3.8	80.6	30.8
	4-6	22	22.7	36.4	0.0	59.1	50.0
	Total	48	37.5	33.3	2.1	70.8	39.6
III	1-3	23	65.2	11.5	0.0	82.6	0.0
	4-6	23	13.0	34.8	0.0	47.8	21.7
	Total	46	39.1	23.9	0.0	65.2	10.9

In case of green leafy vegetables, only 12.5 per cent and 2.1 per cent of RDA met in group I and II. In case of other vegetable 66.1 per cent, 70.8 per cent, 65.2 per cent of RDA were met respectively. Only of 10.7 per cent, in group I and 10.9 per cent in group III could fulfill their milk requirement. Whereas 39.6 per cent in group II could meet the milk requirement.

Percentage of children consuming nutrients (Energy, Protein, Vitamin A and Iron) comparable to RDA was presented in Table 21b.

Table 21b: Percentage of children meeting RDA of energy, protein, vitamin A and iron

Group	Age group	Number	Energy (K.cal)	Protein (g)	Vitamin A (ug)	Iron (mg)
I	1-3	26	34.6	73.1	38.5	7.7
	4-6	30	16.7	70.0	23.3	0.0
	Total	56	25.0	71.4	30.4	3.6
II	1-3	26	34.6	80.8	11.5	0.0
	4-6	22	18.2	81.8	18.2	0.0
	Total	48	27.1	81.3	14.6	0.0
III	1-3	23	30.4	78.3	4.3	2.0
	4-6	23	0.0	26.1	13.0	0.0
	Total	46	15.2	52.2	8.7	4.3

When the nutrient intake of children of the three groups I, II and III was compared with RDA, only 25 per cent, 27.1 per cent and 15.2 per cent respectively were able to meet the energy requirement; 71.4 per cent, 81.3 per cent, 52.2 per cent from group I, II and III respectively were meeting protein requirements; 30.4 per cent from group I and 14.6 per cent from group II, 8.7 per cent from group III were able to meet the vitamin A requirements and 3.6 per cent and 4.3 per cent from group I and III none of the children of group II was able to meet the iron requirement.

4.3.2 Pregnant and lactating women

The food intake of pregnant and lactating women is presented in Table 22 and in Figures 8a and 8b.

Table 22: Mean food intake of pregnant and lactating women in three groups of families

	Pregnant women				Lactating women			
Foods	RDA*	Group I n=16	Group II n=19	Group III n=8	RDA*	Group I n=9	Group II n=12	Group III n=6
Cereals	475	526.0^{a} (110.7)	486.9^{a} (102.3)	501.4^{a} (105.6)	500	505.3^{a} (101.1)	493.9^{a} (98.8)	487.0^{a} (97.4)
Pulses	60	64.7^{a} (107.8)	51.9^{a} (86.5)	51.5^{a} (85.8)	75	49.2^{a} (65.6)	42.5^{a} (56.7)	45.1^{a} (60.1)
GLV	100	36.5^{a} (36.5)	17.4^{b} (17.4)	21.4^{ab} (21.4)	100	38.9^{a} (38.9)	19.8^{b} (19.8)	29.1^{c} (29.1)
Other vegetables	40	58.7^{a} (146.8)	61.6^{a} (154.0)	60.8^{a} (152.0)	40	61.0^{a} (152.5)	61.8^{a} (154.4)	48.1^{a} (120.3)
Milk & milk products	250	170.4^{a} (69.2)	225.7^{b} (90.3)	160.7^{ab} (64.3)	250	184.2^{a} (73.7)	226.5^{b} (90.6)	163.4^{a} (65.4)
Fats & oils	20	25.2^{a} (126.0)	22.3^{a} (111.5)	20.0^{a} (100.0)	35	26.5^{a} (75.7)	19.1^{a} (54.6)	20.5^{a} (58.6)

*ICMR (1992)
Figures in parentheses represent percentage of requirement met
Figures carrying the same superscript are not significant between the groups.
Figures carrying different superscript are significantly different (p<0.01) between the groups.

Fig.8(a) Mean food intake of pregnant women

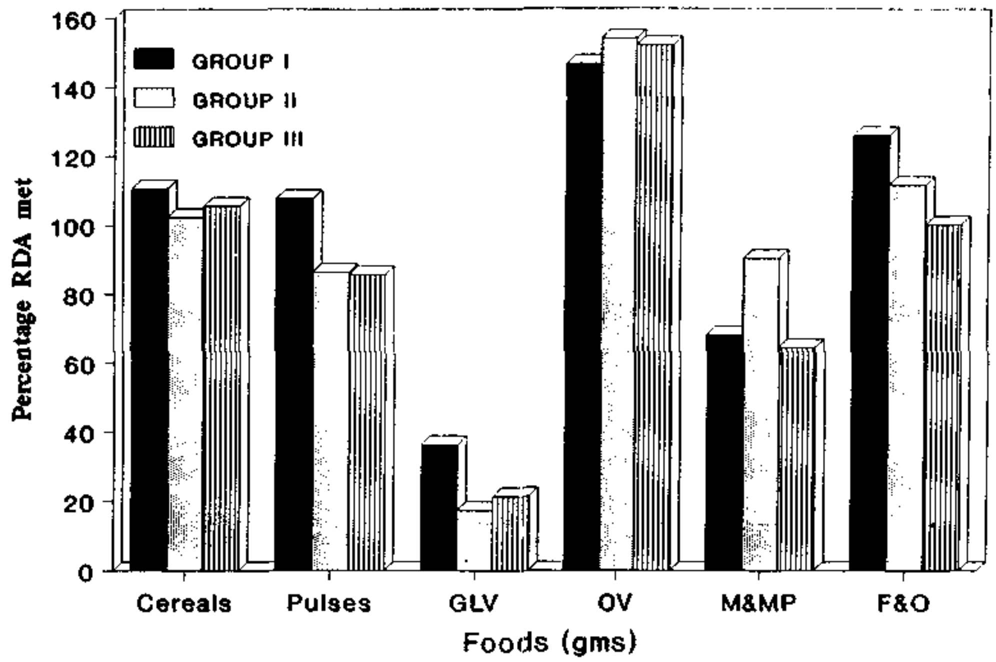
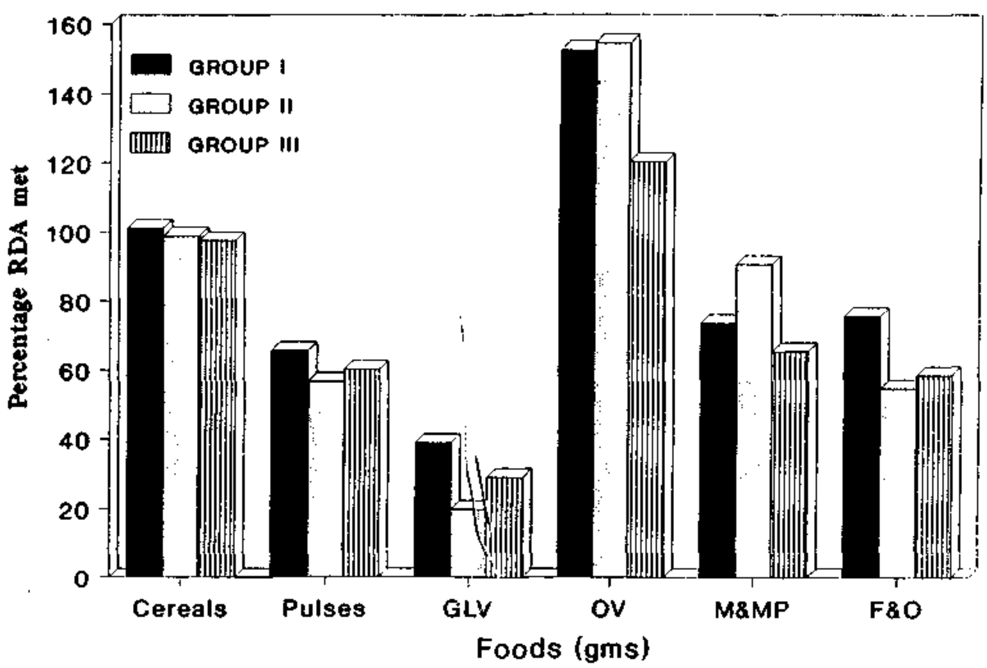


Fig.8(b) Mean food intake of lactating women



The food consumption pattern of pregnant women showed that GLV, milk and milk products intake was low in comparison to RDA. The intake of green leafy vegetables is only 17.4 per cent to 36.5 per cent of RDA among all the three groups, but the intake was significantly ($P<0.01$) higher in group I families. Milk consumption was significantly ($P<0.01$) higher in group II and there were no significant differences between group I and group III. Whereas in all the three groups the intake of other vegetables, cereals is higher than RDA and pulse intake is satisfactory in all the groups.

Among the three groups, consumption of cereals and other vegetables is adequate and pulses is just adequate. Consumption of green leafy vegetables is significantly higher ($P<0.05$) in group I when compared to other two groups. But the per cent RDA met being lower in all the three groups. Intake of milk and milk products is less than RDA in group I and group III but it is higher in lactating mothers of group II.

Nutrient intake of pregnant and lactating women among three groups is presented in Table 23 and Fig.9a and 9b.

Table 23: Mean nutrient intake of pregnant and lactating women in three groups of families

	Pregnant women				Lactating women			
Foods	RDA*	Group I	Group II	Group III	RDA*	Group I	Group II	Group III
Energy (K.cal)	2525	2470.0^{a} (97.8)	2357.1^{a} (93.4)	2171.6^{a} (86.0)	2775	2381.7^{a} (85.8)	2364.8^{a} (85.[illegible])	2377.7^{a} (85.7)
Protein (gm)	65	62.3^{a} (95.8)	58.7^{a} (90.3)	55.0^{a} (84.6)	68	52.0^{a} (76.5)	54.4^{a} (80.0)	[illegible]
Calcium (mg)	1000	309.45^{a} (30.95)	398.8^{b} (39.9)	345.2^{ca} (34.5)	1000	347.7^{a} (34.8)	414.6^{b} (41.5)	[illegible] (38.[illegible])
Iron (mg)	38	23.3^{a} (32.3)	9.4^{b} (24.7)	9.1^{c} (23.9)	30	8.4^{a} (28.0)	6.7^{b} (22.3)	[illegible] (23.3)
Vitamin A (ug)	2400	299.6^{a} (49.9)	194.5^{b} (32.4)	215.2^{cb} (35.9)	950	272.4^{a} (24.2)	202.7^{b} (19.7)	194.6^{cb} ([illegible])

*ICMR (1992)
Figures in parentheses represent percentage of requirement met.
Figures carrying the same superscript are not significant between the groups.
Figures carrying different superscript are significantly different (P<0.01) between the groups.

Pregnant women are deficient in all the nutrients excepting energy and protein. The calcium intake is below RDA and only one third of requirement was met. The intake of iron and vitamin A is fell short of RDA. Only in group I the intake is significantly (P<0.05) higher than the other two groups but 50 per cent lower than RDA.

Almost all the nutrients fell short in the diets of lactating women except calories. Gross deficiency was observed in calcium, iron and vitamin A intake, which was less than 50 per cent of RDA. Though among the three groups the intake of the three nutrients was below RDA. The intake of vitamin A and iron was significantly higher (P<0.05) in group I than other two groups. Whereas the intake of calcium is significantly higher (P<0.05) in group II than group I and III.

Fig.9(a) Mean nutrient intake of pregnant women

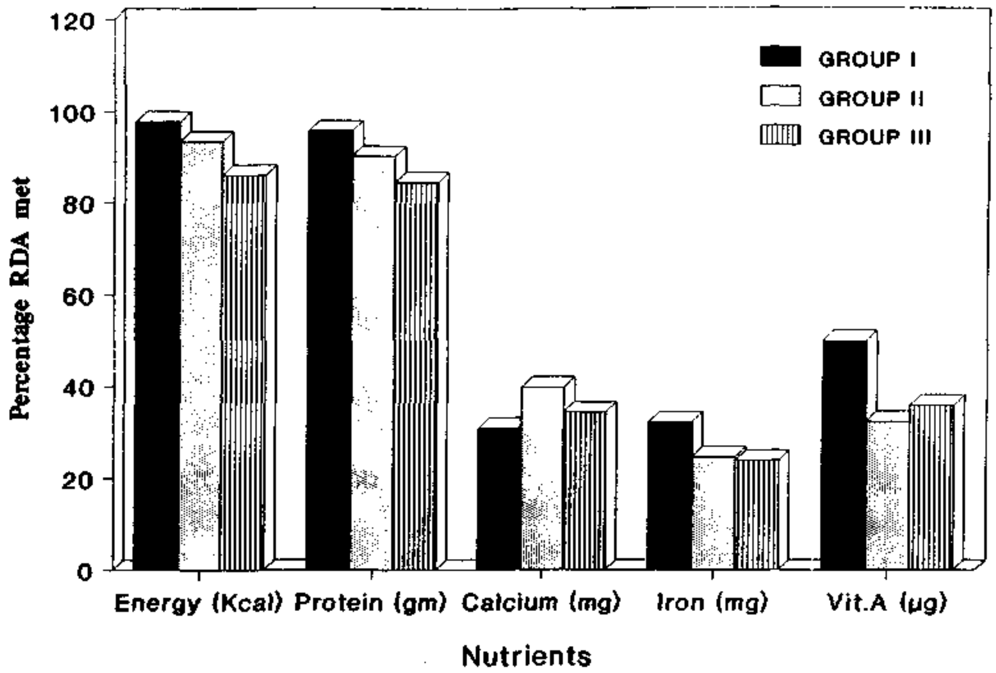
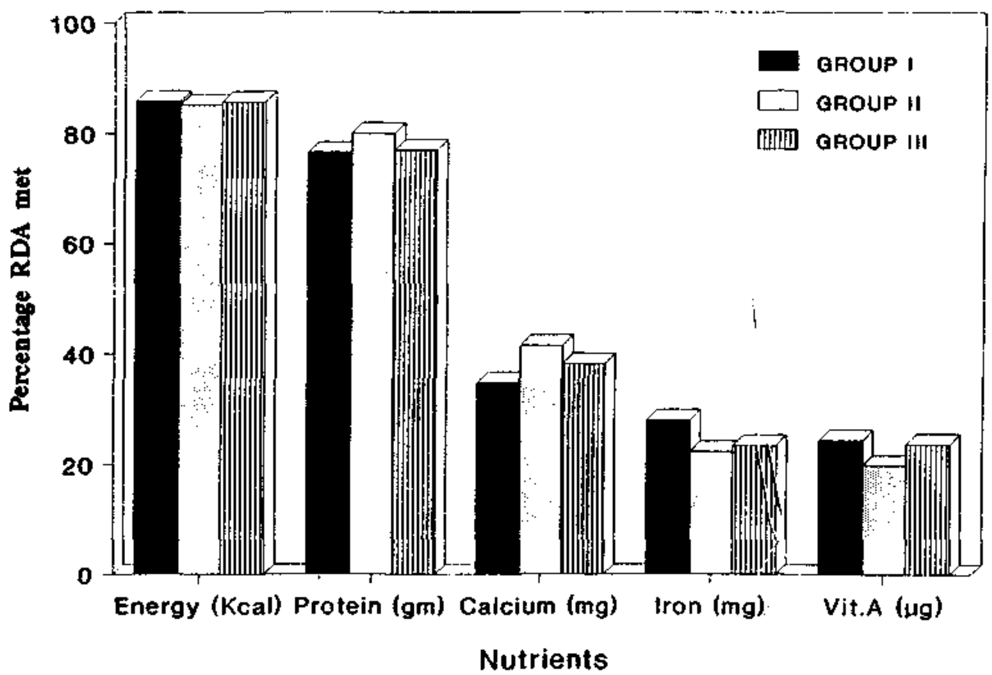


Fig.9(b) Mean nutrient intake of lactating women



When food intake of pregnant and lactating women in the three groups Group I, II and III were compared with RDA, about 87.5 per cent, 68.4 per cent, 75 per cent respectively in case of cereals; 87.5 per cent, 84.2 per cent, and 87.5 per cent respectively in case of other vegetables; only 12.5 per cent in group I, 26.3 per cent in group II and no consumption in case of milk and milk products by pregnant women in group III. And none of the pregnant women could meet the green leafy vegetable requirement.

Only 66.7 per cent, 41.7 per cent and 50 per cent lactating women respectively were found to meet the RDA of cereals; 11.1 per cent of group I and none in group II and III were able to meet RDA with respect to pulses. None of lactating women were able to meet green leafy vegetable requirement. 77.8 per cent, 91.7 per cent, 50 per cent respectively were meeting other vegetable requirement; only of 11.1 per cent, 25 per cent, 33.3 per cent respectively were able to meet milk and milk products requirement (Table 24a).

Table 24a Percentage of pregnant and lactating women consuming foods to meet RDA among three groups

Group	Physiological status of women	Number	Cereals	Pulses	Green leafy vegetables	Other vegetables	M & MP
I	Pregnant	16	87.5	75.0	0	87.5	12.5
II	Pregnant	19	68.4	52.6	0	84.2	26.3
III	Pregnant	8	75.0	37.5	0	87.5	0
I	Lactating	9	66.7	11.1	0	77.8	11.1
II	Lactating	12	41.7	0	0	91.7	25.0
III	Lactating	6	50.0	0	0	50.0	33.3

Only 62.5 per cent in group I, 36.8 per cent in group II and 25 per cent in group III pregnant women were able to meet energy requirement; 50 per cent, 57.9 per cent, 37.5 per cent respectively were able to meet RDA in case of proteins. Only 12.5 per cent, 5.3 per cent and nil respectively were able to meet vitamin A requirement and none of the pregnant women were able to meet iron requirement (Table 24b).

Table 24b: Percentage of pregnant and lactating women meeting RDA of energy, protein, vitamin A and iron

Group	Physio-logical status of women	Number	Energy (K.cal)	Protein (g)	Vitamin A (ug)	Iron (mg)
I	Pregnant	16	62.5	50.0	12.5	0
II	Pregnant	19	36.8	57.9	5.3	0
III	Pregnant	8	25.0	37.5	0	0
I	Lactating	9	0.0	11.1	0.0	0
II	Lactating	12	8.3	8.3	0	0
III	Lactating	6	16.7	33.3	0	0

When nutrient intake of lactating women of three groups was compared with RDA, only 8.3 per cent, 16.7 per cent in group II and III were meeting energy requirements. Whereas 11.1 per cent, 8.3 per cent, 33.3 per cent respectively with respect to protein. None of lactating women were meeting vitamin A and iron requirement in all the three groups.

4.3.3 Anthropometric measurements

Height and weight of children between 1-3 years and 4-6 years and pregnant and lactating women were recorded. The mean values of heights and weights are compared with NNMB data and presented in Table 25.

Table 25: Mean weights and heights of preschool children among horticulture, dairy based and other families

Anthropometric measurements	Group I	Group II	Group III	NNMB (1990-91)
1-3 years				
n	66	47	45	
Weight (kgs)	11.3±1.4	10.9±1.6	10.6±1.4	8.9
Height (cms)	85.68±8.4	85.65±8.5	86.9±8.2	76.8
4-6 years				
n	134	108	60	
Weight (kgs)	14.4±1.8	13.9±1.65	12.6±1.2	14.5
Height (cms)	98.2±8.9	97.0±9.6	96.6±7.9	101.9

± S.D. n=Number of children

4.3.3.1 Pre-school children

The mean weight of pre-school children ranged from 10.6 to 11.3 kgs among 1-3 years age group children. Whereas the mean heigts of children varied from 85.65 to 86.9 cms. In 4-6 years age group children the mean weights and heights ranged from 12.6 to 14.4 kgs and 96.6 to 98.2 cms. Though the mean weights of children in group III was comparatively less than group I and II but no significant difference was observed. Among all the groups, the heights and weights of children were lower than NCHS standards. Impact of horticulture and dairy has reflected on the anthropometric measurement of preschool children very much. But the difference between the groups was not statistically significant due to large covariance. But when compared to NNMB (1990-92) values, the mean weights of 1-3 years children were more than NNMB values, where as mean weight of 4-6 years children below NNMB values. But when compared to group II and group III, group I children were better in their weights. Mean heights of children were high in 1-3 years children and low among 4-6 years children.

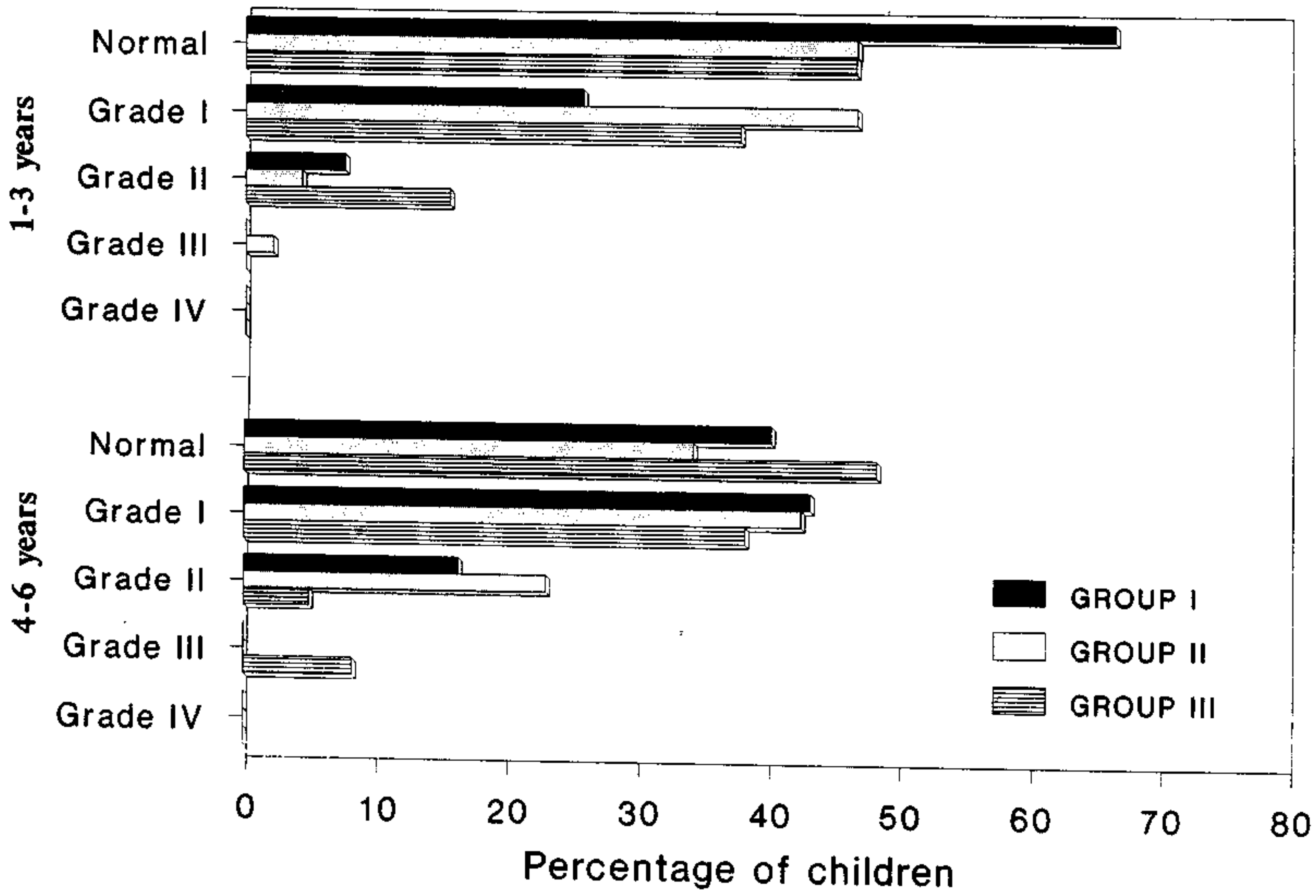
4.3.3.2 Prevalence of malnutrition

Prevalence of malnutrition in children was assessed by weight for age using NCHS standards and the classification supported by Indian Academy of Paediatrics is presented in Table 26 and in Fugure 10.

Table 26: Prevalence of malnutrition based on weight for age according to IAP

Grades of malnutrition	Group I	Group II	Group III
1-3 years			
n	66	47	45
> 80% (normal)	44 (66.6)	22 (46.8)	21 (46.7)
71-80% (Grade I)	17 (25.8)	22 (46.8)	17 (37.8)
61-70% (Grade II)	5 (7.6)	2 (4.3)	7 (15.6)
51-60% (Grade III)	0	1 (2.1)	0
< 50% (Grade IV)	0	0	0
4-6 years			
n	134	108	60
> 80% (normal)	54 (40.3)	37 (34.3)	29 (48.4)
71-80% (Grade I)	58 (43.3)	46 (42.6)	23 (38.3)
61-70% (Grade II)	22 (16.4)	25 (23.1)	3 (5.0)
51-60% (Grade III)	0	0	5 (8.3)
< 50% (Grade IV)	0	0	0

Fig.10 Prevalence of malnutrition based on weight for age



It is seen from Table 26 that in group I families 66.6 per cent of 1-3 years age group children were with normal weight, 25.8 per cent with grade I malnutrition and only 7.6 per cent were classified under grade II malnutrition. When the children were compared with the other two groups majority (51.1% in groupII, 53.4% in group III) were with grade I and II malnutrition. Whereas in group I 33.4% were with Grade I and II malnutrition. Grade II malnutrition in Group III was about twice that of the other two groups.

With regard to 4-6 years age group majority of children (40.3% in group I, 34.3% in group II, 48.4% in group III) were normal. Whereas 43.3 per cent in group I, 42.6 per cent in group II and 38.3 per cent in group III were with grade I malnutrition. The percentage of children with grade I malnutrition being higher in group I when compared to other two groups. Only around 16 per cent in group I and 5 per cent in group III were with grade II malnutrition when compared to group II (23%).

The mean heights and weights of pregnant and lactating women are presented in Table 27.

Table 27: Mean weights and heights of pregnant and lactating women

Anthropometric measurements	Group I	Group II	Group III
Pregnant women			
n	16	19	8
Weight (kgs)	47.8±5.5	47.3±6.1	46.7±2.9
Height (cms)	156.5±5.0	154.8±6.68	151.7±4.8
Lactating women			
n	9	12	6
Weight (kgs)	48.4±3.6	48.0±7.1	45.3±8.4
Height (cms)	156.5±5.95	153.6±8.95	154.9±5.9

± S.D. n=Number of Women

Clinical assessment

The details regarding clinical assessment of the sujects is given in Table 28.

Table 28: Per cent distribution of children according to clinical signs and symptoms of vitamin A and iron deficiency

	Group I			Group II			Group III		
	PS	P	L	PS	P	L	Ps	P	L
Vitamin A deficiency									
Night-blindness	1.5	0.0	0.0	3.2	0.0	0.0	3.8	0.0	0.0
Bitot spots	4.0	0.0	0.0	7.1	0.0	0.0	10.5	0.0	0.0
Iron deficiency									
Pale conjuctiva	29.0	68.8	55.5	41.3	52.6	66.6	56.7	75.0	66.6
Koilonychia	6.0	0.0	0.0	9.9	15.7	0.0	13.3	50.0	33.3

Clinical examination of the subjects revealed that the prevalence of vitamin A and anaemia are limited in group I and II when compared to group III families children. Major percentage of (52.6% to 75.0%) of pregnant and lactating women in three groups were with pale conjuctiva and only of 10 to 50 per cent were with Koilonychia. However it may be mentioned here that clinical diagnosis of anaemia on the basis of pale conjunctiva is known to be subjective. The prevalence of vitamin A deficiency was higher in group II and III than in group I(PLATE 3).

4.4 ECONOMIC VALUE OF FOODS CONSUMED INCLUDING THE FOODS PRODUCED AND PURCHASED.

Mean quantity of consumption of vegetables and fruits produced and purchased by families and the value of products is shown in Table 29.

CLINICAL EXAMINATION OF CHILDREN

Table 29: Monetary value (Rs.) on vegetables and fruits among three groups from their own production and purchased foods

Name of foods and particulars	Mean quantity consumed kg/week/family and its value in Rs.			
	Group I		Group II	Group III
	Produced	Purchased	Purchased	Purchased
GLV				
Percentage (%)	68.8	31.2	100.0	100.0
Mean quantity(kg)	1.06	0.48	0.87	1.13
Rate (Rs.)/kg	2.60	3.20	3.20	3.20
Value (Rs.)	2.75	1.53	2.78	3.62
Total value spent per week (Rs.)	4.28		2.78	3.62
Other vegetables				
Percentage (%) of families	73.0	27.0	100.0	100.0
Mean quantity(kg)	3.65	1.35	4.87	4.71
Rate (Rs.)/kg	4.25	4.95	4.95	4.95
Money (Rs.)	15.51	6.68	24.10	23.30
Total money spent per week (Rs.)	22.19		24.10	23.30
Fruits				
Percentage (%) of fmailies	85.6	14.4	100.0	100.0
Mean quantity(kg)	1.96	0.33	2.16	1.82
Rate (Rs.)/kg	5.75	7.80	7.80	7.80
Money (Rs.)	11.27	2.57	16.85	14.19
Total money spent per week (Rs.)	10.78		43.73	41.11
Money spent on vegetables & fruits/month	40.31		97.36	81.40

Consumption particulars revealed that all the families in three groups were consuming vegetables regularly. Almost 68.8 per cent of the cultivators in group I families are retaining about 1.06 kg/week from their own farm produce for their consumption and the value of the retained quantity is about Rs.2.75 whereas 31.2 per cent of the cultivators in Group I families are purchasing the green leafy vegetables for about Rs.1.53. With regard to other two groups all of them are purchasing green leafy vegetables i.e. 0.87 kg/wk by group II families and 1.13 kg/wk by group III families respectively. On the whole they are purchasing GLV for about Rs.1.53, Rs.2.78 and Rs.3.62 by group I, II and III families respectively.

With regard to other vegetables in group I families majority 73 per cent of families utilised their own produce for consumption and they are retaining about 3.65 kg/wk costing about Rs.15.51 paise. Only 27 per cent were purchasing other vegetables, other than what they produced for about Rs.6.68, whereas in group II and group III they are purchasing at the rate of Rs.4.95 /kg and they are spending Rs.24.10 and Rs.23.30 respectively.

As the percentage of farmers producing fruit crops are less and among them 85.6 per cent were utilising for their own consumption i.e. 1.96 kg/wk which is equal to value of Rs.5.75 ps. whereas 14.4 per cent purchased the fruits at the rate of Rs. 7.80 paise. With regard to group II families they are spending about Rs.16.85 for 2.16 kg/wk. Whereas group III families are spending little less i.e. about Rs.14.19 for 1.82 kg/wk. In all the three groups consumption of green leafy vegetables was rare. Whereas, other vegetables were consumed regularly per week.

4.5 FREQUENCY OF CONSUMPTION OF VEGETABLES AND FRUITS

4.5.1 ***Preschoolers*** : The frequency of consumption of vegetables and fruits rich in carotene during pre-school age, was presented in Table 30.

Carrots are consumed weekly once by children among all the groups.However the percentage of children being higher in group I (75%) compared to group II (55.5%) and group III (44.8%).Only one fourth percent of children were consuming green leafy vegetables daily in group I and less than one fourth per cent in group II and group III. Majority (46.5%) in group I were consuming green leafy vegetables twice a week and is significantly ($P<0.01$) better than other two groups. Almost three fourth percent (75%) of children were consuming other vegetables daily in group I and around 29 percent in group II, 27 percent in group III. Whereas 22 percent to 33 percent in all the three groups were consuming other vegetables twice a week. Pumpkin was consumed by pre schoolers only once in a week in all the three groups. During the season Papaya and Mango are consumed twice or weekly once by children. The percentage of children being almost same in all the three groups.

Table 30 : Per cent distribution of pre-school children according to frequency of consumption of vitamin A and Iron rich foods

Name of the foods	Pre-schoolers														
	Group I					Group II					Group III				
	D	T	W	F	N	D	T	W	F	N	D	T	W	F	N
Carrots	0.0	0.0	75.0^{a}	0.0^{a}	25.0^{a}	0.0	0.0	55.5^{ab}	15.5^{b}	29.0^{a}	0.0	0.0	44.8^{bc}	17.7^{b}	37.5^{ab}
Green leafy vegetables	27.0^{a}	46.5^{a}	25.5^{a}	1.0^{a}	0.0^{a}	9.7^{a}	27.7^{b}	41.4^{b}	18.7^{b}	2.5^{b}	12.5^{ab}	37.5^{ba}	45.8^{bc}	4.2^{ca}	0.0^{b}
Other vegetables	75.5^{a}	22.0^{a}	2.5^{a}	0.0	0.0	29.7^{b}	53.5^{b}	16.8^{b}	0.0	0.0	27.1^{ac}	39.6^{c}	33.3^{c}	0.0	0.0
Pumpkin	0.0	0.0	28.0^{a}	10.5^{a}	61.5^{a}	0.0	0.0	38.7^{b}	0.0^{b}	61.3^{a}	0.0	0.0	31.3^{ba}	0.0	68.7^{a}
Papaya	0.0	30.5^{a}	62.0^{a}	1.0^{a}	6.5^{a}	0.0	27.7^{a}	37.5^{b}	24.5^{b}	10.3^{a}	0.0	22.9^{a}	62.5^{ca}	10.4^{c}	4.2^{a}
Mango	2.0^{a}	12.5^{a}	44.0^{a}	27.0^{a}	14.5^{a}	3.9^{a}	28.4^{b}	35.5^{a}	25.8^{a}	6.4^{a}	3.1^{a}	23.9^{bc}	56.3^{b}	10.4^{bc}	6.3^{bc}

D - Daily; T - Twice a week; W - Week; F - Fortnightly; N - Not consuming
$P<0.01$ $P<0.05$

4.5.2 Pregnant women

Frequency of consumption of B-carotene rich foods by pregnant women in three groups is presented in Table 31a.

Pregnant women were consuming carrots, papaya, pumpkin, mango weekly in all the three groups. Whereas green leafy vegetables were consumed by majority women (62.4%) in group I daily and 37.5 per cent were consuming twice a week. Whereas majority (52.2 per cent and 50 per cent) of women in group II and group III were consuming green leafy vegetables twice a week and 31.5 per cent, 25 per cent in group II and III were consuming green leafy vegetables daily. Though percentage of women consuming greens daily and twice a week in group I was more but significantly not differed with other two groups (II & III).

4.5.3 Lactating women

Per cent distribution of lactating women according to frequency of consumption of ß-carotene and iron rich foods is presented in Table 31b.

From the table it is evident that majority of women were rarely consuming carrots, papaya, pumpkin and during season mango is consumed twice a week (44.4% in group I, 33.3% in group II and III). Green leafy vegetables consumption was observed to be better in group I (44.4%) when compared to group II (25%) and group III (16.6) who were consuming GLV twice a week. However, no significant difference was observed between groups.

Table 31a: Per cent distribution of pregnant women according to frequency of consumption of vitamin A and Iron rich foods

Name of the foods	Pregnant women														
	Group I					Group II					Group III				
	D	T	W	F	N	D	T	W	F	N	D	T	W	F	N
Carrots	0.0	6.3^{a}	62.4^{a}	0.0	31.3^{a}	0.0	0.0^{a}	73.6^{a}	0.0	26.4^{a}	0.0	0.0^{a}	25.0^{ca}	0.0	75.0^{bc}
Green leafy vegetables	62.5	37.5	0.0	0.0^{a}	0.0	31.5	52.2	10.5	5.8^{a}	0.0	25.0	50.0	25.0^{b}	0.0	0.0
Other vegetables	56.3	24.9	18.8	0.0	0.0	52.6	26.3	21.1	0.0	0.0	50.0	25.0	25.0	0.0	0.0
Pumpkin	0.0	0.0	6.3	6.3	87.4	0.0	0.0	0.0	10.5	89.5	0.0	0.0	12.5	12.5	75.0
Papaya	0.0	0.0	12.5	12.5	75.0	0.0	0.0	10.5	10.6	78.9	0.0	0.0	0.0	25.0	75.0
Mango	0.0	31.3	50 0	18.7	0.0	0.0	21.1	68.4	10.5	0.0	0.0	25.0	50.0	25.0	0.0

D - Daily; T - Twice a week; W - Week; F - Fortnightly; N - Not consuming
$P<0.01$ $P<0.05$

Table 31b: Per cent distribution of lactating women according to frequency of consumption of vitamin A and Iron rich foods

Name of the foods	Lactating women														
	Group I					Group II					Group III				
	D	T	W	F	N	D	T	W	F	N	D	T	W	F	N
Carrots	0.0	11.1	66.7	11.1	11.1	0.0	0.0	75.0	16.7	8.3	0.0	0.0	50.0	16.6	33.4
Green leafy vegetables	11.1	44.4	33.3	11.2	0.0	8.3	25.0	50.0	16.7	0.0	0.0	16.6	50.1	33.3	0.0
Other vegetables	66.7	22.2	11.1	0.0	0.0	41.6	33.3	16.6	8.5	0.0	33.3	50.1	16.6	0.0	0.0
Pumpkin	0.0	0.0	88.9	11.1	0.0	0.0	0.0	66.8	16.6	16.6	0.0	0.0	50.0	33.4	16.6
Papaya	0.0	0.0	22.2	55.6	22.2	0.0	0.0	25.0	50.0	25.0	0.0	0.0	16.7	50.0	33.3
Mango	0.0	44.4	22.3	33.3	0.0	0.0	33.3	33.5	16.6	16.6	0.0	33.3	33.5	16.6	16.6

D - Daily; T - Twice a week; W - Week; F - Fortnightly; N - Not consuming

4.5.4 Mean quantity of consumption of vegetables and fruits by vulnerable groups

Data regarding mean quantity of consumption of vegetables and fruitsper week was presented in Table 32 and Fig.11.

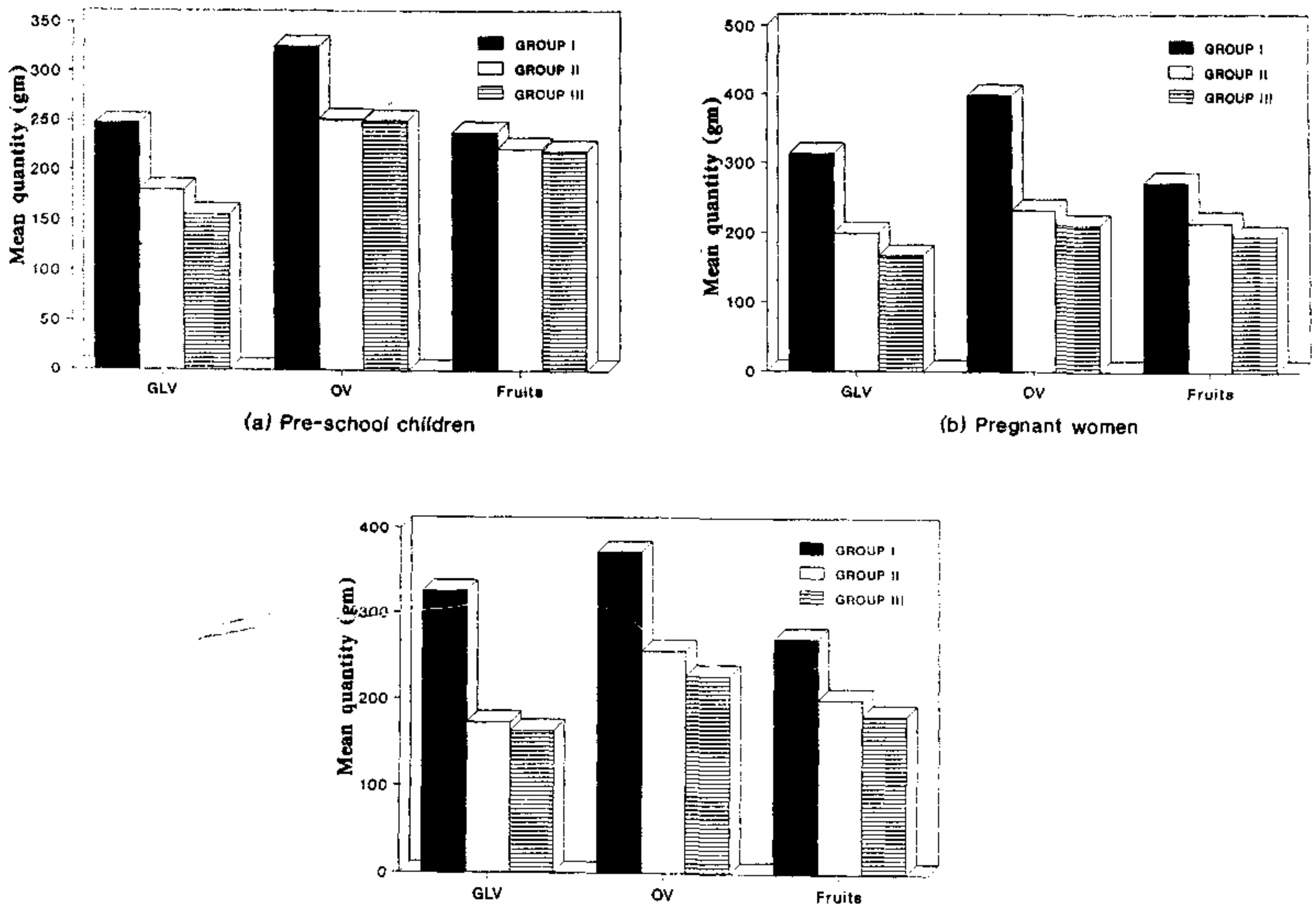
Table 32: Mean weekly consumption of vegetables and fruits by pre-schoolers, pregnant and lactating women

	Group I			Group II			Group III		
	GLV	OV	Fruits	GLV	OV	Fruits	GLV	OV	Fruits
Pre-school children	246.4 ±52.9	325.3 ±75.8	238.5 ±111.5	180.0 ±49.8	251.5 ±62.3	221.8 ±61.4	155.7 ±40.8	250.2 ±66.2	219.3 ±61.0
Pregnant women	312.5 ±81.3	398.4 ±74.2	272.2 ±70.0	198.6 ±45.6	231.8 ±84.9	215.0 ±86.6	166.6 ±36.2	210.6 ±43.6	195.0 ±84.3
Lactating women	324.4 ±66.8	370.6 ±58.6	270.2 ±90.0	172.9 ±50.5	255.8 ±53.1	200.0 ±62.1	163.3 ±31.4	226.6 ±40.2	181.7 ±50.7

± S.D. GLV : Green Leafy Vegetables OV : Other Vegetables

Among pre-school children the mean quantity of consumption of greens per week was better in group I than in other two groups. Whereas with regard to other vegetables consumption, the mean quantity of consumption per week is significantly higher ($P<0.05$) in group I than other two groups and no difference was observed in group II and III. Intake of fruits was almost similar in all the three groups.

Fig.11 Mean weekly consumption of vegetables and fruits by pre-school children, pregnant and lactating women



(a) Pre-school children

(b) Pregnant women

(c) Lactating women

The intake of green leafy vegetables per week among pregnant women and lactating women is very less in all the three groups but the mean quantity of consumption is higher when compared to other two groups. Other vegetables intake is some what higher (398.4 g/wk) in group I than 370.6 g/wk by lactating women in group II and III. Fruits consumption is also better in group I when compared to other two groups.

4.5.5. Mean quantity of consumption of milk and milk products by Preschool, pregnant and lactating women

Mean quantity of consumption of milk and milk products by preschool, pregnant and lactating women was presented in Table 33 and in Fig.11.

Table 33: Mean quantity of milk and milk products consumed by preschool children, pregnant and lactating women

	Group I			Group II			Group III		
	PS	P	L	PS	P	L	PS	P	L
Milk (lt)	560.0 ±225.0	284.7 ±146.2	178.3 ±63.0	880.5 ±347.7	305.2 ±112.9	272.5 ±57.7	401.6 ±185.9	183.7 ±43.6	253.3 ±40.8
Dahi	123.2 ±85.0	193.4 ±71.9	207.2 ±58.8	201.3 ±143.7	245.7 ±41.6	266.7 ±61.6	106.0 ±77.2	130.6 ±42.8	146.6 ±18.3
Butter milk	170.0 ±119.2	264.6 ±120.3	225.6 ±12.8	314.4 ±193.8	283.4 ±104.0	302.9 ±84.8	195.6 ±125.6	215.0 ±81.4	164.2 ±59.2
Ghee	43.0 ±27.8	23.4 ±13.3	25.5 ±15.8	65.4 ±42.6	26.3 ±8.4	20.8 ±14.4	39.4 ±24.4	10.0 ±10.8	7.5 ±8.8
Butter	16.0 ±26.0	80.9 ±8.6	93.8 ±11.3	118.8 ±45.9	68.2 ±8.8	116.3 ±12.1	42.8 ±23.2	66.3 ±5.9	76.7 ±9.8
Sweets	63.4 ±63.8	80.9 ±54.8	93.8 ±48.5	118.8 ±136.8	68.2 ±54.9	116.3 ±24.0	42.8 ±40.0	66.3 ±47.5	76.7 ±27.3

± S.D. PS : Pre-school children P : Pregnant women
L : Lactating women

The mean quantity of consumption of milk and milk products was significantly higher($P<0.05$) in group II families, when compared to group I and group III. Consumption of milk, dahi, butter milk was higher in group II and very less quantity of ghee, butter and sweets were consumed by group I and group III famillies of preschool children, pregnant and lactating women.

4.6 BIOCHEMICAL ASSESSMENT

4.6.1 Distribution of children according to their serum vitamin A levels

Children were distributed according to their serum vitamin A levels into deficient (< 10 μg/dl), low (10-20 μg/dl) and normal (> 20 μg/dl) levels and the distribution of children indicated in Table 34 and Fig.12.

Table 34: Distribution of children according to serum vitamin A levels (percentage)

Serum vitamin A levels (μg/dl)	Group I n=56	Group II n=48	Group III n=46
Mean ± SD	27.0±9.6	23.4±7.3	18.1±5.4
< 10	0	0	0
10 - 20	18 (32.1)	23 (47.9)	31 (67.4)
> 20	38 (67.9)	25 (52.1)	15 (32.6)

x^2 = 12.54; P<0.05
Figures in parenthesis represent percentage
'Z' score between Group I & II ---> 3 (P<0.01)
'Z' score between Group I & III ---> 5.9 (P<0.01)
'Z' score between Group II & III ---> 3.1 (P<0.01)

The mean serum vitamin A levels of group I, II and III are 27.0, 23.4 and 18.1 μg/dl respectively.

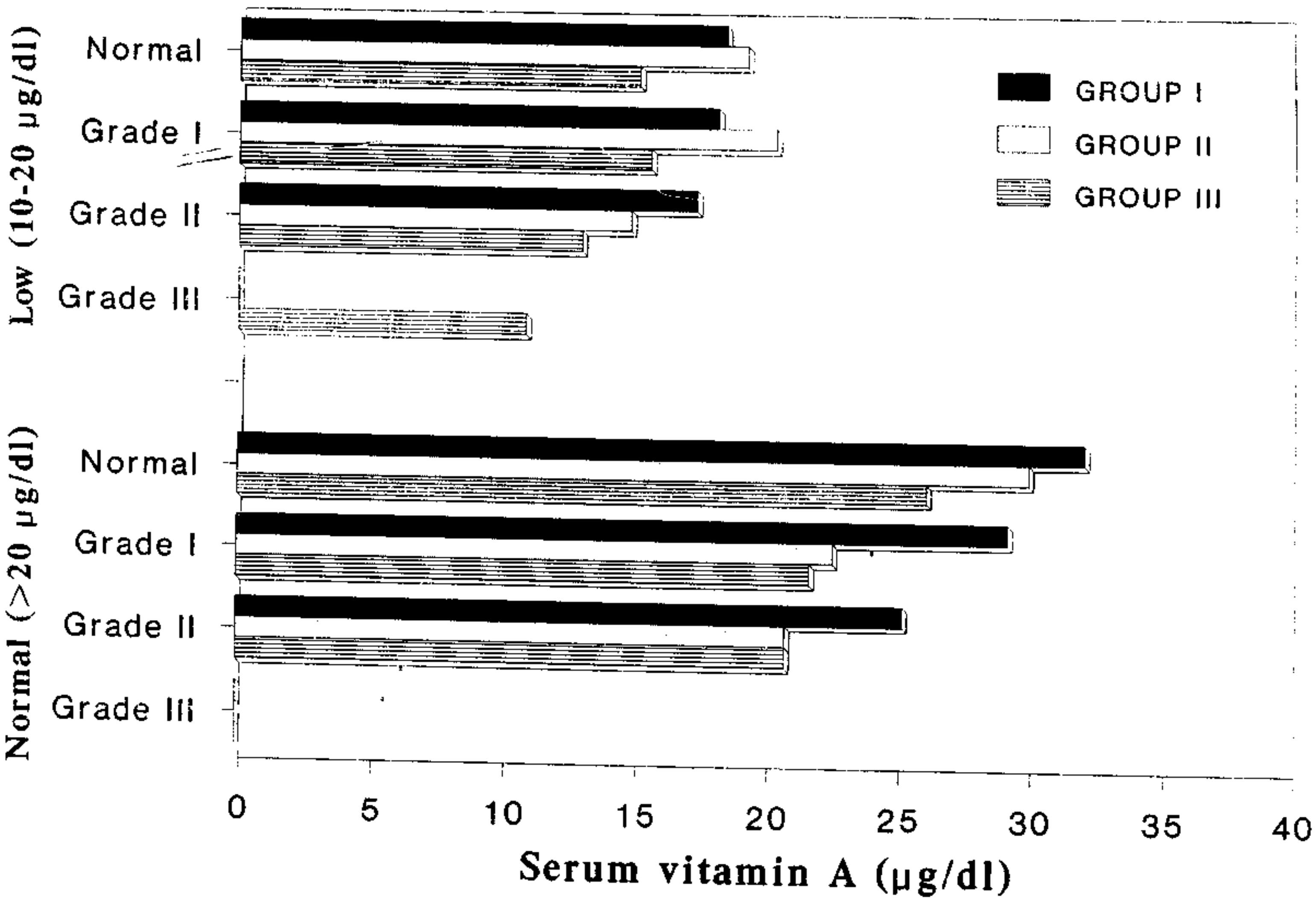
When the children were divided based on different levels of serum vitamin A in group I, it was noticed that 67.9 per cent of the children in group I families had serum Vitamin A levels more than 20 μg/dl and 32.1 per cent had serum vitamin A levels between 10-20 μg/dl. With regard to group II families about 52.1 per cent had serum levels > 20 μg/dl and 47.9 per cent had serum levels between 10-20 μg/dl. In group III families most of the children (67.4%) had serum vitamin A levels between 10-20 μg/dl and only 27 per cent had serum vitamin A levels (> 20 μg/dl). The chi-square test indicated a significant relationship between serum vitamin A levels and groups. 'Z' test indicated significant difference (P<0.01) between groups.

Mean serum vitamin A levels of children of different grades of nutrition are presented in Table 35.

Table 35: Mean serum vitamin A levels of children in relation to different grades of nutritional status

Grades of malnutrition	Low (10-20 μg/dl)			Normal (>20 μg/dl)		
	I	II	III	I	II	III
>80% (normal)	18.5	19.3	15.2	32.2	30.1	26.2
	(7)	(6)	(3)	(28)	(18)	(9)
71-80% (Grade I)	18.2	20.4	15.6	29.3	22.6	21.7
	(8)	(12)	(23)	(7)	(5)	(5)
61-70% (Grade II)	17.4	14.9	13.0	25.3	20.8	20.8
	(3)	(6)	(3)	(3)	(1)	(1)
51-60% (Grade III)	0	0	10.9	0	0	0
			(2)			

Fig.12 Mean serum vitamin A levels of children in relation to different grades of nutritional status



The mean serum values of normal children ranged from 26.2 μg/dl to 32.2 μg/dl. Children with grade I malnutrition have serum levels ranging from 21.74 μg/dl to 29.3 μg/dl; and children with Grade II malnutrition have serum levels ranging between 20.8 μg/dl to 25.3 μg/dl. None of the children with normal serum levels were with Grade III and Grade IV malnourishment. Whereas children with low serum values observed to be 15.2 μg/dl to 18.5 μg/dl and are normal. Children with Grade I malnutrition have serum levels ranging from 15.66 μg/dl to 20.4 μg/dl; children classfied as Grade II malnutrition have serum retinol values ranging from 13.02 μg/dl to 17.4 μg/dl; only two children on group III are with 10.9 μg/dl of serum vitamin A and are severely malnourished.

4.7 HAEMOGLOBIN STATUS OF PRE-SCHOOL CHILDREN PREGNANT AND LACTATING WOMEN.

4.7.1 Haemoglobin levels of pre-school children

Haemoglobin levels of pre-school children in three groups of families were shown in Table 36 and in Fig.13.

Fig.13 Distribution of children according to haemoglobin levels

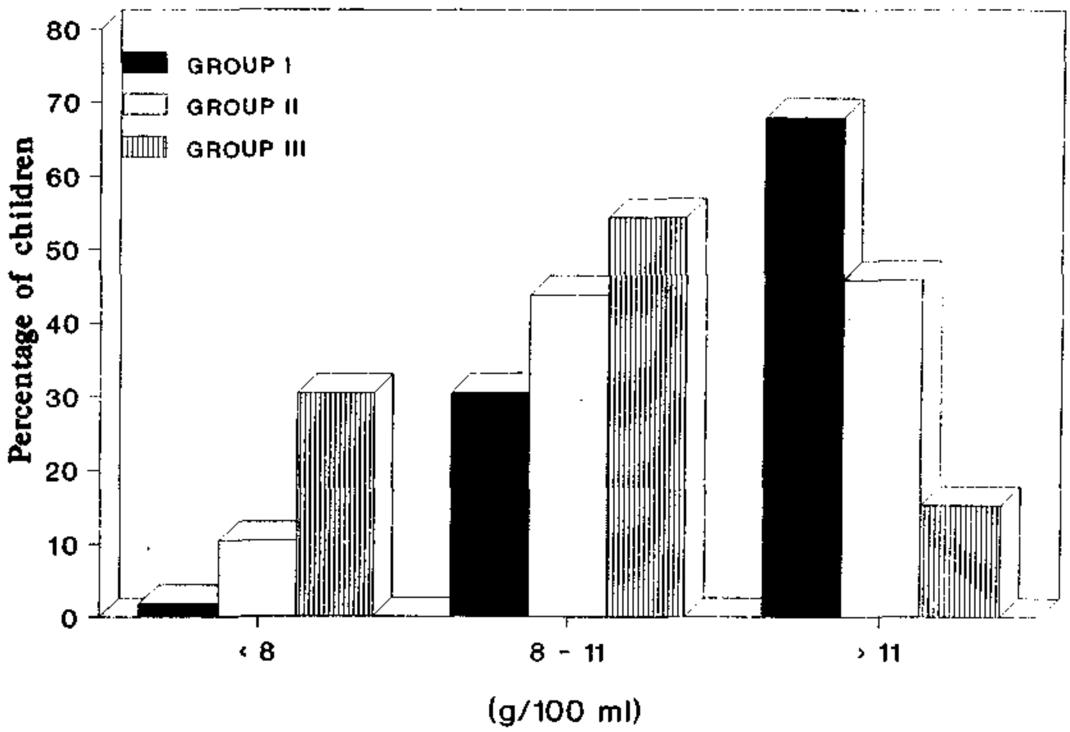


Table 36: Distribution of children according to haemoglobin levels (percentage)

Haemoglobin levels (g/100 ml)	Groups		
	Group I	Group II	Group III
n	56	48	46
Mean ± S.D.	11.55±1.7	10.62±1.86	9.43±1.80
< 8 (severe)	1 (1.8)	5 (10.4)	14 (30.4)
8-11 (mild to moderate)	17 (30.4)	21 (43.75)	25 (54.3)
> 11 (normal)	38 (67.9)	22 (45.8)	7 (15.2)

x^2 = 35.3; P<0.01
Figures in parenthesis represent percentage
'Z' score between Group I & II ---> 2.7 (P<0.01)
'Z' score between Group I & III ---> 6.2 (P<0.01)
'Z' score between Group II & III ---> 3.2 (P<0.01)

From the table 36 it is observed that about 67.9 per cent of children in group I families had blood haemoglobin levels more than 11 g/100 ml and in the remaining two groups i.e. 45.8 per cent and 15.2 per cent of children had normal levels. Chi-square test shows that there is a significant difference between the blood haemoglobin levels of pre-schoolers in horticulture families, dairy families and other families. The 'Z' test indicated a significant difference (P<0.01) between group I and II, group I and III, and Group II and III families children.

Correlation between serum vitamin A of pre-school children and other variables was presented in Table 37.

Table 37: Correlation coefficients ('r' values) between serum vitamin A and haemoglobin, dietary protein and vitamin A of pre-school children

Serum vitamin A (μg/dl) Vs	Group I	Group II	Group III
Haemoglobin (mg/dl)	0.51382**	0.55775**	0.68579**
Protein (gm)	0.52302**	0.43486*	0.61982**
Vitamin A (μg)	0.60350**	0.47969*	0.69803**

* Significant P<0.05
** Significant P<0.01

As seen from the Table 37 in relation to computed correlation coefficients of serum vitamin A of pre-school children with haemoglobin, dietary protein and vitamin A intake, serum vitamin A is positively correlated. Hence it could be inferred that there existed relationship between serum vitamin A and haemoglobin, dietary protein and dietary vitamin A.

4.7.2 Distribution of pregnant and lactating women according to haemoglobin levels

Pregnant and lactating women were classified as severe (<8 g/100 ml), mild to moderate (80-11 g/100 ml) and normal (>11 g/100 ml) according to their haemoglobin levels and presented in Table 38.

Table 38: Per cent distribution of pregnant and lactating women according to haemoglobin levels

Haemoglobin (g/100 ml)	Group I	Group II	Group III
Pregnant women			
n	16	19	8
Mean ± SD	9.6±1.8	8.95±1.0	8.9±1.7
< 8	2(12.5)	3(15.8)	3(37.5)
8 - 11	10(62.5)	15(78.9)	4(50.0)
> 11	4(25.0)	1(5.3)	1(12.5)
Lactating women (b)			
n	9	19	6
Mean ± SD	11.7±1.5	10.0±1.4	8.8±1.0
< 8	9(0.0)	1(8.3)	1(16.5)
8 - 11	2(22.2)	8(66.7)	5(83.3)
> 11	7(77.8)	3(25.0)	0(0.0)

Figures in parenthesis represent percentage

(a) X^2 = 5.1 (b) X^2 = 11.03

The mean haemoglobin values of pregnant women ranges from 8.9 to 9.6 g/100 ml. Majority of pregnant women in group I (62.5%) in group II (78.9%) and in group III (50%) were with mild to moderate grades of anaemia. Only in group III 37.5 per cent of women were severely anaemic followed by group II 15.8 per cent and group III 12.5 per cent. One fourth of pregnant women in group I were having normal levels and less percentage of pregnant women were observed to have normal haemoglobin levels in group II (5.3%) and group III (12.5%). Chi-square test indicated no significant difference between groups.

The mean haemoglobin values of lactating women ranges from 8.8 to 11.7 g/100 ml. The percentage of women with mild to moderate anaemia is higher in group III 83.3 per cent and in group II 66.7 per cent and less per cent being observed in group I (12.2%). Lactating women with normal haemoglobin values are higher in group I (77.8%) and in group II (25%) and none were with normal haemoglobin values in group III. Chi-square test indicated significant difference between groups.

4.8 KNOWLEDGE, ATTITUDE AND PRACTICES (KAP) OF MOTHERS RELATED TO NUTRITION WITH REFERENCE TO VITAMIN A AND IRON

The role of mothers in combating malnutrition through changing the socio-cultural barriers for good nutrition is vital and unique. They alone are responsible for the methods adopted for the preparation and serving of food. They play a major part in influencing the dietary habits of their husbands, children and other family members. The nutritional status of the family members are greatly influenced by the sound knowledge, attitude, beliefs and values possessed by the mother. Keeping this in view the influence of mother's knowledge on dietary intake of vitamin A and iron rich foods by pre-school children were assessed.

Nutrition knowledge scores of mothers in three groups were presented in Table 39.

Table 39: Nutrition knowledge scores of mothers in three groups

Category	Group I	Group II	Group III
0 - 25	20 (37.7)	8 (16.6)	12 (32.4)
26 - 50	22 (39.3)	30 (75.0)	27 (54.0)
51 - 75	11 (19.6)	10 (20.8)	7 (15.2)
76 - 100	3 (5.6)	0 (0.0)	0 (0.0)
Total	56	48	46

Figures in parenthesis represent percentage

From the table it is evident that about 37.7 per cent mothers had very low score of 0-25 and majority of 39.3 per cent had score between 26-50 only 25.2 per cent had better score in group I families. In the other two groups it is evident that about 75.0 per cent and 54.0 per cent of mothers had very little knowledge about general nutrition, diet during pregnancy and lactation, nutritional deficiency diseases and awareness about vitamin A and iron nutrition and their scores ranged between 26-50. Only about 20.8 per cent of mothers in group II and 15.2 per cent had knowledge scores ranging between 51-75.

4.8.1 Attitude scores of mothers with regard to nutrition

The attitude scores of mothers are presented in Table 40.

Table 40: Mothers attitude scoresfor nutrition

Category	Group I	Group II	Group III
Favourable (X±S.D.)	7 (13.2)	6 (12.5)	4 (10.8)
Undecided (X+SD) to (X-SD)	38 (71.7)	32 (66.7)	28 (75.7)
Unfavourable (X-SD)	8 (15.1)	10 (20.8)	5 (13.5)
	53	48	37

Figures in parentheses represent percentage

In all the three groups it was observed that 71.7 per cent in group I, 66.7 per cent in group II, 75.7 per cent in group III were undecided in answering the questions related to nutrition. While 15.1 per cent, 20.8 per cent, 13.5 per cent in group I, II and III respectively had unfavourable attitude. Only 13.2 per cent in group I, 12.5 per cent in group II, 10.8 per cent in group III had agreed that less intake of vitamin A and iron rich foods in the diet lead to deficiency of that particular micronutrient.

4.8.2 Nutrition knowledge of mothers and vegetable intake of pre-school children

Nutrition knowledge of mothers and vegetable intake of preschool children was presented in Table 41.

Table 41: Percentage of women with prior knowledge about Vitamin A and iron deficiency and the amount of vegetables produced/purchased/consumed in three groups of families

Parameter	Group I	Group II	Group III
n	56	48	46
Presence of Vit.A and iron in food items			
Prior knowledge	11 (19.6)	13 (27.1)	8 (17.4)
No knowledge	45 (80.4)	35 (72.9)	38 (82.6)
Vitamin A capsule in prevention of night-blindness			
Prior knowledge	5 (8.9)	5 (10.4)	2 (4.3)
No knowledge	51 (91.1)	40 (83.3)	44 (95.7)
Anaemia prophylaxis programme			
Prior knowledge	8 (14.3)	6 (12.5)	5 (10.9)
No knowledge	48 (85.7)	42 (87.5)	41 (89.1)
Average amount of vegetables			
Produced per week (kg)	1.06	-	-
Purchased per week (kg)	0.48	0.87	1.13
Consumed by children per day (g)	30.20	21.10	19.80

Figures in paranthesis represent percentage

From the table it could be inferred that 80.4 per cent of women of group I families, 72.9 per cent in group II and 82.6 per cent in group III did not have any prior knowledge about vitamin A or vitamin A capsule, its importance in vision and its wide presence in vegetables and fruits. The figure for control households was more when compared to group I and II. With regard to anaemia prophytaxis programme 85.7 per cent in group I, 87.5 per cent in group II, 89.1 per cent in group II did not have prior knowledge. The quantity of vegetables consuemd was less by pre-school children (19.80 g) of group III when compared to group I (30.2 g) and group II (21.10 g).

CHAPTER - V

DISCUSSION

DISCUSSION

The results incorporated in earlier chapter were interpreted and discussed under the following headings.

5.1 General Information.

5.2 Economic contribution from crops and dairy to the families studied.

5.3 Food intake and nutritional status of the selected sub sample.

5.4 Economic value of foods consumed including the foods produced and purchased.

5.5 Frequency of consumption of vitamin A and iron rich foods by vulnerable groups.

5.6 Vitamin A nutritional status of pre-school children.

5.7 Haemoglobin (Hb) status of pre-school children, pregnant and lactating women.

5.8 Knowledge, Attitude and Practices (KAP) of mothersrelated to nutrition with reference to Vitamin A and Iron.

5.1 GENERAL INFORMATION

Socio-Economic factors are an integral part of the nutritional outcomes for assessing the nutritional adequacies in poorer sections of population.

5.1.1 Family size

The average family size ranges from 5.5 to 6 among the three groups (Table 8). However the mean family size was slightly high in families of group

I and group III when compared to All India average of 5.6 and less than that reported by NNMB (1982-83). Family size affects nutritional care of pre-school children especially when there are more than two pre-school children in the same family. Contrary to this Rafiqual (1984) had pointed out that it was not the family size per se but the number of adults relative to children in a household that crucially influenced the nutrient intake of the children.

5.1.2 Educational status

Majority of families heads were illiterates. In the present selected sample majority of respondents were literates in group II who had more than primary education evidenced as per Table 9. This finding was in confirmity with Ramadevi (1991). High literacy in group II might have influenced them to adopt dairying besides crop husbandry.

Literacy is an indicator of social developement and should be promoted in population below poverty line so as a to avail the benefits of the existing programmes.

5.1.3 Occupational status

The results of table 10 indicated that majority (77.3 to 92%) of the household head and women (Table 10) in three groups were tenant cultivators and remaining were land owners, and involved in their own farm activities. In the selected farm community women were also engaged in the family occupation which could influence nutrition of children. The positive effect being the increase in purchasing power and negative effect being lack of time for adequate care, by and large women's income has been found to have positive effect on nutrition of the family (Gulate, 1978 & Kumar, 1978).

In India, employment in the household in general and of female members in particular was found to be a major factor affecting the energy intake of children under 6 years of age (Bidinger et al, 1986). The occupation of father and mother was found to have positive association with the income status of the family.

The household heads whose major occupation in Group I is cultivating horticultural crops especially fruits (mango, papaya, guava, sapota and banana) and vegetables (GLV, cabbage, pumpkin, tomatoes etc.). Whereas 92 per cent of farmers in group II were tenant cultivators, maintaining dairy and selling 3 litres to 12 litres of milk per day. The remaining 8 per cent in this group were land owners maintaining one or two animals and selling milk of 4 to 6 litres per day. In group III most of household heads were land owners (77.3%) cultivating cereal crops, minor crops and fodder crops. Similar findings were reported by Shantha Kumari (1991). Among vegetable growers and non vegetable growers.

5.1.4 Land holding

It is observed from Fig.3 that land holdings were unevenly distributed in all the three groups. Nearly 48.7 per cent, 46.7 per cent and 40 per cent in group II, III and I respectively were having less than one acre of land. It was also found that 31-45% of farmers from all the groups were having 1-2 acres of land (Table 11) and are marginal farmers. Eventhough the landholding is small, the higher yield of crops were observed due to better irrigation facilities. The percentage of small farmers are less among all the three groups. Farm size could influence the availability of farm produced products at household level to meet the basic needs of household members.

5.1.5 Income

Income is categorised after calculating their per capita annual income. The mean annual income of families who are earning income from vegetable and fruit crops ranged from Rs.6,800, to Rs.12,700. Families with both dairy and agriculture was found to have higher income i.e., Rs.15,260 to Rs.20,800. This clearly shows that the higher returns were found from dairy with agriculture as compared to horticulture alone and other crops. This finding was in tune with that of Singh (1980), Patel (1987) and Rajendra et al. (1992) that the additional income received by dairy indirectly improves the net returns from the farm and also creates employment to the rural household members.

5.1.6 Expenditure pattern of the families

5.1.6.1 Expenditure on Food and non food items

It was inferred from the data that the per capita expenditure on food items is more than non food items. Farmers were spending major expenditure on repayment of loans and on clothing. Similar findings were reported in rural India (Choudhary, 1984), among agricultural labourers (Lalitha, 1981) and among sorghum and non-sorghum rating families of Andhra Pradesh (Ramadevi, 1986).

5.1.6.2 Expenditure on food

Percapita food expenditure is one of the most important predictor of nutritional status of pre-school children. Families who spend more of their income on food may be providing adequate food to the children also. It is obvious that, what limits the quantity & quality of food available to the individual is the amount of money actually spent per person in the household.

Although there was not much difference in the total expenditure on food there was difference in the money spent on vegetable, fruits, fleshy foods and oils (Table 15 and Fig 6). This shows that with increase in income quality of food changes. When money is readily available the tendency to buy vegetables and fruits also increased. It can be presumed that with increasing intake of vegetables cereals intake is reduced. This change in trend is appreciable provided that cereal intake is not reduced far below the recommended allowances.

It was observed that the expenditure on food was more than non-food items in all the three groups (Table 14). Which may be probably be due to the fact that food is an essential item and first preference will be given to this with available resources. The work reported by Anuradha (1981), Kesavan and Kalla (1985), Ramadevi (1986), Pathak and Goswami (1989), Reddy (1986), Skawinski (1986) also showed that food expenditure was more than non-food expenditure in rural families in India and in other countries.

In the present study the horticultural families are spending significantly less on vegetables and fruits, this reflects the availability of these food items at household level. Whereas dairy based and families with other sources of income were spending moderately higher amount on these food items.

5.2 ECONOMIC CONTRIBUTION OF CROPS AND DAIRY INCOME TO THE FAMILIES STUDIED

5.2.1 Economic contribution of vegetable crops

Majority of group I families were growing Brinjal followed by Ridgegourd, Ladies finger, tomatoes and green leafy vegetables (Table 15a). Ramachander et al. (1983) also reported that brinjal, yam, cucumber, chillies, leafy vegetables were popular all over India. Among the districts of Andhra Pradesh East Godavari district accounted for largest area under horticultural crops followed by Kurnool and Rangareddy (Directorate of Horticulture, 1991-92).

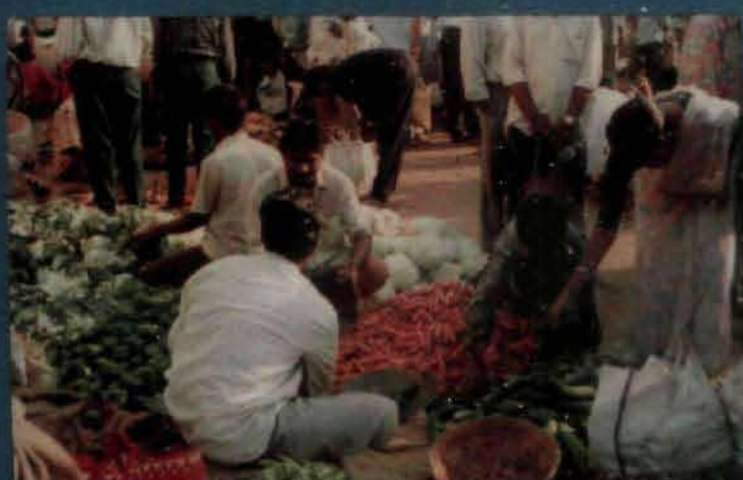
The respondents of group I families informed that the reasons for most per cent of farmers growing brinjal having regular market eventhough its rate per quintal is Rs.177/- at that time. Among the vegetables the gross returns are high from chillies (Rs.5647), but are grown by less percentage of farmers with regard to chillies (8.6) and cauliflower (2.0), whereas 20 per cent of farmers were cultivating tomatoes. This may be due to the high net returns to farmers. Similar findings were reported by Divakar (1986). The gross returns from Brinjal crop was around Rs.1996. Subramanyam (1983) and Kiresur and Kumar (1989) reported that tomato and Brinjal crops cultivated in kharif season were profitable. High profitability from fruits has induced a 26.8 per cent shift of area from field crops and 22.6 per cent shift of area from barren and other wastelands in favour of fruit crops (Srivastava and Dogra, 1991).

The reason for growing Banana crop by most of (16.6%) the farmers is due to availability of ready market, the farmers are growing these crops in less area and average yield observed to be less. The study carried out in rural Andhra Pradesh by Pushpamma et al. (1984) also revealed that the most frequently consumed vegetables are brinjal, ladies finger, tomato, cluster beans, sour greens, amaranth and onion. They also observed that the consumption of above mentioned vegetables incresed based on increased production.

5.2.1.1 Marketing of vegetables and fruits

Marketing of vegetables differ from other crops due to the twin problem of high perishability and seasonality. Along with these natural factors, the concentration of trade in few hands and the supply of small quantity of produce

MARKETING OF VEGETABLE PRODUCE



by a large number of producers further complicated the pattern. The results reported by Kalyani (1985) indicated the several middlemen were involved in the marketing of vegetables in Andhra Pradesh (PLATE 4).

A major percentage of the group I families in the present study marketing the produce to the nearest wholesale market, which is situated in Kadiam mandal. And most of them transported their produce through lorries and some of them used carts, cycles and motor cycles for transporting. Whereas Subramanyam (1983) reported that in Karnataka, most of the cultivators (76%) have used lorry for transporting the produce, followed by bus (23%). On the otherhand in Tamilnadu, cart was the main mode of transport for majority of cultivators (81%). Truck was used by only 9 per cent of cultivators. They also revealed that in case of Andhra Pradesh, there was no clear cut preference between the lorry, bus and cart though slightly more number of cultivators used lorry.

5.2.2 Information on dairy

5.2.2.1 Income and expenditure on dairy

The average milk yield per buffalo was 5.6 lts, and for cows it was 1.45 lts (Table 16). Sohal and Singh (1986) in an impact study reported that the average milk production per day was 4 per cent higher in cooperative member households as compared to that of non-member households. Chauhan and

Sharma (1990) reported that milk yield per day per animal in respect of buffaloes and cows was 2.50 kg and 1.78 kg respectively and the average per household production of milk was found to be 7.66 kg. Out of which 29.11 per cent of milk was marketed.

In group II many households took government loans and invested more than Rs.3000 on dairy this might be because the government gave loans to buy milch animals.

The average income earned per month by dairy families was Rs.828 (Table 16) whereas Geetha Sailaja (1981) reported that dairying provided about Rs.313/month among farm families in Guntur district, A.P. Singh (1980) also found that dairying provides about two thousand rupees per year. It is also presumed, that dairy not only gives cash income but it also indirectly improves the net returns from farm and also creates employment to the rural household members. Similar studies confirming dairy adds income and creates employment to rural poor were reported by several workers (Patel, 1987; Thirunavakkarasu et al., 1991; Rajendra et al., 1992).

The mean total dairy income from previous year and study period from Table 18 indicates that the decrease in income might be due to the cost estimated based on the milk production in summer during the study. Dairying involves less expenditure and which gives income equal to other sources of income such as minor crops, small trading and business, if managed well.

5.2.2.2 Management of dairy

In group II families fairly large percentage of housewives and servants were involved in dairy management. Though the servents were also helping in dairying, the main responsibility was taken by women only (Table 19). This indicates that unlike any other subsidiary activity and in many villages women are taking up dairy for their side business or as a part time job. In rural areas farm women devotes the maximum time in home management activities i.e.,21.96 per cent, followed by 19.38, 8.33 and 5.33 per cent in dairying agriculture and miscellaneous activities respectively (Omprakash, 1988). Overall women participation rate in dairy enterprise was as high as 65.49 per cent as against 31 and 3.5 per cent only for men and children respectively (Usha and Singh, 1982).

5.3 FOOD AND NUTRIENT INTAKE OF VULNERABLE GROUPS

5.3.1 Pre-school children

5.3.1.1 Food intake

The main staple food of most of the selected families is rice along with small amounts of vegetables in their daily life. When the mean food intake was compared with RDA (ICMR, 1992) none of the children met the recommended dietary allowance in all the three groups, except that of cereals and pulses (Table 20). Among the six food groups, the least consumed food groups were green leafy vegetables in group II and III milk and milk products in group I and III respectively in both the age group children. In group I 60 per cent of green leafy vegetable requirement is met in 1-3 years age group. Sixty two per cent of milk requirement is met in 1-3 years age group and 90 per cent in 4-6 years children in group II obviously due to availability of milk because of dairy.

There was no significant difference in intake of cereals, pulses, other vegetables, and fats among all the three groups. Similar results were reported by Anuradha (1981) on farm families of Nalgonda district in Andhra Pradesh depending on Agriculture, Dairy and other sources of income and Pushpamma (1983) on rural pre-school children of Andhra Pradesh, Bhat & Saroj (1985) on rural pre-school children in Gangwa village of Hissar district.

Significant difference ($P<0.01$) was observed in the intake of green leafy vegetables, where higher consumption was observed in group I when compared to the other two groups. As this group of families growing vegetables in their farms, their children had chance of consuming more vegetables than others.

Milk was consumed in least quantity by group I and III pre-school children and mostly taken in the form of tea. In group II more milk consumption was observed in children because of sufficient quantity available in their homes apart from marketing.

5.3.1.2 Nutrient Intake

When the data on nutrient intake of children was analysed, a significant difference was seen in iron and vitamin A (Table 21). Eventhough vitamin A intake was observed to be low in all the three group, group I is significantly better than other two groups, and vitamin A was mainly consumed in the form of ß-carotene derived from the fruits and vegetables. Large variation in intake of fruits and vegetables was observed in three groups where as in the horticultural dependent families (Group I) children had the chance of consuming more vegetables.

When the nutrient intake of the children was compared with RDA, the extent of inadequacy was almost 56 per cent, 65 per cent (in case of 1-3 years) and 43 per cent, 58 percent (in case of 4-6 years) meet the RDA of Iron and vitamin A in group I children (Table 21a & 21b). In group II only 35 to 43 per cent in both the age groups with respect to iron and around 48-50 per cent with respect to vitamin A among the two age groups, meet the RDA Lie Cheng et al., (1993) in a study carried out in China reported that 27 per cent of the the children in supplementation group and 31 per cent of the children in control group could meet the RDA of vitamin A. In another study carried out in pre-school children of urban slums of Hyderabad, it was reported that the daily intake was far below the requirement, ranging from 60 to 100 μg whereas the recomended level as 300 μg (Reddy et al 1991).

The intake of fat was adequate in 1-3 years age group children of all the groups of families but only 49-55 per cent of requiremtnt is met in 4-6 years age group children. Protein and fats are very essential for the absorption and utilization of vitamin A. Increased dietary protein is known to aid in dispersion as well as intracellular retinaldehyde formation from carotenoids and dietary fat acts as a vehicle for transporting vitamin A and carotenoids from the stomach into the intestinal lumen. The intake of fats & oils was low in these children. This might be one of the reason for vitamin A malnutrition in these children.

Lower intake of nutrients such as vitamin A, B-complex, Iron, Calcium and Vitamin C by pre-schoold children was also reported by several workers (Madhyasta et al., (1988) in coastal India, Roberts et al., (1984) in children following vegetarian diets. Pepping et al., (1990) in Tanzanian children of 4-9 years old).

Apart from low vitamin A intake, iron intake was observed to be only 35-56 per cent among all the three groups of children. This clearly indicates that vitamin A could influence utilization of iron. In a cross-sectional analysis of the baseline data of 1060 children from Thailand showed that vitamin A status is significantly associated with the iron status (Bloem et al, 1990). Many of supplementation studies also revealed that, vitamin A supplementation yielded significant increase in the serum concentration of retinol, blood haemoglobin, hematocrit, erythrocytes, serum iron and per cent transferin saturation further they also reported vitamin A supplementation had no effect on total iron-binding capacity or serum ferritin (Mejia and chew, 1988) and similar observations were reported by Bloem et al (1990).

5.3.1.3 Food & Nutrient intake of pregnant women

Food intake

The general dietary pattern of pregnant women showed that their diets were lacking in several foods. The diets were fully adequate with regard to cereals and pulses when compared to RDA (ICMR, 1992) (Table 22). The protective foods like green leafy vegetables, milk and milk products were found to be inadequate. Only 30 per cent of green leafy vegetales requirement is met in group I families. The intake of other accessory foods like fats and oils were meeting the RDA in all the three groups. These findings were in line with those of vijaya lakshmi et al (1988) and Latha & Verma (1989). However the intake of milk and other foods were more in dairy category among three groups of families.

Nutrient Intake

As the cereal & pulses intake was adequate in all the three groups, the caloric and protein requirement is met in all the groups. But deficiency was observed in the intake of iron, calcium and vitamin A in the three groups due to inadequate intake of protective and fleshy foods. Significant difference in the intake of vitamin A, iron and calcium was observed between the groups.

However green leafy vegetable consumption is significantly higher when compared to other two groups but not meeting the RDA (Table 23).

Pregnancy consititutes a state of significant physiological stress where large number of metabolic and hormonal changes occur. Due to growth of the foetus and other products of conception, pregnant mother's nutritional requirements are generally more than normal healthy women.

5.3.1.4 Food and Nutrient intake of lactating women

Food Intake

The diets of lactating women were found to be dificient in all the foods except in cereals and other vegetables (Table 22). Food intake pattern of lactating women belonging to horticultural and dairy group, were found better than those depending on other crops. Similar findings were reported in dairy and non diary group lactating women (Rama devi 1991). Lata & verma (1989) reported inadequate intake of protective foods by lactating women.

Nutrient intake

The diets of lactating women were deficient in iron, calcium and vitamin A which is due to lower consumption of protective and fleshy foods (Table 23). The dietaries of group I lactating women with regard to vitamin A and Iron were significantly better than dairy group and farmers with other crops. In under nourished lactating women milk vitamin A shows a progressive decrease reaching the lowest level by 3 months, and thereafter maintained as such throughout the period of lactation (Ramanathan et al, 1962).

The dietary fat consumption is also below the requirement in lactating women. About 55 to 58 per cent of requirement was met by group II and III and 75 per cent by group I women. Dietary fat helps to facilitates the absorption and utilization of pre-formed vitamin A and provitamin A (FAO, 1988).

5.3.2 Anthropometric measurements

5.3.2.1 Pre-school children

The mean weights and heights of the children of 1-3 and 4-6 years age groups were higher among group I and Group II children while it is low in group III (Table 25).

The nutritional status of the children as assessed by anthropometric measurements weight for age (Table 26), the per cent of normal children was found to be high in families of group I and group II as per IAP classification. Among 1-3 years old children 66.6 per cent, 53.2 per cent and 46.7 per cent respectively in three groups were found normal. While in 4-6 year old children 38.8 per cent, 35.2 per cent 48.3 per cent of the children were found as normals in group I, II and III respectively. Low incidence of grade I and grade II malnutrition was abserved in all the three groups children. Whereas grade III and grade IV malnutrition was absent. Similar findings were reported by Taygi and Kaur (1986), Ragimol et al, (1988), Rama devi (1991), Abdullah (1982), Krishna et al (1991) that the severity of malnutrition increases as the age progresses.

5.3.2.2 Pregnant women and lactating women:

Pregnant women

The mean weights and heights of pregnant women of group I and group II were found to be more when compared to women of group III (Table 27). But no significant difference was observed between groups. The prepregnant maternal weight and total weight gain have a significant impact on birth weight (Rohit et al, (1980)., Nisha Bhandari, (1992)). A higher per cent of pregnant women were found to be anaemic when assessed clinically. However the per centage of anaemic women are found to be higher in group III (75%) Narasinga Rao (1991) also reported 75 per cent of pregnant women in India are anaemic (Based on haemoglobinometry). Vitamin A deficiency is also observed in group III pregnant woment (1.6%). In group I & II none were vitamin A deficient several studies in humans and animals have shown that vitamin A deficiency is associated with abnormalities of iron metabolism. (Hodges et al, 1978; stabb et al, 1984; Mejia et al, 1979). Cross-sectional study carried out by Djoko Suharno et al. (1992) in west Java, Indonesia. The results of their study revealed that out of 318 women studied, 49.4% were anaemic and according to multiple criteria, 43.5% had iron deficiency anaemia, 22.3% had iron deficient erythropoiesis, and 6.6% with iron depletion and 8.9 per cent of women had deficient vitamin A liver stores.

Lactating women

The weight and height of lactating women are found to be slightly higher in group I and II though significant difference were not seen with group III. (Table 27). progressive fall in body weight, arm circumference and skinfold thickness with increasing duration of lactation was observed in lactating women (Prema, 1980).

The prevalence of iron deficiency was found to be more than 50 per cent in lactating women in all the three groups. The percentage prevalence of anaemic signs were 55.5 per cent in group I, 52.6 per cent in group II, 66.6 per cent in group III (Table 28). This is because of lower consumption of vitamin A and iron rich foods.

5.3.2.3 Clinical assessment

Pre-school children

When the children were assessed for clinical signs of vitamin A and anaemia (Table 28) it was found that vitamin A deficiency was prevalent in all the three groups (5.5% in group I; 10.3% in group II; 14.3% in group III%. Among the three groups less percentage (1.5-4%) of children complained of nightblindness, but number of children with bitot spots were more in group III (10.5%) when compared to group I and II.

Vitamin A deficiency and protein energy malnutrition are the two most frequently encountered deficiency diseases in children. Under controlled conditions vitamin A deficiency impairs humoral and cell mediated immunity in laboratory animals and humans, but under field conditions it has been difficult to sort out the individual effects of vitamin A deficiency from those of other nutrient deficits and proverty related factors. For instance PEM also impairs the humoral and cell mediated immune responses and is recognised frequent confounder in studies of vitamin A deficiency. Its prevalence and severity in children in countries where vitamin A deficiency is exixting, may account for the inconsistencies reported from investigations of the influence of vitamin A supplementation on morbidity (Chandra and Vyas et al 1989). Studies with labelled vitamin A confirmed that the absorption of vitamin A is not impaired even in severe PEM (Sivakumar & Reddy 1972).

5.4 VALUE OF FOODS CONSUMED INCLUDING THE FOODS FROM THEIR OWN PRODUCTION

Seasonality is a major barrier to obtaining the benefits of fruits, vegetables. The mean quantity of the own farm produce consumed by the families with horticulture and besides the amount spent on these items is comparatively less when compared to dairy families and families with other crops (Table 29). Only 1.06 kg of GLV per week, 3.65 kg of other vegetables per week, 1.96 kg of fruits per week were consumed by group I families in fresh form and no storage was observed in the households. The quantity of Glv, vegetables and fruits purchased by other two groups (II & III) varied because of fluctuating market prices during study period. Shanthakumari (1991) also stated that the percapita consumption of vegetables was significantly higher in vegetable growers than in non-growers. Horticulture intervention trial carried out in Andhra Pradesh during 1990-1994 (Vijayaraghvan et al., 1995) revealed that encouraging of homegardens at household level, besides nutrition education had a beneficial effect in increasing production and consumption of vitamin A rich foods. In another study pingle & Sivakumar (1991) reported that extensive development of mango orchards showed positive impact and substantial increase in consumption of mangoes in summer which resulted in decreased vitamin A deficiency.

5.5 FREQUENCY OF CONSUMPTION OF VEGETABLES, FRUITS MILK AND FLESHY FOODS

Frequency of consumption of protective foods is an indicator of quality of diets.

5.5.1 Pre-school children:

The daily, weekly, and rare consumption of vitamin A and iron rich foods was observed (Table 30). Among green leafy vegetables, spinach, amaranth, gogu, fenugreek leaves were commonly consumed. Most of the children were consuming green leafy vegetables daily and twice a week in group I, whereas, weekly consumption was noticed in group II and III. Both frequency of consumption and per cent of children consuming green leafy vegetables, other vegetables and fruits was significantly more in horticultural families due to availability from their own farm. Less freequent consumption of dark green leaves, fruits or eggs was reported in < 3 years children by Lisa et al (1991). Though they were cheap and easily available, they were consumed in a very small quantity owing to the ignorance of nutrition importance by parents. Vegetables like carrots, yellow pumpkin were consumed by very less percentage of children due to the same reason.

Fruits like papaya, mango are consumed twice a week. The percentage being 30 in group I, 27.7 in group II, 12.9 in group III were consuming papaya twice a week. During summer season mango is consumed by all the children even in group II and group III families also. Milk consumption is observed to be daily in group II children (73.4%) and only 33 per cent in group I, 28.6 per cent in group III. The children in group I & III are consuming milk principally in the form of tea. Whereas families who own milch animals serve tea with milk at home and are also making it into curds or butter milk. About 13 to 56 per cent of children were consuming fleshy foods once in a week, and once in fifteen days. This pattern of food consumption indicates that the o y dietary source of vitamin A and iron are green leafy vegetables and fruit but its intake was below the requirement in all the three groups and thus could not meet their daily recommended allowances.

Availability of greens is not a constraint for consumption in group I families, because though they are produ greens in their own farms consumptia is rather low since other vegetables have priority over GLV. Certain deep rooted negative awareness about carotene and iron rich foods appears to play a role calling for education oriented nutrition programme. One of the ways of overcoming the present dismal situation is to encourage cultivating horticultural crops for improving household nutrient availability coupled with education programme.

5.5.2 Pregnant women and lactating women

The frequency of consumption of vitamin A and iron rich foods by pregnant and lactating women was presented in Table 31(a) & 31(b). Very less percentage of women in three groups were consuming carrots, papay & pumpkin in all the three groups, this may be due to the ignorence. The percentage of women consuming GLV in group I were slightly higher in comparison to other two groups, and their per capita expenditure on vegetable was low while the other yellow/orange fruits and vegetables is considered there was not much difference. In group I with only 12 percent of women stating that they consume these foods once in a week or fortnight. The poor consumption could be due to lack of knowledge of the importance of vitamin A and iron rich foods in health & nutrition. this is due to availability of greens in their own farms. Milk and milk products consumption is comparatively better in group II families due to availability of milk.

This clearly shows that the consumption of various foods is directly proportional to availability of produce at household level.

5.5.2.1 *Mean quantity of consumption of vegetables and fruits by vulnerable groups*

Vegetables and fruits are the only natural sources of protective foods as they supply nutrients, vitamins and minerals. The mean consumption of vegetables and fruits/week by vulnerable groups was presented in Table 32. Low consumption was observed among all the three groups. However the consumption was comparatively higher in group I families when compared to group II and group III. Eventhough impressive production of fruits and vegetables was observed in Andhra Pradesh, they are inadequate to meet the minimal nutritional needs of our population (Narasinga Rao, 1991). The reason for low consumption of vegetables and fruits may be due to non-carotene containing crops were predominantly cultivated in the study area.

5.5.2.2 *Mean quantity of consumption of milk and milk products by pre-schoolers, pregnant and lactating women*

The mean consumption of milk and milk products by vulnerable groups was dipicted in Table 33. Less consumption of milk and milk products by pre-schoolers, pregnant and lactating women were observed excepting pre-schoolers from dairy group, where regular consumption (125 ml) of milk was observed. The milk consumption pattern of different socio-economic groups was studied by Thimmayamma (1982), she reported differences were observed in the milk intake of upper, middle and low income groups. Similarly Saxena (1984) reported per capita milk consumption was significantly correlated with income from dairying in all milk producing households. Similar findings were reported by other workers (Srinivasa Rao, (1986) and Chauhan and Sharma, (1990)).

5.6 Bio-chemical assessment

5.6.1 Serum retinol levels of pre-school children

Serum vitamin A levels were used to assess vitamin A nutrition status. The mean serum retinol level of children of the three groups were 27.0 μg/dl in group I, 23.4 μg/dl in group II, 18.1 μg/dl in group III (Table 34). It was observed that there was significant difference in serum retinol levels among three groups. The results were in accordance to Pingle and Sivakumar (1991) where the reduction in both clinical vitamin A deficiency as well as increase in serum vitamin A levels during post mango harvest in the orchad area, than in control area.

As inadequate intake of dietary vitamin A is the most obvious and constant factor responsible for the widespread prevalence of vitamin A deficiency. Supplementation studies by Devadas and Saroja (1987) revealed that bioavailability of ß-carotene from Amaranth, Papaya fruit and carrots on selected group of pre-school children of Coimbatore village. Many of the supplementation studies with Amaranth Papaya fruit and carrots (Devadas and Saroja, 1987), Amaranth and leaf protein (Nirmala Krishnamurthy et al, 1976), extent of absorption of ß-carotene from green leafy vegetables (Janabai & Nandini, 1985) revealed that significant increase in serum vitamin A levels after feeding the different sources of ß-carotene.

Serum retinal levels of dairy group was significantly better than group III. This may be that milk protein & fat consumption might have increased the absorption and conversion of ß-carotene from plant sources. Whereas the protein in vegetables is lost while cooking. Canfield et al (1991) studied oral dose of ß-carotene on plasma response alongwith 8.4g of fat in Guatemalan children and observed that maximum increase in plasma ß-carotene after the 30 and 15 mg doses for all subjects occured at 24 hour and were 0.29 and 0.23 µmol/l, respectively.

In another study conducted at Hyderabad, a group of pre-school children were fed 40g of spinach providing 1200 µg beta carotene daily for 4 weeks. Two other groups received additional amount of 5 or 10g of vegetable oil respectively along with the supplement. There was a significant increase in serum vitamin A levels in all the 3 groups following supplementation with spinach, but the rise was significantly higher in those who received additonal fat in the diet. (Jayarajan et al., 1980).

Carotenoids are absorbed much more effectively from oily solution like redpalm oil than plant foods. High doses of carotene are poorly absorbed because the absorption and conversion system becomes saturated while low doses, in the range of daily requirements are much better absorbed.

A sizeable proportion of the children in the community suffer from subclinical vitamin A deficiency having serum retinol levels less than 20 μg/dl. (Bhaskaram et al 1989).

5.5.3.2 Iron nutritional status of pre-school children

The mean haemoglobin levels of pre-school children among the three groups are 11.55 in group I, 10.62 in group II and 9.43 in group III. The mean haemoglobin levels of group I families children was significantly higher than the two groups (Table 36). This may be mainly due to the availability of non-haem iron derived mainly from plant sources.

The anaemic children with deficient haemoglobin level are more in group III. Iron deficiency results when iron absorption is not sufficient to meet the needs of the body. This occurs where there is poor absorption of iron from the diet, when rapid body growth occurs, or when substantial blood loss occurs (FAO/WHO expert group, 1988). A lack of iron causes iron stores to decrease, which is followed by a drop in serum ferritin concentrtion becasue serum ferritin is in equilibrium with the body's iron stores. Each microgram of ferritin per liter of serum equals 10 mg stored iron (Herbert, 1992). The incidence of anaemia is observed in all the three groups children, this may be due to low intake of foods rich in iron, folic acid and vitamin B12.

The content of vitamin A was very low in their diets which also might have contributed for poor absorption of iron. Muhilal (1988) reported an increase in haemoglobin values in the vitamin A supplemented group. Similar observation also reported by Bloem et al (1990), Mejia and Chew, (1988), Luis et al (1988).

Impaired cellular immune functions were observed in children with haemoglobin levels less than 10 g /dl (Srikantia et al 1976).

Correlation of serum retinol with haemoglobin, protein and dietary intake of vitamin A was presented in Table (36).Significant correlation was observed between serum retinol concentration which is associated significantly with haemoglobin, protein and dietary vitamin A. The present results were in accordance with the results presented by Djoko Suharno et al, (1992) and Bloem et al (1990).

5.3.3.3 Distribution of pregnant and lactating women according to haemoglobin levels

The mean haemoglobin levels of pregnant women ranged from 8.9 to 9.6 g/100 ml which is below 11 g/100 ml. In the present study, 50 to 79 per cent of women among three groups suffer from mild to moderate degrees of anaemia (Table 37). Pregnant women are tend to become anaemic very easily. Among pregnant women in India about 75 per cent are anaemic (Narasinga Rao, 1987).

About 22 to 83 per cent of lactating women were anaemic (Table 37) and the mean haemoglobin level of these women ranged from 8.8 to 11.7 g/100 ml in three groups which was lower than normal value. This may be due to prolonged period of lactation. There will be a progressive fall in the matarnal haemoglobin levels with increase in the duration of lactation (Prema 1980).

5.6 KNOWLEDGE, ATTITUDE AND PRACTICES (KAP) RELATED TO NUTRITION

The medium scores obtained for KAP in the present study (Table 38) were almost similar to the results obtained by Buttar and Geetha (1989). About 15.2 to 20.8 per cent of the sample obtained high scores for KAP, indicating better nutritional awareness of horticulture dairy and other families of Andhra Pradesh than the rural home makers of Ludhiana as none of them obtained high scores.

Certain vegetables were considered stress provoking and avoided during pregnancy, lactation and simple sickness or disorder as fevers, diarrhea.

The nutrition knowledge, attitudes and practices of 160 mothers in Hissar city were studied (Veena kumari et al., 1989). The results of the study revealed that mothers answered 90 per cent nutrition knowledge questions correctly but received low scores because they indicated a low degree of certainity on their answers. Similar findings were observed in the present study (Table 39).

About 90 per cent of women were not aware of questions related to vitamin A and iron in all the three groups. One of the reasons is that the community is neither aware of the sequales of vitamin A and iron deficiency nor of the dietary means to protect themseleves against it. Several studies reveals that pregnant & lactating women avoids Papaya, Gogu Pumpkin (Krishna et al., (1984) Rao, (1985)). Similar beliefs were observed in the present study.

The mothers whose childrens retinol levels were estimated, their knowledge regarding presence of vitamin A and iron in food item revealed that only 19.6 per cent, 27.1 per cent 17.4 per cent of women in group I, II & III had prior knowledge, whereas 83 to 91 per cent of women are lacking the knowledge regarding vitamin A prophylaxis programme.Thus when the average amount of vegetables produced purchased or the amount actually consumed by the children were significantly lower in all the three groups indicating that knowledge of mother had an effect on nutritional status of children. Similar findings were reported by Mahesh et al. (1991) (Table 41). Nurul Islam et al (1991) conducted a baseline survey to determine the incidence of vitamin A deficiency and nutritional blindness amongst the children of some coastal villages in Bhola, Bangladesh. The results of the study revealed that lack of nutritonal knowledge and the consequent indifference to dietary vitamin A intake were stronger determinants than factors like formal educational level and family landholding.

CHAPTER - VI

SUMMARY

SUMMARY

Vitamin A and iron deficiency continued to be a major problem in the country. The main cause of this problem is inadequate intake of vitamin A and iron rich foods particularly by vulnerable segments of population. Action has been initiated in India for production of such foods through kitchen gardens, encouraging horticultural crops and animal husbandry. The present study is an attempt to study the vitamin A and iron nutritional status of people subsisting on horticultural crops and dairy farming in East Godavari district of A.P. The specific objectives of the study are as follows:

- To assess the economic contribution of vegetable crops and dairy to the small and marginal farm families
- To assess the food and nutrient intake of sub-sample of farm families subsisting on horticultural crops/dairy farming and compare with the families not subsisting on these farming systems.
- To assess the economic value of foods consumed by the families including the foods produced and purchased by these families.
- To study the frequency of consumption of fruits and vegetables by vulnerable segments.
- To assess the vitamin A nutritional status of the pre-school children of the selected families by clinical assessment and 30 per cent of the sample by bio-chemical method.

- To assess the iron nutritional status of pregnant women and pre-school children on the selected families by estimating haemoglobin level in blood.
- To assess the growth of all pre-school children in the selected villages by height/weight profile over a period of one year.
- To assess the KAP of 30 per cent of the selected farm women regarding the nutritional value of horticultural crops and dairy products and problem of vitamin A deficiency and anaemia.

The study was carried out in the interior villages of Kadiam mandal from East Godavari district of Andhra Pradesh. One hundred and fifty households with horticultural crops alone, another one hundred and fifty families with dairy as a major source of income, seventy five households depending on other crops were selected for comparision. The criteria for selection of sample was age, income from horticultural crops, dairy and other crops and having either pre-school child, pregnant and lactating women.

The parameters selected to be assessed in the study were economic contribution of crops, dairy and other crops to the families income, dietary intake, anthropometric status, clinical signs of vitamin A and iron deficiencies, serum and haemoglobin levels. Amount spent on purchased foods, knowledge of mothers regarding the nutritional value of their farm produced products and problem of vitamin A and iron deficiency.

The results of the study revealed that the annual income of families maintaining dairy was more than those depending on horticultural crops and other crops. However, the income from fruit crops was higher during the season in horticultural families. The percentage of expenditure on food by dairy families was slightly higher than horticulture and families with other crops. Even though the income from brinjal is less most of them were cultivating brinjal. Most of the farmers were marketing their produce and no storage was observed in horticultural families due to perishable nature of fruits and vegetables. High profitability was observed from fruit crops.

The average milk yield per buffaloe was 5.6 lts and for cows it was 1.45 lts in dairy families. Dairy is not only giving cash income but it is also indirectly improving their net returns from farm and also creating employment to the family members. High percentage of women were participating in dairy activities.

The vegetables, fruits consumption by horticulture based families was found to be significantly more in preschool children, pregnant and lactating women. Whereas milk consumption by preschoolers is significantly higher when compared to horticultural based families and families with other crops. This indicates proportionate increses in consumption based on the produce available at household level. The frequency of consumption also revealed that green leafy vegetables and vegetables were consumed daily or twice a week by horticultural families with respect to dairy families milk consumption is significantly better and children were consuming milk daily. Diets of children, pregnant and lactating women were found to be adequate with regard to cereals and other vegetables on the basis of RDA (1992). But diets were inadequate in protective nutrients especially vitamin A and iron.

Since green leafy vegetables supply ß-carotene and also an important source of iron (next to cereals), community should be encouraged to grow and consume green leafy vegetables frequently through horticultural interventions and health and nutrition education programmes. This in addition to vitamin A and iron improves intake of other micronutrients such as vitamin C and calcium.

Clinical examination of the subjects shows that all the children, pregnant and lactating women exhibited the signs of anaemia and vitamin A deficiency but the percentage of children, pregnant and lactating mothers with these signs were high in families with other crops. Anthropometric status of children, pregnant and lactating women reflects the impact of these programmes as their mean values for height and weight being normal though significant difference was not observed between groups.

The biochemical analysis revealed that mean serum retinol levels of preschool children were found to be significantly better in horticultural faimiles than other two groups. Significant difference was also found in the serum retenol levels of dairy group children when compared with families with other crops. In addition to low serum retenol levels the third group childrens haemoglobin levels was also found to be low when compared to other two groups. Serum vitamin A was found to have positive correlation with haemoglobin, protein and dietary vitamin A. No difference was observed in the nutritional awareness of mothers between horticulture, dairy and families with other crops.

It is, therefore, necessary to increase the horticultural crop production and encourage the animal husbandry programmes. The success of the community oriented programmes generally depend on the direct involvement of the community. To improve the vitamin A and iron nutritional status of population there is an urgent need :

- to improve the knowledge and awareness among the farming community with regard to carotene and iron rich foods.

- to ensure supply of good quality seeds and to encourage correct crop management procedures and.

- to reduce post-harvest losses.

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APPENDICES

APPENDIX I

SCHEDULE

Project Title : **VITAMIN A AND IRON NUTRITIONAL STATUS OF NUTRITIONALLY VULNERABLE SEGMENTS OF POPULATION SUBSISTING ON HORTICULTURE CROPS AND DAIRY FARMING IN EAST GODAVARI DISTRICT**

Month of survey : ______________________________

Household identification number : ______________________________

Name of the village: ______________________________

Name of the mandal : ______________________________

Interviewer name : ______________________________

Respondants name : ______________________________

Date of interview : ______________________________

INTERVIEW SCHEDULE

SECTION -A

I. GENERAL INFORMATION

1. Name of the Head of the family ______________________
   Name of the Housewife ______________________

2. How many children under the age of :
   6 years live in the household?

3. Family particulars and Occupation :

Family members	Age (Yrs.)	Sex (M/F)	Educational level	Daily activity of the family members	Income per annum

* That which provides major source of income

1. Illiterate	1. Agril. Labourer	1. < 6000
2. Literate	2. Tenant cultivator	2. 6000-10000
3. Primary	3. Farmer	3. > 10000
4. Secondary	4. Dairy farmer	
5. More than secondary	5. Poultry farmer	
	6. Any other	

4. What is the major source of income :
   for the household?

5. What is the major occupation of the :
   main wage-earner or the provides of
   income in the household?

   a) Farming
   b) Livestock
   c) Work for wages
   d) Trading/business
   e) Home Industry
   f) Other (specify)

5. a) What is the major occupation of the female wage earner in the household?

   a) Farming
   b) Livestock
   c) Work for wages
   d) Trading/business
   e) Home Industry
   f) No work

6. What is the main source of household cash income? :

   a) Sale of agricultural produce :

   b) Sale of livestock :

   c) Sale of home produced products :

   d) Trading/own business :

   e) Wages from work off household farm :

   f) Others specify :

7. Particulars of income :

Source	Income/Annum (Ref. 1993)	
	Kind	Rupees
1. Wage income		
2. Total farm income (crop wise)		
3. Income from other sources		
Total		

8. Are the children in family involved in the occupational activity after school? : YES/NO

9. If yes, what activity? :

10. How many hours in a week they spend in agricultural activities in Kharif and in Rabi season :

II. DETAILS OF PRODUCTION AND MARKETING

KHARIF SEASON

Types of crops	Area	No.of crops raised last year	Season June to October	Qty.paid out (in kind) for wage for land leasing	Yield/ year	Qty. sold	Place of sale	Rate/ Quintal	Income

RABI SEASON

Types of crops	Area	No.of crops raised last year	Season Nov. to March	Qty.paid out (in kind) for wage for land leasing	Yield/ year	Qty. sold	Place of sale	Rate/ Quintal	Income

2. Do you utilise/sell any byproducts of vegetable and fruit crops : YES/NO

3. If yes, give the particulars :

Uses	By product used for Family	Income through sale of by products
Fuel		
Housing material		
Fencing		
Roofing		
Manure		
Seeds		

III. PARTICULARS OF STORAGE

1. Do you store the horticulture produce before selling? : YES/NO

   If yes, How long you store products after harvesting :

Crop	Duration

2. Where do you store the produce? :

   a) Keeping it in shade on the farm or at home

   b) Keeping it in Baskets

   c) Covering it with gunny bag material

   d) Spreading it on the ground or hay

   e) No particular method

3. What are the methods used for preserving : the quality of the Produce?

   a)
   b)
   c)
   d)
   e)

4. Do you incur any storage loss? : YES/NO

5. If yes, in case of what cros :

Crop	Quantity (last season)

6. Do you preserve vegetables or fruits : YES/NO for off-season use for household?

7. If, yes, in what form and what quantity? :

Form	Quantity

IV. DETAILS OF HOUSEHOLD CONSUMPTION

1. a) How much quantity of the farm produce do you use for the family consumption? :

Crops	Quantity used in a week	Quantity used in a day

1. b) Do you purchase vegetables other than what you grow : YES/NO

1. c) If, yes Indicate the names and quantities purchased last week :

Names	Quantities

2. What is the average quantity of consumption of the family/day? :

3. How often do the following age group consume these vegetables and fruits? (Ref. period previous month) :

Age-Group	Carrots	Pumpkin	Green leafy vegetables	Other vegeta-bles	Papaya	Mango
1. Pre-school Children						
2. Pregnant women						
3. Lactating women						

Frequency code : 1. Daily
2. Twice a week
3. Thrice a week
4. Weekly
5. Fortnightly
6. Rarely

4. How much quantity of vegetables and and fruits do the following age groups consume in a week in your family? :

Age-Group	Carrots	Pumpkin	Green leafy vegetables	Other vegeta-bles	Papaya	Mango
1. Pre-school Children						
2. Pregnant women						
3. Lactating women						
4. Adult Man						
5. Adult Women						

5. What are the vegetables and fruits specially preferred/avoided during? :

	Preferred	**Avoided**
Pregnancy	________	________
Lactation	________	________
Pre-school children	________	________
Illness	________	________

V. A. Household food expenditure

Names of all Foods purchased or consumed from: Own production/ in kind/wage/ gifts/share crop/kind loan	Purchased (A)			Own production in/kind-wage/gifts/share cropping/kind loan (B)		Total expenditure (A+B)
	Quantity	Rate	Total cost of purchased items (Rs.)	Quantity	Total volume of foods produced	
Cereals						
Pulses						
Vegetables						
Fruits						
Fleshy foods						
Fats & Oils						
Miscellaneous						
Total						

1. On what items your expenditure is is higher. Rank first three items :

    a) Cereals
    b) Pulses
    c) Oilseeds
    d) Vegetables
    e) Fruits
    f) Oil
    g) Milk

B. HOUSEHOLD NON-FOOD EXPENDITURE

Names of all Non-food expenditure	Value/Annum
House Rent	
Fuel and Light	
Clothing, Bedding, Shoes etc.	
Education	
Entertainment	
Medicines	
Transport	
Other services	
Tobacco	
Toddy	
Interest on loans	
Other specify	
Total	

SECTION - B

I. DETAILS OF DAIRY

S.No.	Type of species		Number of animals	Total milk yield/ day	Amount of milk sold/ day	Amount of milk retained for consumption/day	Income earned/ day
1.	Cows	Milch					
		Dry					
2.	Buffaloes	Milch					
		Dry					
3.	Sheep						
4.	Goats						

2. **What is the average yield of milk for last month?** :

3. **Where do you sell the milk?** :

Agency	Qty. sold	Price/Rate	Income/Day
Village Co-op.			
Milk vendors			
Neighbours			
Hotels			
Local Shops			
Any others			

4. a) Do you also sell milk products : YES/No

   b) If yes, what products :

5. How much cow dung do you get per week :

   a) One full cart

   b) More than one cart

6. How do you use it?

   a) Manure   b) Cakes-fuel   c) Any other

7. Do you use all the quantity? : YES/NO

8. If, no how do you dispose them?

Items	Sale Amount	Income/Month
Manure		
Cakes-fuel		
Any other specify		
Total		

9. How do you dispose dry animals?

   a) Selling   b) Agricultural purpose   c) Gifting

10. If you sell how many animals did you sell and what income was derived (last year) :

II. CONSUMPTION OF MILK BY HOUSEHOLD MEMBERS

1. How much quantity of milk do you retain for family consumption? :

2. What is the average milk consumption/day by the family last week? :

3. How much quantity of milk is consumed by different members of family in a day? :

Family Members	Age/Sex	Qty. consumed/ day	Values of milk

4. a) Do you purchase milk when you fall short :

4. b) If yes, which month and how much :

III. HOW MUCH OF MILK PRODUCTS ARE CONSUMED BY DIFFERENT FAMILY MEMBERS

Form of consumption	Family members	Agge/Sex	Amt./day (or) month	Value of milk products
Milk				
Dahi				
Butter milk				
Ghee				
Butter				
Milk Sweets				
Any other				

1. Who are the Household members involved in dairy activity :

Family members	Type of activity	No.of hours spent/day
Head of Family		
House wife		
Children		
Servants		
Any other		

IV. A. HOUSEHOLD FOOD EXPENDITURE

Same as in Section - A

IV. B. HOUSEHOLD NON-FOOD EXPENDITURE

Same as in Section - A

APPENDIX II

SCHEDULE FOR COLLECTION OF DATA ON AWARENESS OF NUTRITION AND HEALTH

Date :

Name of the respondent :

I. GENERAL NUTRITION

1. Which foods (or) food items should be eaten daily?

   (a) Rice (or) roti, vegetables/green leafy vegetables
   (b) Dhal, milk, fruits, fleshy foods
   (c) Don't know

2. Why should we eat food daily?

   (a) To give us energy (b) Growth
   (c) Maintenance (d) Don't know

3. Mention names of two body building foods

   (a) Egg (b) Meat
   (c) Don't know

4. Mention names of two protective foods?

   (a) Green leafy vegetables (b) Fruits
   (c) Vegetables (d) Don't know

5. Mention foods rich in energy

   (a) Cereals, sugar, jaggery (b) Oil, oilseeds (c) Any other

6. Which are the foods which help in blood formation?

   (a) Green leafy vegetables (b) Dhals
   (c) Fleshy foods (d) Don't know

7. Which foods that help to build strong bones

   (a) Milk (b) Ragi, dry fruits (c) Don't know

II. DIET DURING PREGNANCY AND LACTATION

8. Should pregnant mother take little extra food than normal amounts?

   (a) Yes (b) No (c) Don't know

9. Why should a pregnant mother take little extra food than normal amounts?

   (a) For the health of the mother
   (b) For the growth of the baby (c) Do not know

10. Which foods should be taken in extra quantities by a pregnant mother.

    (a) Rice (or) roti, dhal, vegetables/green leafy vegetables
    (b) Milk, fruits, eggs and fleshy foods
    (c) Do not know

11. Which foods should be taken in extra quantities by a lactating mother.

    (a) Rice (or) roti, dhal, vegetables and greens
    (b) Milk, eggs and fleshy foods
    (c) Do not know

III. BREAST FEEDING

12. How long mothers milk alone is sufficient for the baby?

    (a) 6 months (b) 1 or 2 years
    (c) Don't know

13. Do breastfed infants have less number of diarrhoeal attacks?

    (a) Yes (b) No (c) Do not know

14. Till what age of the child can mother breast feed her baby?

    (a) As long as possible (b) 2-3 years (c) Don't know

IV. WEANING AND CHILD FEEDING

15. At what age should the child be introduced soft cooked foods?

    (a) 6-9 months onwards (b) 1-3 years onwards
    (c) Don't know

16. From what age adult foods can be given to a child?

    (a) By 1 year (b) By 2-3 years (c) Don't know

17. Should feeding be stopped when the child is sick?

    (a) Yes (b) No (c) Do not know

18. At what age the child should be given preparations made with greens?

    (a) 6 months onwards (b) 1-3 years onwards
    (c) Do not know

19. Which food (or) food items promote growth and health of young child?

(a) Rice/roti, dhal, vegetables/green leafy vegetables
(b) Milk, egg/meat/fish
(c) Do not know

V. NUTRITIONAL DEFICIENCY DISEASES

20. Why do young children suffer from malnutrition?

(a) Inadequate food (b) Frequent illness
(c) Delay in introducing supplementary foods
(d) Do not know

21. Can you identify a malnourished child, If so, what are the symptoms?

(a) Loss of weight/thin body with poor muscular development
(b) Dull apathetic with or without pot belly
(c) Loss of weight for age/less height for age/less weight for height stunted
(d) Do not know

22. Are soreness of mouth and cracks at the corners of the lips due inadequate intake of some foods in the diet?

(a) Yes (b) No (c) Do not know

23. Can bleeding gums be prevented by consumption of any foods? Yes/No

If yes, what foods

(a) Citrus foods (b) Amla, guava, green leafy vegetables
(c) Do not know

VI. AWARENESS ABOUT VITAMIN A AND IRON NUTRITION

24. Which foods prevent nightblingness in children?

(a) Green leafy vegetables, yellow/orange coloured fruits like papaya, pumpkin, mango, milk/eggs/fish/liver
(b) Other foods (c) Do not know

25. What are the three symptoms you know of Vitamin A deficiency?

(a) Dull dry eyes/conjuctiva (b) Night blindness
(c) Bitot's spots, xeropthalmia (d) Do not know

26. What plant foods have more vitamin A?

(a) Green leafy vegetables/spinach/radish leaves
(b) Papaya/Pumpkin/carrots (c) Do not know

27. What animal foods have more vitamin A?

(a) Butter/milk/curds (b) Egg/Liver/fish/fish oil
(c) Do not know

28. What foods (or) food items should be given to children to prevent night blindness?

(a) Green leafy vegetables, yellow coloured fruits
(b) Milk, fleshy foods
(c) Do not know

29. Does night blindness in pre-school children lead to total blindness if neglected?

(a) Yes (b) No (c) Do not know

30. Are you aware of the six monthly dose of vitamin A solution, given by health workers to prevent vitamin 'A' deficiency in pre-school children?

(a) Yes (b) No (c) Do not know

31. How many doses should be given in a year to prevent night blindness?

(a) Two times (b) Do not know

32. Do you know what is Anaemia?

(a) Yes (b) No (c) Do not know

33. What are the causes for occurance of anaemia in women?

(a) Due to deitary deficiency (b) Any other reasons
(c) Do not know

Dietary reasons	Non dietary reasons
______________	______________
______________	______________
______________	______________
______________	______________

34. By what symptoms can you identify an anaemic women?

(a) Fatigue (b) Pale conjuctiva
(c) Spoon shaped nails (koilonychia) (d) Do not know

35. Do you know about the tablets given at PHC for prevention of anaemia? Yes/No

If yes, for how many days should a pregnant women take this tablets.

(a) For 100 days (b) More than 100 days
(c) Do not know

36. What are the foods that can prevent anaemia?

(a) Green leafy vegetables (b) Liver, fish
(c) Egg (d) Do not know

VI. **HEALTH AND HYGIENE**

37. What are the diseases which can be prevented by immunization?

(a) Diphtheria/woophing cough/measles/tuberculosis/polio/tatanus
(b) Do not know

38. Why do children get diarrhoea frequently?

(a) Poor sanitation/poor personal hygiene/eating spoiled food
(b) Due to heat/indigestion
(c) Contaminated water
(d) Do not know

39. Have you heart of "salt sugared water" that saves children from diarrhoea?

(a) Yes (b) No (c) Do not know

40. Which is the method used to prepare "salt sugared water"?

(a) Mixing four finger scoops of sugar and a two finger pinche of salt in a glass of boiled and cooled water
(b) Do not know

41. What are the diseases caused by contaminated water?

(a) Diarrhoea (b) Cholera (c) Typhoid
(d) Any other communicable diseases (e) Do not know

ATTITUDES OF RURAL FARM WOMAN TOWARDS NUTRITION, HEALTH AND HYGIENE

I. NUTRITION

		A	UD	DA
1.	Our state of health is related to the food we eat			
2.	Rice is more nutritious than millets			
3.	Many ill effects of health are due to illbalanced diet			
4.	Older children do not need to drink milk daily			
5.	Dating papaya during pregnancy leads to abortions			
6.	Cooking rice without straining 'Ganjee' is good			
7.	All vegetables should be washed before cutting			
8.	It is good for health to use green leafy vegetables frequently			
9.	The vegetables should be cut into large pieces before cooking			
10.	Green leafy vegetables help in keeping the bones of young children strong			
11.	Costly foods are always highly nutritious			
12.	New born baby can't digest milk. Therefore it is better to give sugar water			
13.	Mothers eating more food during pregnancy will have difficult delivery			
14.	Mothers who eat less food during pregnancy, deliver low birth weight babies			

III. BREAST MILK AND YOUNG CHILD FEEDING

		A	UD	DA
15.	"Colostrum" is good for the health of the baby			
16.	Bottle fed babies are healthier than breastfed babies			
17.	Infants below 6 months do not require water			
18.	Feeding green leafy vegetables leads to Diarrhoea in children below 1 year			
19.	Citrus fruits like oranges cause cold to children			

20. Children continuing on breast milk need not be given other foods

21. Children should be fed even during illness

IV. NUTRITIONAL DEFICIENCY DISEASES

22. Ill health in childhood is more heriditary than nutrition

23. Night blindness cannot be cured

24. Underweight is not an indication of illhealth in pre-school children

25. Apathy and dullness are symptoms of malnutrition in preschool children

V. HEALTH AND HYGIENE

26. Immunization protects against polio

27. Diarrhoea is caused due to over heat

28. Living in poor environment is one of the causes of frequent illness of the family members

29. Cleanliness prevents many diseases

30. Scabies in children is due to poor personal hygiene

31. Worm infestation in children is due to eating mud

32. Bore water is safer

A - Agree UD - Undecided DA - Disagree

APPENDIX III
24 HOUR DIETARY RECALL

Name of the Village : H.H.No. :

Name of the Respondent : Date :

Sl. No.	Name of the household member	Relationship to Household Head	Sex	Occupation	Occupation classification	Special conditions	Missed a meal	Adult equivalents/ C.U.

24 HOUR DIETARY RECALL

Sl. No.	Names of food preparations	Left overs from the day before	Food stuffs used	Quantity	Total cooked volume	Individual consumption				Food given away	Left over on the day
						1	2	3	4		

APPENDIX IV

NUTRITIONAL ASSESSMENT SCHEDULE FOR PRE-SCHOOL CHILDREN

I.D.No. of Household :

DISTRICT : MANDAL : VILLAGE : DATE :

Family I.D.No.	Name of the child	Age (Yrs.)	Sex F/M	Father's Name	Height (cm)	Weight (kg)	*Frequent morbidity	Vitamin 'A' deficiency signs			Iron deficiency signs			
								Night blind-	Bitot's spots	Corneal leisions	Pale Dry skin	Fatigue	Koil- Pale conjective	Koilonychia

* Atleast once in 15 days becoming sick

APPENDIX V
NUTRITIONAL ASSESSMENT SCHEDULE FOR PREGNANT MOTHERS

I.D.No. of HH :

DISTRICT : MANDAL : VILLAGE : DATE :

Family I.D.No.	Name of the Women	Age (Yrs.)	Husband's Name	Height (cm)	Weight (kg)	*Morbidity	Iron deficiency signs			
							Poor appetite	Fati-gue	Pale conje-ctiva	Koil-onyc-chia

* Atleast once in 15 days becoming sick

APPENDIX VI

Food intake of 1-3 years children - Group I

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
n=26	173.8	-	51.2	20.0	160.0	12.0
	94.3	24.5	30.6	14.7	207.8	12.4
	225.9	26.8	20.4	-	193.6	12.6
	174.5	18.7	20.6	17.2	164.0	10.3
	103.1	31.0	23.4	37.2	99.1	10.2
	113.5	16.9	33.8	56.6	70.0	15.3
	111.3	27.9	56.8	49.7	83.3	11.3
	191.5	15.6	31.2	49.8	83.3	13.3
	184.3	20.2	36.6	17.3	297.3	9.6
	226.7	31.2	24.3	37.3	94.4	12.2
	132.7	24.3	26.4	41.0	55.0	13.0
	163.1	28.5	-	15.4	58.3	14.0
	98.0	19.0	-	14.6	231.7	8.6
	140.3	28.5	-	64.2	133.9	11.6
	120.8	-	22.8	34.6	77.6	11.2
	182.0	21.4	-	63.6	83.3	8.6
	163.5	-	15.6	58.9	-	14.0
	316.1	27.0	20.0	-	194.0	13.0
	131.4	27.3	33.4	26.0	32.0	12.6
	203.3	-	-	84.0	98.0	12.0
	135.6	28.2	24.6	27.0	250.0	20.0
	137.3	34.0	26.3	15.0	175.0	14.0
	219.2	32.6	45.0	43.0	121.0	15.0
	182.1	21.8	35.0	54.0	83.0	17.5
	203.4	-	33.0	44.0	98.0	15.6
	150.5	20.6	15.4	26.4	94.0	18.0
Mean	164.5	20.2	24.1	35.1	124.5	12.9
S.D.	50.4	11.1	15.5	21.1	71.6	2.75

Food intake of 1-3 years children - Group II

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
n=26	145.9	14.9	-	20.8	104.1	9.3
	191.7	20.3	32.0	15.2	143.3	13.4
	155.8	35.5	-	22.3	165.0	13.6
	152.2	41.0	18.6	28.8	219.2	14.1
	147.0	-	-	35.8	140.6	11.6
	136.4	17.0	22.4	-	173.6	11.3
	208.0	24.3	-	29.1	179.3	10.9
	165.5	18.7	23.4	24.6	170.4	12.3
	137.3	34.7	-	20.3	226.9	13.4
	174.8	30.1	18.9	-	209.8	12.0
	137.5	-	16.6	30.4	168.9	12.0
	166.6	16.3	19.6	19.5	250.0	10.6
	148.7	13.6	-	21.8	237.2	9.2
	116.3	19.0	-	18.0	180.0	12.0
	166.0	50.3	-	19.0	220.0	13.0
	115.8	-	49.5	-	162.5	12.0
	162.8	15.6	-	32.6	166.6	16.0
	168.0	44.0	20.4	47.0	150.0	17.0
	214.0	28.0	33.0	79.0	104.0	14.9
	200.4	27.4	29.6	-	225.6	14.1
	116.0	26.0	-	19.0	260.0	18.0
	240.0	29.0	19.4	64.0	240.0	12.5
	176.0	27.0	24.5	26.0	232.0	12.6
	95.0	24.0	-	24.0	200.0	15.0
	130.8	35.5	18.4	22.3	155.0	8.3
	128.0	45.0	-	35.0	180.0	16.0
Mean	156.0	24.5	13.3	25.2	187.0	12.9
S.D.	30.8	13.4	14.1	17.9	42.5	2.4

Food intake of 1-3 years children - Group III

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
n=23	198.4	20.1	22.4	33.0	180.0	12.0
	150.0	22.4	-	23.3	65.6	17.0
	160.3	16.2	17.4	39.8	-	14.5
	160.8	20.3	20.4	13.0	90.8	13.0
	160.3	32.2	18.2	25.0	110.4	12.6
	145.2	18.6	16.4	14.5	210.5	10.0
	188.6	36.0	24.3	20.2	110.8	14.6
	135.3	26.3	20.3	26.8	40.3	17.0
	146.4	23.1	-	20.4	95.1	12.5
	160.1	-	16.4	35.2	70.9	13.0
	210.5	33.2	18.4	24.5	110.6	10.0
	120.6	25.0	20.0	15.4	70.4	14.0
	133.3	22.4	20.0	31.6	100.6	10.0
	220.4	24.5	14.0	23.1	60.2	9.5
	235.8	-	-	33.3	150.0	10.8
	188.4	19.5	20.4.	-	290.0	9.8
	218.5	18.5	23.2	18.4	150.4	16.0
	200.4	20.4	-	60.4	120.5	13.6
	170.2	18.2	15.4	30.4	80.3	14.3
	155.3	20.2	16.3	20.5	-	12.6
	134.5	22.6	-	23.3	-	11.5
	148.6	20.3	-	18.3	60.4	10.2
	160.4	17.6	-	26.6	55.0	9.5
	169.6+	20.76	13.1	25.08	96.6	12.5
	31.7	8.3	9.2	11.52	68.2	2.3

Food intake of 1-3 years children - Group III

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
n=23	198.4	20.1	22.4	33.0	180.0	12.0
	150.0	22.4	-	23.3	65.6	17.0
	160.3	16.2	17.4	39.8	-	14.5
	160.8	20.3	20.4	13.0	90.8	13.0
	160.3	32.2	18.2	25.0	110.4	12.6
	145.2	18.6	16.4	14.5	210.5	10.0
	188.6	36.0	24.3	20.2	110.8	14.6
	135.3	26.3	20.3	26.8	40.3	17.0
	146.4	23.1	-	20.4	95.1	12.5
	160.1	-	16.4	35.2	70.9	13.0
	210.5	33.2	18.4	24.5	110.6	10.0
	120.6	25.0	20.0	15.4	70.4	14.0
	133.3	22.4	20.0	31.6	100.6	10.0
	220.4	24.5	14.0	23.1	60.2	9.5
	235.8	-	-	33.3	150.0	10.8
	188.4	19.5	20.4	-	290.0	9.8
	218.5	18.5	23.2	18.4	150.4	16.0
	200.4	20.4	-	60.4	120.5	13.6
	170.2	18.2	15.4	30.4	80.3	14.3
	155.3	20.2	16.3	20.5	-	12.6
	134.5	22.6	-	23.3	-	11.5
	148.6	20.3	-	18.3	60.4	10.2
	160.4	17.6	-	26.6	55.0	9.5
	169.6+	20.76	13.1	25.08	96.6	12.5
	31.7	8.3	9.2	11.52	68.2	2.3

Food intake of 4-6 years children - Group II

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
n=22	181.5	26.6	22.1	41.0	240.3	10.6
	233.0	22.4	16.3	35.8	240.6	10.4
	286.6	20.5	-	-	295.0	12.3
	282.5	49.1	-	39.0	261.0	15.2
	166.4	40.4	26.7	-	231.2	12.2
	200.4	18.5	-	61.1	225.6	14.8
	236.0	20.6	24.5	33.4	225.6	10.8
	232.7	-	-	29.3	217.6	16.0
	250.5	23.4	37.5	13.7	142.4	9.4
	197.8	56.6	-	54.5	210.2	10.3
	252.4	30.1	24.5	-	209.8	12.0
	245.6	32.1	26.8	45.2	385.0	11.0
	166.6	18.2	33.4	13.6	170.7	13.4
	202.1	-	-	8.9	241.8	16.0
	224.2	20.2	36.8	54.4	175.0	10.6
	296.3	21.4	-	30.5	240.4	10.2
	326.2	13.6	26.7	-	290.0	9.6
	206.8	20.2	-	30.5	208.3	8.9
	232.8	24.6	22.9	16.3	168.8	12.0
	235.0	48.0	22.3	45.0	175.0	12.0
	293.5	49.0	20.4	38.0	161.1	16.9
	188.0	54.0	28.4	51.0	208.0	16.0
Mean	233.5	26.8	16.8	29.1	226.6	12.3
S.D.	43.7	16.8	13.8	19.7	54.06	2.4

Food intake of 4-6 years children - Group II

	Cereals	Pulses	GLV	Other vegetables	Milk & milk products	Fats and oils
n=22	181.5	26.6	22.1	41.0	240.3	10.6
	233.0	22.4	16.3	35.8	240.6	10.4
	286.6	20.5	-	-	295.0	12.3
	282.5	49.1	-	39.0	261.0	15.2
	166.4	40.4	26.7	-	231.2	12.2
	200.4	18.5	-	61.1	225.6	14.8
	236.0	20.6	24.5	33.4	225.6	10.8
	232.7	-	-	29.3	217.6	16.0
	250.5	23.4	37.5	13.7	142.4	9.4
	197.8	56.6	-	54.5	210.2	10.3
	252.4	30.1	24.5	-	209.8	12.0
	245.6	32.1	26.8	45.2	385.0	11.0
	166.6	18.2	33.4	13.6	170.7	13.4
	202.1	-	-	8.9	241.8	16.0
	224.2	20.2	36.8	54.4	175.0	10.6
	296.3	21.4	-	30.5	240.4	10.2
	326.2	13.6	26.7	-	290.0	9.6
	206.8	20.2	-	30.5	208.3	8.9
	232.8	24.6	22.9	16.3	168.8	12.0
	235.0	48.0	22.3	45.0	175.0	12.0
	293.5	49.0	20.4	38.0	161.1	16.9
	188.0	54.0	28.4	51.0	208.0	16.0
Mean	233.5	26.8	16.8	29.1	226.6	12.3
S.D.	43.7	16.8	13.8	19.7	54.06	2.4

Food intake of 4-6 years children - Group III

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
n=23	247.0	26.0	26.4	-	110.0	11.6
	168.6	25.4	23.4	15.0	194.0	15.3
	198.2	28.0	-	16.0	150.0	20.0
	215.0	34.0	25.3	58.0	110.4	13.0
	252.4	38.3	11.2	9.0	237.3	20.0
	187.1	29.0	-	16.0	180.2	16.6
	180.0	22.1	23.4	18.2	102.3	17.6
	204.4	-	-	-	270.2	12.2
	195.6	28.0	27.2	44.5	110.1	6.7
	221.3	33.0	26.3	31.2	166.3	10.6
	198.4	38.1	28.0	-	190.2	10.0
	180.3	36.2	-	70.0	250.8	17.0
	198.1	-	-	36.0	160.2	14.0
	244.3	33.5	18.6	41.0	110.2	8.6
	210.5	32.0	13.0	30.0	200.3	10.0
	220.1	15.4	16.4	20.0	230.0	9.8
	260.6	34.3	40.0	40.6	200.0	14.0
	212.3	-	20.4	27.3	230.0	10.0
	202.6	19.5	-	36.6	160.3	20.0
	210.4	28.0	19.5	59.1	120.2	17.0
	210.8	18.6	-	38.0	250.0	13.8
	175.6	26.0	-	20.0	-	16.9
	286.6	-	-	-	195.0	14.5
Mean	212.1	23.7	13.8	27.2	170.7	13.8
S.D.	29.2	12.6	12.6	19.8	63.6	3.8

Food intake of Pregnant women - Group I

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
n=16	528.6	58.9	49.4	30.7	223.0	26.0
	561.9	54.6	-	-	115.0	20.0
	527.0	45.2	70.4	99.9	126.8	26.0
	442.0	68.6	-	85.0	175.0	25.0
	514.6	100.0	-	68.0	195.0	30.0
	498.4	88.0	52.6	64.4	45.0	25.0
	560.0	74.0	-	82.4	220.0	25.0
	440.0	78.0	66.4	76.6	155.0	30.0
	520.0	62.0	64.4	-	260.0	28.0
	544.3	66.4	40.8	46.4	210.0	26.0
	563.0	84.0	58.6	65.2	156.0	30.0
	576.0	62.4	36.4	46.6	160.0	28.4
	540.0	58.6	51.8	52.4	224.0	20.0
	506.0	59.7	50.4	60.2	155.0	18.0
	586.0	74.4	-	74.6	141.0	24.0
	510.0	-	43.0	86.6	166.0	23.0
Mean	526.1	64.7	36.5	58.7	170.4	25.2
S.D.	42.0	22.0	26.9	28.8	52.0	3.6

Food intake of Pregnant women - Group II

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
n=19	426.1	-	-	68.9	71.4	25.0
	503.7	54.2	38.7	76.3	224.0	24.0
	529.7	51.3	43.0	55.0	159.6	23.0
	514.0	60.6	-	60.2	-	23.0
	515.6	61.4	42.4	29.6	200.0	28.0
	478.6	58.9	39.2	63.1	174.0	20.0
	571.0	75.0	-	67.0	395.0	24.5
	455.0	60.0	-	84.6	435.0	26.0
	446.0	62.0	44.6	80.4	380.0	29.0
	494.0	51.0	-	-	253.0	18.0
	460.0	60.0	30.3	68.0	270.0	24.0
	492.0	56.0	-	-	180.0	18.0
	478.0	64.0	-	52.4	240.0	17.0
	516.0	57.0	36.8	74.5	240.0	16.0
	556.0	48.4	-	96.8	300.0	19.0
	480.0	53.0	42.4	75.0	150.0	22.0
	500.0	35.0	-	68.0	200.0	17.0
	440.0	46.0	-	67.0	200.0	25.0
	394.0	33.0	14.2	84.0	216.3	26.0
Mean	486.8	51.9	17.4	61.6	225.7	22.3
S.D.	43.9	15.9	19.9	25.9	104.5	3.9

Food intake of Pregnant women - Group III

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
n=8	520.2	40.2	-	62.2	220.2	20.0
	460.1	56.3	45.0	48.3	120.3	18.0
	532.4	46.2	-	30.1	155.0	34.4
	540.6	58.0	49.5	62.2	220.6	16.6
	485.3	62.2	38.4	60.4	150.1	22.0
	537.6	64.3	-	77.4	100.0	15.0
	425.7	40.6	-	65.6	210.0	15.0
	510.0	44.6	38.2	80.3	110.0	19.0
Mean	501.4	51.5	21.4	60.8	160.7	20.0
S.D.	41.3	9.7	23.1	15.9	50.1	6.3

Food intake of Lactating

	Cereals	Pulses	GLV	Other vegeta-bles	Milk & milk products	Fats and oils
Group I	520.6	43.3	60.4	35.2	160.0	15.5
n=09	484.3	62.5	37.4	83.4	180.3	12.5
	484.0	48.2	43.2	75.7	200.6	25.0
	513.4	54.1	40.6	68.6	232.4	20.0
	531.1	44.0	30.6	64.8	253.6	36.0
	506.2	76.5	45.4	74.5	245.3	35.0
	526.5	43.4	40.8	32.4	120.8	20.0
	456.8	34.4	52.4	58.3	100.0	40.0
	525.2	36.8	-	56.4	164.7	35.0
Mean	505.3	49.2	38.9	61.0	184.2	26.5
S.D.	25.1	13.3	16.9	17.6	53.9	10.1
Group II	516.5	44.5	36.9	60.9	178.6	17.0
n=12	458.6	38.2	26.9	-	220.0	18.0
	526.7	42.6	-	81.7	220.0	16.0
	445.6	50.2	44.6	70.7	244.4	18.0
	486.3	43.6	-	73.5	330.3	17.6
	464.4	44.0	-	83.3	260.6	24.0
	546.3	54.8	38.4	64.4	220.2	22.0
	520.2	43.4	24.8	64.5	220.2	23.0
	510.0	33.2	-	63.2	195.5	22.0
	496.8	42.3	-	48.1	168.2	18.0
	478.1	39.6	33.3	64.4	220.4	17.0
	476.4	34.5	32.6	66.3	240.0	17.0
Mean	493.8	42.5	19.8	61.75	226.5	19.1
S.D.	30.7	6.0	18.2	21.6	41.9	2.8
Group III	440.6	38.6	28.6	38.0	210.7	13.0
n=6	540.0	34.0	44.0	36.3	250.0	20.0
	498.3	52.0	-	-	110.3	37.0
	420.6	40.5	30.4	60.4	78.6	13.0
	518.0	50.6	38.4	85.8	180.8	18.0
	505.0	55.2	33.4	68.6	150.0	22.0
Mean	487.0	45.1	29.1	48.1	163.4	20.5
S.D.	46.4	8.5	15.3	30.1	63.6	8.8

APPENDIX VII

Nutrient Intake of 1-3 years children - Group I

	Energy	Protein	Calcium	Iron	Vit.A
n=26	811.8	28.4	280.9	6.6	71.8
	928.6	22.2	493.5	5.6	404.0
	1284.1	37.8	302.3	4.2	270.4
	823.8	33.2	215.9	9.2	361.5
	621.1	20.6	274.8	4.4	215.2
	1023.1	22.5	456.9	7.6	396.4
	769.0	19.0	232.1	8.7	344.2
	1023.2	21.64	214.2	9.4	383.0
	1161.6	32.65	634.1	16.5	134.5
	1233.8	28.5	350.3	15.9	389.2
	959.3	30.72	216.4	6.9	394.1
	1118.0	19.32	182.8	5.0	157.8
	882.2	21.9	532.2	4.6	118.0
	943.2	23.1	357.8	4.5	179.7
	656.5	11.6	191.4	6.5	182.6
	997.9	21.1	224.5	4.8	145.1
	840.2	18.2	127.4	6.2	154.5
	1731.0	29.5	352.7	4.7	272.5
	1145.8	38.6	360.9	6.6	357.7
	1010.8	20.1	191.4	4.84	163.9
	1893.0	33.4	647.0	5.9	154.5
	859.7	22.0	583.2	6.7	223.6
	1448.8	31.8	936.0	12.5	369.4
	979.9	30.9	237.7	5.3	323.7
	1078.9	21.7	258.0	9.9	197.5
	1030.5	14.7	725.7	4.2	156.3
	1048.3	25.2	368.5	5.7	258.5
	291.8	7.01	200.9	3.2	109.3

Nutrient Intake of 1-3 years children - Group II

	Energy	Protein	Calcium	Iron	Vit.A
n=26	879.9	23.39	360.6	3.6	61.6
	1182.4	26.5	628.5	7.0	164.2
	921.4	26.0	508.3	3.7	99.8
	950.9	32.0	233.6	6.3	377.1
	797.2	15.7	209.7	3.3	128.9
	1115.6	33.4	829.8	7.9	162.3
	1056.8	29.7	414.9	5.8	141.4
	1063.1	30.2	424.0	5.9	148.4
	1038.8	29.7	507.3	3.6	93.7
	1102.1	37.9	896.4	5.7	338.6
	749.8	26.6	425.8	4.9	195.2
	951.2	26.8	578.4	3.6	211.6
	1185.4	25.6	528.8	6.3	152.1
	657.0	15.8	217.1	4.0	154.8
	1107.4	34.4	464.4	3.7	101.1
	618.2	14.9	239.7	5.5	172.5
	947.1	26.4	490.2	3.0	185.3
	1106.7	25.8	504.6	8.6	183.5
	1166.3	27.5	317.5	5.2	312.7
	1041.2	28.0	283.1	7.2	220.6
	783.0	24.0	789.0	3.9	155.0
	1976.5	28.0	895.2	4.6	220.3
	1237.7	33.7	348.7	3.8	404.6
	718.0	17.9	728.0	4.2	146.3
	913.4	25.5	467.3	3.7	296.6
	608.0	18.0	815.0	8.6	150.3
	995.2	26.3	504.1	5.1	191.5
	271.7	5.9	212.3	1.7	87.3

Nutrient Intake of 1-3 years Children - Group III

	Energy	Protein	Calcium	Iron	Vit.A
n=23	1027.9	24.4	513.3	4.0	78.3
	901.7	16.4	180.6	3.9	151.8
	849.3	20.1	73.5	4.4	78.3
	916.7	24.0	274.8	4.3	77.9
	853.6	28.7	166.0	4.9	224.7
	835.8	21.1	387.3	5.0	188.7
	898.4	47.8	190.7	6.6	334.8
	772.9	21.0	248.8	5.2	216.8
	892.3	23.0	260.3	4.5	152.7
	901.5	17.1	188.8	5.7	117.2
	1176.9	25.6	324.1	6.6	68.9
	808.0	18.9	255.4	4.8	204.8
	882.7	34.5	317.6	5.0	313.4
	1161.4	26.5	214.0	12.9	399.4
	1533.9	21.1	620.5	12.2	146.2
	1094.5	26.8	825.4	6.1	125.5
	1288.4	20.3	380.3	5.0	115.8
	1180.2	21.1	225.4	6.0	73.6
	1060.3	23.4	200.3	4.5	120.5
	1220.3	20.6	216.2	4.6	175.3
	1140.4	23.4	192.3	5.4	142.1
	920.5	24.6	186.4	4.6	121.0
	880.3	30.0	212.0	4.3	114.6
	1008.6	24.4	289.3	5.7	162.7
	188.3	6.6	166.9	2.2	87.5

APPENDIX VI

Nutrient Intake of 4-6 years children - Group I

	Energy	Protein	Calcium	Iron	Vit.A
n=30	1660.5	38.2	601.4	11.3	194.3
	1659.1	35.7	441.3	4.7	202.8
	1372.1	44.7	383.3	5.7	424.5
	1267.6	33.6	351.5	8.4	406.7
	1650.9	26.5	433.5	4.9	210.0
	1341.5	33.1	542.6	8.7	269.5
	883.3	35.8	279.4	5.1	58.4
	952.1	21.3	226.7	5.4	347.2
	1266.3	38.8	406.2	14.6	404.5
	1333.6	31.1	519.6	8.5	314.8
	1316.4	32.9	538.0	12.9	217.9
	1277.8	33.2	771.6	9.4	205.8
	856.9	28.3	241.5	7.3	175.3
	1427.8	35.5	434.3	6.0	293.2
	1111.8	26.5	331.6	4.8	73.5
	1347.7	28.3	845.9	6.6	332.9
	1319.0	36.3	425.7	6.9	184.4
	1444.6	30.9	676.6	6.5	132.6
	1534.6	36.8	627.7	7.4	118.5
	761.3	19.7	243.7	4.5	57.1
	937.8	26.8	288.1	5.9	256.6
	1215.3	27.2	316.1	12.2	326.2
	852.6	18.2	147.8	5.0	209.5
	1409.5	34.5	382.2	13.0	348.1
	1092.3	21.1	223.8	5.5	73.6
	1331.2	47.8	231.0	11.1	413.5
	1389.9	27.4	385.2	6.6	115.8
	1097.5	26.8	631.4	6.4	125.5
	1114.2	27.5	317.3	12.2	412.6
	1533.9	22.8	839.9	16.3	146.2
	1258.6	31.2	436.2	7.79	235.05
	248.2	7.1	187.8	2.9	116.9

Nutrient Intake of 4-6 years children - Group II

	Energy	Protein	Calcium	Iron	Vit.A
n=22	1035.9	22.0	376.2	4.4	211.4
	1286.7	50.8	652.3	5.5	394.8
	1690.5	50.3	481.8	3.6	171.4
	1653.5	50.8	634.0	8.1	243.5
	1218.4	29.9	420.0	5.3	313.3
	1183.1	28.2	285.2	7.3	220.6
	1262.0	30.6	208.1	6.8	236.6
	1238.4	43.6	361.7	8.8	76.3
	1260.6	27.9	348.7	3.4	128.9
	1258.7	30.3	248.4	6.6	100.0
	1537.9	32.3	506.2	6.8	176.9
	1410.0	50.3	649.3	5.8	410.6
	972.8	24.4	409.0	9.8	163.9
	1336.9	26.8	335.7	8.2	80.5
	1198.7	25.1	464.0	5.5	159.4
	1311.1	31.9	345.8	5.3	76.1
	1403.1	49.7	472.3	4.6	389.4
	1168.7	34.74	771.9	5.5	69.3
	1410.2	29.4	478.6	5.8	116.7
	1139.0	35.1	617.5	5.8	369.9
	1733.3	33.8	517.1	6.8	130.8
	1118.6	44.9	712.8	10.2	158.8
	1310.3	34.2	468.0	6.35	199.95
	200.9	8.5	153.4	1.8	110.9

Nutrient Intake of 4-6 years children - Group III

	Energy	Protein	Calcium	Iron	Vit.A
n=23	1359.7	33.2	467.2	7.6	160.4
	1181.9	34.3	500.8	5.13	255.1
	1154.2	22.3	224.1	7.3	58.7
	1064.4	45.7	198.0	7.2	448.2
	1076.11	30.3	463.6	7.6	85.6
	1002.6	23.3	221.5	6.6	162.7
	939.4	22.8	250.6	5.8	191.0
	1152.9	26.9	420.9	4.6	59.8
	1054.3	25.4	310.8	5.7	114.0
	1020.8	23.8	157.0	6.6	154.4
	1106.1	26.8	264.8	6.2	166.7
	1093.4	30.6	448.1	6.5	186.6
	947.9	17.3	90.4	8.8	88.6
	1479.4	36.3	375.4	8.4	236.3
	976.2	20.2	129.6	5.0	98.6
	1119.3	23.1	199.8	4.6	110.3
	1329.1	20.8	185.3	8.6	51.83
	1103.4	34.3	421.8	7.7	314.3
	1075.9	23.5	148.2	6.1	148.6
	961.7	23.2	122.8	6.0	133.2
	1125.4	26.7	421.9	5.7	107.2
	928.7	25.4	125.9	6.3	121.6
	1457.0	25.0	465.4	5.0	160.5
	1118.6	27.4	287.5	6.48	157.1
	154.6	6.2	137.8	1.2	90.3

Nutrient Intake of Pregnant women

	Energy	Protein	Calcium	Iron	Vit.A
Group I n=16	2692.7	61.7	414.2	7.4	354.9
	2585.2	57.2	156.4	6.3	38.7
	2661.6	60.1	430.6	11.5	630.3
	2086.8	51.4	527.2	6.2	86.7
	2686.2	74.2	301.5	7.4	92.14
	1735.4	50.4	273.7	9.8	443.0
	2699.7	45.8	355.7	18.0	245.7
	2287.9	52.9	277.6	10.8	515.7
	2697.0	87.5	377.2	8.8	326.0
	2502.4	62.6	235.9	7.7	339.7
	2802.6	66.0	630.9	7.3	453.6
	2651.1	58.2	263.3	8.1	332.7
	2341.0	54.5	462.8	18.5	274.2
	2245.9	51.7	244.2	6.1	326.6
	2756.0	63.7	413.1	11.6	68.0
	2088.7	100.4	187.1	15.7	265.8
	2470.0	62.3	346.9	9.9	299.6
	306.4	14.3	128.4	4.0	167.7
Group II n=19	1908.7	35.5	237.2	5.4	121.4
	2306.3	51.7	361.8	7.1	337.1
	1718.5	36.9	218.8	7.2	616.9
	2606.5	79.8	353.1	18.5	48.8
	2526.8	61.5	626.6	9.6	247.4
	2547.6	50.3	224.2	7.4	211.3
	2808.8	66.8	769.9	6.8	197.7
	2372.8	53.1	766.8	7.2	105.9
	2431.1	59.2	668.4	6.9	192.1
	2436.8	68.8	495.4	7.4	75.3
	2333.5	71.4	344.5	7.9	213.5
	2478.0	73.8	188.0	5.6	38.9
	2303.0	64.2	490.8	7.6	76.5
	2458.8	62.6	416.0	8.3	256.9
	2799.7	69.9	608.2	17.3	128.5
	2337.1	79.2	651.8	10.3	353.5
	2317.4	60.7	298.9	7.5	50.2
	2136.6	51.2	386.4	8.6	82.6
	1957.4	19.2	442.5	6.5	342.5
	2357.1	58.7	398.8	8.2	194.5
	277.8	15.6	180.2	2.6	144.8
Group III n=8	2256.6	56.8	266.0	10.3	142.4
	2241.1	72.3	289.5	11.4	231.7
	2479.8	56.0	236.8	11.0	215.6
	2414.3	56.2	353.4	6.0	580.0
	2271.1	61.4	571.2	12.2	193.9
	2255.1	65.9	394.7	7.9	250.9
	1984.5	42.5	171.7	5.4	60.6
	1470.8	29.0	179.0	3.7	47.0
	2171.6	55.0	345.2	8.4	215.2
	318.2	13.6	200.9	3.1	165.8

Nutrient Intake of Lactating women

	Energy	Protein	Calcium	Iron	Vit.A
Group I n=9	2155.1	46.6	200.9	12.3	275.3
	2547.8	51.8	244.6	6.5	219.7
	2195.5	47.8	426.5	8.2	185.4
	2216.3	47.9	538.3	8.0	238.9
	2544.2	53.5	312.3	8.8	159.0
	2486.8	52.8	436.2	7.8	232.0
	2492.8	64.1	444.8	9.5	363.5
	2413.7	46.5	245.5	6.3	177.7
	2381.7	52.0	347.7	8.4	230.2
	154.8	5.8	116.3	1.8	61.2
Group II n=12	2478.5	59.1	492.5	6.4	139.8
	2147.0	45.3	346.2	5.8	190.3
	2313.7	53.6	191.4	6.1	161.8
	2175.9	49.3	563.9	6.3	281.3
	2433.8	60.6	533.2	7.0	156.8
	2366.9	76.7	405.6	5.8	120.4
	2565.5	54.3	509.7	7.5	329.5
	2732.4	42.6	561.0	9.7	192.5
	2352.1	53.0	234.6	5.9	110.6
	2366.7	58.2	423.4	6.4	130.5
	2188.6	55.2	448.4	6.9	290.2
	2257.4	45.5	365.8	6.6	146.4
	2364.8	54.4	414.6	6.7	187.5
	170.9	9.05	116.6	1.1	73.1
Group III n=6	2140.4	43.3	221.8	6.2	196.8
	2399.6	56.3	456.5	8.1	320.0
	2451.9	38.4	119.2	5.4	122.2
	1894.7	43.6	296.3	5.6	235.0
	2520.7	64.3	373.2	7.9	265.0
	2859.3	67.8	325.5	8.9	198.6
	2377.7	52.3	382.0	7.0	222.9
	331.0	12.2	280.2	1.5	67.5

APPENDIX VIII

SERUM VITAMIN A AND HAEMOGLOBIN LEVELS OF PRE-SCHOOL CHILDREN

Age (1-3 yrs)	Serum vitamin A (ug/dl)			Haemoglobin (g/100ml)		
	Group I (n=26)	Group II (n=26)	Group III (n=23)	Group I (n=26)	Group II (n=26)	Group III (n=23)
	19.94	20.59	18.08	9.1	11.4	7.4
	28.89	26.72	13.3	12.3	12.5	9.7
	50.94	18.2	11.2	13.7	8.1	8.6
	26.25	18.6	20.8	10.3	8.6	7.4
	20.6	17.3	25.05	11.4	8.5	12.2
	26.8	25.8	14.42	12.6	13.6	8.3
	38.2	18.47	28.6	12.0	11.1	11.0
	33.5	20.2	13.46	12.9	8.3	11.0
	22.89	21.6	14.32	10.3	8.5	8.4
	18.55	28.71	13.6	11.9	12.8	7.3
	34.76	21.84	17.45	13.6	8.5	11.2
	12.11	20.82	12.8	12.1	11.1	8.5
	20.75	23.4	28.66	9.6	10.3	13.4
	31.37	13.3	32.21	11.4	14.2	12.2
	15.86	14.6	14.8	9.7	8.5	10.3
	17.22	21.88	15.86	12.3	10.8	8.3
	25.08	21.2	22.4	13.0	11.1	8.0
	27.39	19.95	16.4	11.4	12.2	8.5
	47.72	25.8	13.6	13.7	10.5	7.5
	25.04	20.44	21.3	11.7	8.9	10.5
	34.0	17.83	16.4	14.3	11.4	7.2
	18.58	20.8	15.9	10.4	9.3	10.0
	48.94	34.1	23.3	13.7	14.2	10.1
	36.7	19.12		8.3	11.4	
	26.2	19.61		10.3	10.8	
	20.3	17.63		8.30	9.7	
ean	28.02+	21.09	18.4	11.55	10.62	9.43
.D.	10.26	4.38	5.82	1.71	1.86	1.80

APPENDIX VIII

SERUM VITAMIN A AND HAEMOGLOBIN LEVELS OF PRE-SCHOOL CHILDREN

Age (4-6 yrs)	Serum vitamin A (ug/dl)			Haemoglobin (g/100ml)		
	Group I (n=26)	Group II (n=26)	Group III (n=23)	Group I (n=26)	Group II (n=26)	Group III (n=23)
	25.86	17.07	17.12	10.8	6.0	7.2
	27.86	41.9	14.04	10.3	14.8	7.9
	50.0	19.03	12.36	14.0	7.9	9.6
	18.24	20.66	32.33	11.4	11.4	12.6
	15.81	34.8	18.3	10.3	14.8	5.8
	16.86	14.07	19.12	13.05	7.9	6.5
	25.77	34.02	20.65	13.12	8.5	11.1
	20.18	40.34	12.36	11.1	15.0	8.5
	35.88	20.19	18.23	14.2	13.4	10.2
	31.89	25.07	14.61	12.8	7.1	7.7
	24.58	28.29	16.62	13.9	11.1	10.6
	18.55	47.47	20.8	10.5	13.2	9.8
	23.4	17.21	20.62	13.16	8.3	12.3
	26.17	22.14	22.38	13.1	7.8	13.2
	17.21	12.36	11.26	7.8	12.8	8.8
	28.9	15.86	10.53	13.4	10.6	11.0
	27.26	40.34	15.06	12.3	12.2	7.6
	20.35	28.9	25.57	13.6	12.5	12.8
	20.08	16.06	13.3	13.5	10.3	8.0
	26.08	40.66	21.08	14.5	12.0	9.2
	17.73	19.95	17.01	13.9	10.2	10.7
	28.8	20.82	15.52	14.2	8.4	6.0
	27.66		19.61	11.1		10.1
	35.76			13.9		
	19.9			12.2		
	55.4			14.1		
	24.6			9.6		
	20.18			8.7		
	22.18			7.8		
	31.38			11.2		

APPENDIX - X

Haemoglobin levels of pregnant and lactating women

	Haemoglobin levels (g/100 ml)					
	Pregnant women			Lactating women		
	I (n=16)	II (n=19)	III (n=8)	I (n=9)	II (n=12)	III (n=6)
	7.85	8.0	7.62	12.2	8.8	8.0
	9.85	8.36	7.75	12.4	10.4	8.5
	7.25	9.50	7.8	11.8	10.3	7.85
	8.25	10.2	8.2	9.85	11.5	8.22
	9.25	7.62	8.0	14.50	9.6	9.7
	10.00	8.5	9.3	10.85	7.8	10.3
	9.75	9.62	10.3	11.6	8.0	
	8.55	11.4	12.4	12.5	11.8	
	11.20	10.25		9.6	12.2	
	8.50	9.8			10.3	
	12.30	8.8			9.6	
	13.60	8.75			10.2	
	11.30	7.82				
	9.75	8.62				
	8.25	9.75				
	8.00	9.00				
		8.65				
		8.00				
		7.56				
Mean	9.60	8.95	8.9	11.7	10.0	8.8
SD±	1.8	1.0	1.7	1.5	1.4	1.0

APPENDIX X I

Heights and weights of 1-3 years children

Age group	Height (cm)			Weight (kg)		
	I (n=66)	II (n=47)	III (n=45)	I (n=66)	II (n=47)	III (n=45)
1-3 years	63.0	65.0	76.5	10.2	8.0	12.0
	64.0	75.0	80.5	10.2	8.6	12.2
	90.0	80.6	80.9	10.0	11.0	10.2
	90.0	90.0	96.4	9.0	11.4	8.5
	80.0	85.0	78.0	10.0	9.0	8.1
	90.0	86.0	70.3	11.0	11.3	9.6
	82.0	83.4	68.6	11.2	12.0	11.6
	92.0	90.0	78.4	12.0	10.5	10.5
	90.0	92.5	82.0	11.0	11.0	11.5
	94.0	85.5	91.5	10.0	10.5	9.5
	84.0	86.0	70.9	10.6	11.5	12.0
	83.4	96.0	87.0	12.0	13.3	9.5
	86.5	96.0	80.5	11.5	11.2	10.4
	85.0	80.6	96.0	11.0	11.0	12.0
	95.0	94.0	80.7	12.0	12.0	8.4
	90.0	84.0	86.5	10.0	12.4	10.0
	90.2	93.0	88.2	12.0	11.3	11.5
	80.7	95.0	90.6	11.3	13.5	13.5
	80.2	92.0	104.4	12.0	13.0	13.3
	80.2	90.2	78.6	12.0	12.0	9.5
	80.2	92.0	100.3	13.0	12.0	13.0
	93.0	71.0	84.5	10.4	8.3	11.0
	92.0	94.0	90.5	11.5	9.0	11.4
	80.0	61.0	105.0	12.0	7.5	10.3
	95.0	70.7	90.4	12.5	6.0	9.6
	89.0	82.0	84.2	13.0	10.0	10.0
	88.0	85.0	87.0	12.5	11.4	10.0
	91.0	86.0	88.6	13.5	11.0	12.0
	97.0	85.0	94.6	11.0	10.0	12.5
	80.3	85.0	85.4	10.3	11.0	9.3
	98.0	80.5	96.4	13.5	10.4	10.0
	99.0	90.0	95.4	13.0	12.2	12.5
	94.0	98.0	94.0	13.0	12.0	9.2
	60.0	92.0	82.0	8.5	11.0	10.5
	62.0	91.0	91.4	8.3	14.0	12.0
	86.0	82.0	95.0	11.0	10.2	8.6
	81.5	84.0	89.0	11.0	11.5	11.2

Contd..

Age group	Height (cm)			Weight (kg)		
	I (n=66)	II (n=47)	III (n=45)	I (n=66)	II (n=47)	III (n=45)
	80.0	85.0	84.0	9.3	12.0	9.5
	83.4	90.0	82.0	12.0	10.0	10.5
	80.6	87.5	92.0	10.7	11.5	9.4
	85.0	83.5	88.4	10.5	10.5	11.0
	90.0	85.5	80.0	10.5	12.5	9.5
	85.0	90.0	85.5	11.0	12.0	11.4
	79.5	90.0	86.4	9.5	13.0	8.5
	80.2	93.0		10.2	11.0	12.3
	80.5	80.0		9.0	11.0	
	82.5	98.0		11.0	10.5	
	90.0			13.0		
	96.0			12.5		
	70.9			11.0		
	90.2			11.3		
	94.0			12.0		
	90.0			14.0		
	92.0			10.0		
	84.0			10.0		
	83.0			10.5		
	90.0			13.5		
	88.0			12.5		
	95.0			16.0		
	90.6			12.3		
	80.7			9.4		
	80.9			9.4		
	92.0			13.0		
	93.0			11.5		
	80.9			11.3		
	91.0			10.0		
Mean	85.68	85.65	86.9	11.3	10.9	10.6
S.D.	8.4	8.5	8.2	1.4	1.6	1.4

Heights and weights of 4-6 years children

Age group	Height (cm) I (n=134)	Height (cm) II (n=108)	Height (cm) III (n=60)	Weight (kg) I (n=134)	Weight (kg) II (n=108)	Weight (kg) III (n=60)
4-6 years	90.5	90.4	89.5	14.3	12.0	12.0
	90.1	90.1	86.4	13.2	12.0	14.0
	90.6	80.9	91.0	13.3	12.0	13.5
	106.0	80.9	105.0	14.0	12.3	19.5
	100.0	90.0	103.0	15.0	13.0	18.0
	80.0	100.0	79.0	12.0	12.0	10.5
	90.0	90.0	72.0	15.0	13.0	8.2
	98.0	101.5	73.0	13.0	14.5	9.3
	104.0	80.6	90.5	16.5	12.3	13.5
	100.0	97.0	89.4	14.3	13.5	12.5
	90.1	95.0	99.0	13.4	13.0	13.0
	90.4	104.0	91.5	13.0	14.0	12.0
	80.7	90.0	105.0	16.0	12.0	13.5
	80.0	102.0	100.8	14.5	13.0	13.1
	105.0	104.0	98.2	13.0	12.0	12.0
	106.0	90.1	104.0	14.0	13.4	12.5
	102.0	110.0	100.2	13.2	13.0	14.0
	92.0	101.5	90.8	14.3	15.5	15.0
	90.0	91.5	102.3	12.5	15.0	15.0
	80.8	80.4	98.6	14.0	12.0	16.0
	90.0	94.0	96.0	16.0	12.5	12.0
	106.0	90.7	93.5	13.0	12.4	11.4
	105.0	100.1	94.0	12.6	15.2	12.0
	97.0	90.7	98.0	12.5	16.4	10.4
	110.5	100.0	96.4	18.3	15.0	10.6
	110.0	100.6	100.0	16.0	15.0	12.0
	90.4	110.0	100.8	12.3	15.0	13.1
	100.0	100.8	87.0	14.1	16.1	12.0
	90.9	100.0	95.6	14.2	15.0	12.5
	90.8	90.7	104.6	12.6	14.4	11.6
	90.9	72.0	106.6	13.2	11.5	13.6
	100.0	98.0	105.0	14.0	13.5	11.6
	100.0	101.0	90.5	13.0	13.0	10.4
	83.0	100.0	110.5	16.0	13.5	16.4
	85.0	100.0	100.2	12.0	12.0	10.2
	112.0	100.0	94.9	19.2	12.0	13.6
	102.0	100.4	101.0	18.0	15.0	12.2
	105.5	100.0	100.5	14.5	13.0	13.2
	106.0	90.0	88.7	17.5	13.0	10.0

Contd..

Age group	Height (cm) I (n=134)	Height (cm) II (n=108)	Height (cm) III (n=60)	Weight (kg) I (n=134)	Weight (kg) II (n=108)	Weight (kg) III (n=60)
	100.9	100.0	104.6	17.2	16.0	13.6
	100.3	103.0	106.4	16.2	14.0	14.0
	110.0	105.0	96.5	16.0	15.0	14.2
	90.0	101.0	100.0	13.0	14.5	13.0
	104.0	110.0	89.7	12.9	13.0	12.0
	90.6	100.0	98.4	13.0	16.0	8.3
	100.4	103.0	95.4	17.0	14.0	12.4
	110.0	105.0	96.8	14.0	15.0	12.4
	120.0	101.0	110.6	15.0	14.5	11.4
	110.0	110.0	96.2	13.0	13.0	10.6
	100.0	100.0	112.6	14.0	14.0	15.6
	105.0	100.0	96.0	17.5	12.4	12.5
	95.0	80.0	90.6	14.5	14.0	12.3
	97.0	100.0	92.0	15.5	17.0	12.4
	110.0	100.6	94.0	14.0	17.0	13.2
	108.0	110.9	97.3	19.0	14.0	12.0
	100.3	100.9	86.5	13.6	16.3	12.1
	106.0	100.4	100.6	12.5	14.4	13.0
	100.4	100.0	98.6	13.4	14.0	16.0
	100.3	107.0	100.5	13.0	20.0	11.4
	100.7	102.0	100.0	14.0	15.5	13.0
	100.9	101.5		12.7	16.5	
	110.7	103.0		14.0	17.0	
	100.9	102.5		12.7	16.2	
	110.7	111.0		14.6	13.0	
	99.0	100.0		15.0	13.0	
	100.2	80.8		13.0	11.2	
	90.8	100.0		14.3	15.0	
	120.3	80.8		13.6	11.2	
	100.0	100.0		12.0	16.2	
	90.2	100.0		11.2	14.0	
	90.7	86.0		15.0	14.0	
	90.2	80.0		11.6	10.0	
	90.6	105.0		14.3	13.0	
	102.0	87.0		13.0	14.0	
	95.0	84.0		14.2	12.5	
	90.0	107.0		11.5	13.5	
	100.0	90.1		15.0	13.1	
	106.0	98.5		13.0	12.5	

Contd..

Age group	Height (cm) I (n=134)	Height (cm) II (n=108)	Height (cm) III (n=60)	Weight (kg) I (n=134)	Weight (kg) II (n=108)	Weight (kg) III (n=60)
	96.0	100.2		13.5	14.4	
	84.0	90.9		14.0	13.3	
	86.0	100.0		16.0	14.0	
	94.0	100.1		12.2	15.0	
	102.5	100.0		15.0	14.8	
	80.7	100.6		13.4	14.6	
	90.0	110.0		13.0	16.3	
	100.0	100.0		14.0	12.0	
	105.0	90.0		13.0	14.5	
	95.0	100.1		11.5	15.0	
	90.5	90.3		14.0	12.2	
	90.5	100.8		13.2	16.2	
	100.4	70.0		16.0	11.0	
	90.8	90.0		14.0	12.0	
	100.2	110.0		14.4	14.0	
	90.1	100.0		12.5	16.0	
	100.7	100.0		15.4	12.0	
	90.9	90.9		15.0	13.4	
	100.3	100.4		13.4	13.4	
	90.4	110.0		14.4	14.0	
	100.5	110.0		12.0	14.2	
	110.0	100.0		14.0	13.0	
	109.0	100.0		13.2	13.0	
	110.0	110.0		13.0	14.0	
	100.0	92.0		15.0	13.5	
	98.0	90.3		13.5	12.4	
	99.5	80.0		17.5	14.5	
	90.5	110.2		14.0	18.0	
	92.5	100.2		14.5	16.0	
	90.9	100.4		14.0	15.0	
	90.1	100.9		12.1	17.0	
	90.7	111.0		15.0	15.0	
	100.8	110.0		14.0	16.0	
	110.0	100.5		15.0	15.3	
	90.0	100.5		13.6	13.4	
	90.4			14.0		
	90.8			12.4		
	110.0			15.0		
	110.0			13.4		
	100.0			12.5		

Contd..

Age group	Height (cm)			Weight (kg)		
	I (n=134)	II (n=108)	III (n=60)	I (n=134)	II (n=108)	III (n=60)
	90.0			13.0		
	90.0			16.0		
	78.0			14.0		
	86.0			14.5		
	110.0			15.0		
	110.7			17.0		
	110.7			16.6		
	100.2			14.3		
	100.4			16.3		
	100.9			19.4		
	90.6			13.4		
	99.0			15.5		
	100.9			15.2		
	110.0			16.0		
	110.6			18.3		
	110.3			18.2		
	120.3			22.1		
	100.4			17.1		
Mean	98.2	97.0	96.6	14.4	13.9	12.6
S.D.	8.9	9.6	7.9	1.8	1.7	1.2

Heights and Weights of pregnant women

	Height (cm)			Weight (kg)		
	I (n=16)	II (n=19)	III (n=8)	I (n=16)	II (n=19)	III (n=8)
Pregnant women	160.0	159.0	153.0	50.0	48.3	48.0
	162.2	160.0	160.0	49.0	55.0	48.2
	150.3	161.1	151.0	45.0	50.2	47.3
	161.5	156.8	148.2	48.2	41.4	43.4
	163.0	148.5	144.6	52.0	46.5	44.4
	154.0	148.0	152.1	48.0	49.5	49.6
	156.0	150.0	156.2	35.0	48.0	50.2
	149.3	154.0	149.1	43.3	49.5	42.3
	154.0	160.5		50.2	51.0	
	160.3	156.8		52.0	41.4	
	150.0	159.8		53.2	48.0	
	148.5	156.2		37.0	50.0	
	160.0	150.0		53.1	48.0	
	154.0	158.0		49.2	53.0	
	162.0	158.5		54.2	33.4	
	158.5	157.5		46.5	47.5	
		142.0			46.0	
		140.5			35.0	
		165.8			58.5	
Mean	156.5	154.8	151.7	47.9	47.3	46.7
SD+	5.0	6.7	4.8	5.5	6.1	2.9

Heights and Weights of lactating women

	Height (cm)			Weight (kg)		
	I (n=9)	II (n=12)	III (n=6)	I (n=9)	II (n=12)	III (n=6)
Lactating women	160.3	150.0	162.3	50.0	55.0	46.0
	149.1	150.0	154.3	45.2	46.0	36.0
	148.3	142.5	148.4	48.0	35.0	41.2
	152.0	158.5	156.8	50.0	46.5	38.0
	160.2	140.0	148.0	51.6	40.1	56.4
	156.4	160.2	160.1	46.4	40.5	54.2
	160.3	163.8		41.3	58.5	
	166.4	167.0		50.3	54.3	
	155.4	145.6		53.1	50.1	
		150.3			48.0	
		164.3			55.6	
Mean	156.5	153.6	154.9	48.4	48.0	45.3
SD+	5.9	8.9	5.9	3.6	7.1	8.4