An Evaluation of the Recommended Dietary Allowances by ICMR (1981) for men doing Moderate and Heavy Work

BY

S. Thilakavathi

A DISSERTATION SUBMITTED TO THE BHARATHIARUNIVERSITY, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE THROUGH SRI AVINASHILINGAM HOME SCIENCE AUTONOMOUS COLLEGE FOR WOMEN, COIMBATORE

MAY - 1986

Acknowledgement

ACKNOWLEDGEMENT

The investigator places on record her heartful thanks to Dr. (Mrs.)S. Premakumari, M.Sc., M.Phil., Ph.D., Dip.Ed (Madras) Professor of foods and Nutrition, Sri Avinashilingam Home Science College for women (Autonomous), Coimbatore for her dynamic guidance, untiring patience, constructive suggestions rendered throughout the study.

She expresses her deep sentiments of gratitude to Mrs. C. Yegamani, M.Sc., M.Phil., Assistant Professor, Department of Foods and Nutrition, Sri Avinashilingam Home Science College for Women, Coimbatore for her continuous help, meticulous guidance, valuable advice and interest in this study.

The author is extremely grateful to Dr. (Mrs.) Lakshmi Shantha Rajagopal, M.S.(Tennessee) Ph.D.(Madras) Principal, Sri Avinashilingam Home Science College for Women, Coimbatore for making available all the amenities to carry out this study.

The author is highly obliged with a deep sense of gratitude to Dr. (Mrs.) Usha Chandrasekhar, M.Sc.,Ph.D.(Purdue), Head of the Department of foods and nutrition, for her valuable advice and interest shown in the conduct of this study.

The investigator expresses her sincere thanks to the Cheran Transport Corporation authorities, Coimbatore for their immense help. The investigator in greatly acknowledged for the esteemed co-operation of the participants in the study.

LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Introduction

I. INTRODUCTION

Nations talk about what they lack

America about peace

Germany about History

Russia about freedom

France about Glory

And India about food-Reston

Throughout the three or four millions years that man has been on the earth, his principal concern has been the quest for daily food. It does not matter whether man eats to live or lives to eat but the fact remains that food is basic to our existence. Man can live in happiness without many earthly possessions but not without good health. And in the promotion and maintenance of health, the food has a vital role to play (Sahani and Bhatt 1982).

The health and happiness are the outcomes of good nutrition. Therefore good nutrition, throughout the lifespan is of paramount importance in fostering the physical, mental, emotional and social growth of the population (Devadas, 1980).

Foods supply the body with energy in the form of carbohydrate, fat, protein, vitamins and minerals all of which are needed for growth and for the maintenance of the different cells and tissues (Devadas and Easwaran, 1975).

The needs for different nutrients must be defined scientifically with due regard to vigorous growth, health and longevity requirements. So that the individual can get what the body needs. The nutrients are needed in different quantities by different age groups for the proper functioning of the human body (Devadas, 1983).

An adequate diet or a 'balanced diet' is one which provided all the essentiall nutrients in sufficient quantities and proper proportions to meet the needs of the body. Thus a 'balanced diet' is one which is balanced in quantity and quality, catering to the requirements of growth, development and maintenance of health and regulation of the body functions, (Devadas and Easwaran, 1975) Gopalan, (1982) states that how much an individual benefits by eating depends not only upon the amount he eats but also on the quality of food and how it is prepared and served. The

balanced meal includes atleast one item from the group of cereals, pulse, fruits and vegetables, milk and milk products, egg and non-vegetarian foods and fats and oils (Horode, 1981).

Dietary standards are derived from compilations of experimental studies designed to determine the nutrient requirements of the human. The first organised attempt at developing a dietary standard came as a result of food shortages during world war I. With the limited knowledge at that time of nutrition in general and of human nutrient needs in particular, recommendations could be made only for energy and protein. In 1933, the British Medical Association proposed a limited set of recommendations for energy value, protein, calcium, iron, phosphorus, vitamin A and vitamin C.

Dietary allowances officially came into being in May 1941 at the National Nutrition conference which met in Washington at the call of President Franklin D. Roosevelt. (Roberts, 1958). The Recommended Dietary Allowances of the Food and Nutrition Board was accepted generally as dietary standards. The Recommended Dietary Allowances are the levels of intake

of essential nutrients considered in the judgement of the Committee of Dietary Allowances of the Food and Nutrition Board on the basis of available scientific knowledge to be adequate to meet the know nutritional needs of practically all healthy persons (Harper, 1980).

Based on the research work carried out in various parts of India the nutrient as well as food requirements of the different segments of the population namely children, women, man and other groups are recommended by the Nutrition Expert Group of the Indian Council of Medical Research (Gopalan et.al, 1971).

In recent years the standard of health and nutrition of the entire nation as well as individual segments of the population has attracted increasing attention and interest of the government and other professional bodies. The importance of adequate nutrition for maintaining good health and normal physical efficiency among the industrial workers was realised during the second world war by the Western Nations (Swaminathan, 1967).

The total number of industrial workers in India is estimated to be about 10 millions. But with the present

tempo of industrialization, this number will increase rapidly in the years to come. As the industrial workers are mostely drawn from the poorer section of the population, their dietary and nutritional status naturally reflects the nutritional status of the population, from which they are drawn (Report of the Sub-Committee of the National Nutrition Advisory Committee, 1965). Industrial workers constitute a vital segment in view of their significant contribution to the national income (Randasmurthy et.al, 1983). Provision of lunches for workers at the work spot increased to a marked extent the output of work in the country.

Manual work, light or heavy, calls for an additional supply of energy and other materials. A low food intake reduces the physical capacity to work and increases the extent of fatique, accident rate, sickness and absenteesm (Nirmala and Usha, 1985). Hence it is very imperative that the Recommended Dietary Allowances (RDA) for these workers are constantly evaluated and revised. The present study in an effort in that direction.

In this investig tion, the adequacy of the recommended food and nutrient allowances for the industrial workers were tested. To evaluate means to appraise carefully, that is to judge, measure or estimate with care, the value, goodness or position of something.

The present investigation was carried out on moderate and heavy workers with the following objectives:

1) To plan diets based on the ICMR recommended food allowances for men doing moderate and heavy work.

2) To prepare the diets and test their adequacy through feeding.

3) To calculate the nutrient content of the planned diets and compare with the recommended nutrient allowances of the ICMR.

4) To suggest modifications (if any) in the recommended allowances based on the findings of this investigation, and

5) To study the existing situations of the dietary pattern and give suggestions for improvement for workers canteen, for better working efficiency.

Review of Literature

II - REVIEW OF LITERATURE

The literature pertaining to the present investigation entitled "An evaluation of Recommended Dietary Allowance by ICMR (1981) for men doing heavy and moderate work" is presented under the following heads:

A. Balanced diets and good nutrition

B. Planning balanced diets

C. Role of different foods in human nutrition

D. Recommended Dietary Allowances and

E. Nutritional requirements of manual workers.

A. BALANCED DIETS AND GOOD NUTRITION:

Devadas, (1983) states that two factors which influence the health of a person are:

(1) The internal factors which include the thoughts, imagination, feelings and emotional status and

(2) External factors which include food, clothing, shelter, economic and environmental conditions. Among the external factors which affect human health, food plays a prominent role.

Food is basic to health, and proper nutrition is the

foundation for the development and maintenance of physical, mental and moral fitness. Fitness here means positive health, the maximum capacity for and efficiency in work, ability in mental and physical tasks and the power to withstand physical, physiological and psychological stresses (Devadas and Krishnamurthy, 1968 and Devadas 1984).

The growth, development, health and survival of the young human organism requires adequate nutrition (Krishnamurthy and Subbulakshmi, 1976 Ghosh and Manmohan, 1978). Gravioto (1976) states that diet adequate in quality and quantity is a relevant factor in the life of man and perhaps the most ubiquitous factor affecting growth, health and development.

Food is not just eaten to satisfy hunger but also to provide the nutrients necessary for growth and maintenance (Patel, 1972 and Clarence, 1974). Banik (1977) states that the importance of balanced food in ensuring positive health and the extent to which malnutrition effects the national health need to be brought known to the community.

Food behaviour can be influenced by all the fields of activity in a given society including technical, economic, social and religious. Emotional and irrational factors also

effect food behaviour (Puri et.al, 1983). The concept that not only the quantity of food but the quality of food nourishes the body gave rise to the idea of "balanced diet" (Jyotila, 1978).

A balanced diet can be formulated by providing sufficient amounts of all the foods from the different food groups namely cereals, pulses, green leafy vegetables, other vegetables, roots and tubers, milk, fruits, oil and fat and sugar and jaggery in order to provide all the nutrients in the amounts prescribed for a day. These foods may vary from region to region depending on the food habits of the people (Clarence 1974; English, 1982, and Thimmayamma, 1983). Good nutrition means a good health and sound manpower forms the base for the national development (Parmajit et.al, 1983).

A 'balanced diet' is one which contains different types of foods in such quantities and proportions that the need for calories, minerals, vitamins and other nutrients is adequately met and a small provision is made for extra nutrients to withstand short durations of leanness (Sahani and Bhatt, 1982 and Gopalan et.al, 1984).

B. PLANNING OF BALANCED DIETS:

Planning the daily allowances of foods in terms of meals and distributing the different foods among the meals taken during the day are very important in the formulation of balanced diets (Devadas and Easwaran, 1975). A normal diet should confirm to the following basic creteria; (1) It should supply all essential nutrients in adequate amounts (2) It should supply a physiologic quantity and bulk and fluids in each meal and should be easily digestible and confer a feeling of satiety. (3) It should be readily available from the stand point of both supply and cost. (4) It should live upto the satisfactory expectations of the prospective consumer (Aykroyd, 1963 and Burton, 1976).

In dealing with diet it is well to remember the distinction between an optimum and an adequate diet. An optimum diet is one which ensures the functioning of the various life processes at their very best, whereas an adequate diet maintains these process but not at their peak levels.

Menus were first heard of as being adopted for table use in 1541, at a banquet given by Duke Henry of Brunswick.

According to Philips (1981) menu planning is the term used to denote the planning in advance of a dietary pattern for a given period of time. Menu planning is an art and menus are compiled rather than written and they present not only the picuture of a truly balanced appetizing meal but also the complete operation of changing raw materials into cooked and served delicacies.

Medved (1973) enlists factors affecting menu planning as the knowledge of the daily nutritional requirements, time, money and energy available, size of the family, age and sex of the members, their activity, customs, seasons, food preferences and attractiveness of the meal. Knowledge and skill in food preparation and the equipment which is available will limit the menu planning. The first important factor to be considered while planning is the nutritional adequacy of the diet.

Devadas and Easwaran (1975) explain that age is an relevant factor to be considered since appetite, taste, growth needs, amount of exercise and food tolerance differ according to age.

Breakfast is the first meal of the day and it breaks the fast of the long night. It should supply from one-fourth

to one-third of the total daily nutrients and calories. Lunch should supply one third of the nutrient needs and it should not be so heavy that it interferes with the activity of the rest of the day. The dinner should be planned first which makes it easier to include the foods in breakfast and lunch that will complete the daily nutrient needs (Medved, 1973).

C. ROLE OF DIFFERENT FOODS IN HUMAN NUTRITION:

Nagarajan (1983) views that a low food intake reduces the physical capacity to work and increases the extent of fatigue, accident rate, sickness and absence. In order to improve the working efficiency and output of the workers, adequate diets not only in calories but also protein, minerals and vitamins must be made available (Nirmala and Mehta, 1985).

The different constituents of foods are carbohydrates, proteins, fats, minerals and vitamins. These are divided into:

(1) Body warmers and workers: These elements form the bulk of the food and are obtained from carbohydrates and fats.
(2) Body builders: These are proteins and some of the minerals.
(3) Body protectors: These are vitamins, minerals and proteins (Philips, 1981).

Inorder to obtain adequate amounts of each of the

different nutrients, our daily diets should include appropriate quantities of a variety of different food stuffs as described below.

CEREALS:

Cereals contain approximately 75 per cent carbohychates, 10 per cent protein, 1 to 2 per cent fat, 10 per cent moisture and 1 to 2 per cent ash (Charley, 1982). Rice, wheat and millets (Jowar, Bajra, Ragi etc) are the main cereal grains consumed in India. They are the cheapest sources of calories and they contribute as much as 70 to 80 per cent of the calories in the diets of a majority of population in India, (Gopalan et.al, 1984).

The main carbohydrate in cereals is starch. Cereals are deficient in the essential aminoacid lysine and low in tryptophan and methionine (Charley, 1982). All cereals except ragi are poor to moderate sources of calcium. Cereals are deficient in vitamins A, D, B_{12} and C (Swaminathan, 1981). Yellow maize is the only cereal containing significant amounts of carotene. Whole cereal grains also contain useful amounts of water soluble B group of vitamins (Davidson and Passmore, 1975).

PULSES:

Most pulses contain about 20 gm of protein / 100 gm dry weight. A combination of pulse and cereal proteins may have a nutritive value as good as animal proteins. Pulses have been described as the 'poor man's meat' (Davidson and Passmore, 1975). Studies have shown that the polyphenolic compounds such as tannins which interfere in the absorption of iron are mostly located in the seed coat of pulses. Bioavailability of pulses was found to be about two to four folds higher in the dhal when compared with whole grains (NIN, 1984).

The amount of pulses included in the habitual diets are low, but because of their high protein content, they make fair contributions to the total dietary protein ingested. Pulses are rich sources of lysine and this compensates for the low lysinge contents of cereals, along with which they are usually eaten (NIN, 1974). Pulses as a class are good sources of the B group of vitamins (except riboflavin). Puffed pulses (eg) puffed Bengal gram and peas are consumed commonly as a snack by the low income groups in India. Tender pulses (eg) green Bengal gram, green peas, green field beans

etc., contain fair amounts of vitamin C (Swaminathan, 1981).

GREEN LEAFY VEGETABLES:

Green leafy vegetables are very rich in carotene. They are good sources of calcium, riboflavin, folic acid and vitamin C. They are the cheapest among the protective foods (Swaminathan, 1981). The inclusion of small quantities of green leafy vegetables in the current Indian dietaries can make a significant impact in the nutritional status of the populations (Rao et.al, 1980). Leafy vegetables contain an attractive natural pigment chlorophyll which adds to the colour appeal of the food (Nagarajan, 1983). Bioavailability of calcium from green leaves indicated that it was indeed very poor. Also, availability of calcium from a source like milk, which is known to be good, was adversely affected by the simultaneous consumption of green leafy vegetables (ICMR, 1976).

ROOTS AND TUBERS:

Root vegetables are rich in carbohydrates and hence they yield mainly energy. Foods like carrots and yellow varieties of yam are also rich in carotene, and potato contains significant amounts of vitamin C (Gopalan et.al, 1984). Potatoes yield more food energy and more protein. Like fruits, vegetables are characterised by a low concentration of fat

and by a high moisture content (Charley, 1982).

OTHER VEGETABLES:

These vegetables are those which do not fall under the category of leafy and root vegetables. Vegetables show a greater range in carbohydrate, vitamin and mineral content than those of fruits. They are rich in iron, thiamine, riboflavin, ascorbic acid and carotene. The calcium in spinach and other plants of this family is unavailable because the oxalic acid present binds the calcium in an insoluble form (Charley, 1982). The percapita annual consumption of vegetables in India is 18.5 Kg (Devadas and Krishnamurthy, 1968).

FRUITS:

Fruits are valued for their attractive colour, for their pleasing aroma mainly due to aldehyde alcohols and others, for their sweet tart taste, for their crisp, crunchy texture from water inflated cells and for the nutrients they contribute to the diet. Indian gooseberry (Amla) and guava are very rich in vitamin, C. They are also the cheapest among the fruits (Swaminathan, 1981). If green leafy vegetables are included in the diet in adequate amounts, the need for fruit as an

essential item in the diet is much reduced (Gopalan et.al. 1984). The percapita annual consumption in India is 11.9 Kg. of fruits (Devadas and Krishnamurthy, 1968). India produces annually about 32 million tonnes of fruits and vegetables. Considering the population of India, which is about 700 million, the production of fruits and vegetables is highly inadequate to meet the nutritional requirements of all the people (Shetty and Patwaradan, 1981).

MILK AND MILK PRODUCTS:

Milk protein contains adequate amounts of those amino acids which cereal proteins lack and so the presence of milk in a vegetarian diet improves the overall nutritional quality of the diet (Bhattacharaya, 1982). It is somewhat deficient in iron and vitamin C and D (Aykroyd et.al. 1963). The sugar present in milk is called lactose which is found only in milk. Milk has a high percentage of water and a good source of high quality protein. The minimum fat content of whole milk varies from 3.0 to 3 per cent (Charrley, 1982). Despite the recommended percapita consumption of 400 g of milk per individual per day, the actual availability of milk is only 107 g per individual per day in India (Budhar et.al. 1981).

OILS AND FATS:

Fats are an integral part of almost every food. They contribute tenderness to pastry crust, tenderness and texture and modify the flavour of foods. Fats are used as a medium transfer of heat to fried foods (Charley, 1982). Fat provides energy to the body which inturn carries out different functions and to maintain body temperature. The dietary surveys show that average fat consumption levels lie between 9.5 and 25.7 g per day, the figures being low in Karnataka (7.5 g), Tamil Nadu (10.5 g) and Maharashtra (11.0 g) and high in Calcutta City (25.7 g) and Kerala (21.7 g)(Achaya, 1979). In the less developed countries the average fat content of the food supply is 39.7 gms/person/day while in the more developed countries the amount is 128.5 gms (Devadas, 1984). A survey by Rao (1967) has shown that in an average Indian diet only 9 to 13 per cent calories are derived from fat.

SUGAR AND JAGGERY:

Sugar and jaggery are the common carbohydrate foods and they are used as sweetening agents in beverages and other foods to increase their palatability. They are mainly sources of energy although jaggery contains in addition, iron (Gopalan

et.al. 1984).

FLESH FOODS:

These foods such as fish and meat are rich in proteins of high biological value and in B vitamins. Vitamin B_{12} is contained only in foods of animal origin and not in plant foods But these foods are generally not good sources of vitamin A. Small fish eaten with bones are good sources of calcium (Gopalan et.al. 1984).

EGGS:

Egg is a rich source of all nutrients except vitamin C. The protein contained in egg is considered to be a perfect protein, and because of its high biological value and digestibility, egg protein is used as a reference protein for comparison with other proteins.

D. RECOMMENDED DIETARY ALLOWANCES:

(1) History and Origin

(2) Meaning and definitions

(3) Uses and

(4) Limitations.

(1). HISTORY AND ORIGIN:

Dietary standards are derived from compilations of

experimental studies designed to determine the nutrient requirements of the human.

The first organised attempt at developing a dietary standard came as a result of food shortages, during world war I. With the limited knowledge at that time of nutrition in general and of human nutrient needs in particular recommendations could be made only for energy and with reservations for protein. In 1933, the British Medical Association proposed a limited set of standards and made more extensive proposals including recommendations for energy value, protein, calcium, iron, phosphorus, Vit. A and Vit. C.

The greatest impetus to the development of dietary standards came as a result of the work of the League of Nations Technical Commission on Nutrition (Burnet and Aykroyd, 1935). The Commission focused international attention on the significance of diet in preventive medicine and as a measure of improving the public health. Dietary standards proposed for energy and protein were expressed as an average requirement on the basis of age, sex and activity.

The first recommendation of the U.S. officially came into being in May 1941 at the National Nutrition conference

which met in Washington at the call of President Franklin D. Roosevelt (Roberts, 1958).

Since, 1940, the food and nutrition board had developed formulations of daily nutrient to be adequate for the maintenance of good nutrition and are designated as Recommended Dietary Allowances, inorder to indicate that they were value judgements based on the existing knowledge of nutritional science and subject to revision as new knowledge become available (NRC, 1974). NRC (1974) explains that RDAS are the levels of intake of essential nutrients considered, in the judgement of the Food and Nutrition Board on the basis of the available scientific knowledge to be adequate to meet the nutritional needs of practically all healthy persons.

In 1957, "Food for Fitness - A daily food Guide" was designed as a nutritionally reliable teaching device. The food groups most likely to be used by home makers in meal planning and shopping were (a) milk (b) meat (c) vegetables and fruits and (d) Breed cereal. The basic four can meet the differing nutritional needs of nearly all individuals (Hertzler and Anderson, 1974).

Today many countries throughout the world are developing dietary guidelines to improve the nutrition of their people.

This action is the result of a growing acceptance of the fact that a nutritions diet is 1) essential for good health 2) a key factor in both the prevention and recovery from any illness and 3) helps to improve the quality of life (English, 1982).

In India, the Nutrition Advisory Committee (NAC) of the Indian Research Fund Association, now Indian Council of Medical Research formulated for the first time a schedule of Recommended Dietary Allowances in 1944. The recommendations were based partly on the recommendations of the League of Nations, the NRC of the USA, the Nutrition Research Council of Canada and the Medical Research Council (MRC) of the United Kingdom and on data collected by the Indian workers (Gopalan et.al, 1971).

The first allowances of dietary standards were published in 1943 and was revised in 1945, again in 1948 and every five years since 1953, 1958 and 1963. The Nutrition Expert Croup of the Indian Council of Medical Research in 1968 made further revisions with regard to the requirements of all nutrients.

(2) MEANING AND DIFINITIONS:

The Recommended Dietary Allowances is to serve as goals

toward planning food supplies and interpreting the food consumption of groups of people (Pike and Brown, 1967). According to WHO (1969) Dietary Allowances usually represent a safe but arbitary margin above the average minimum requirements for a specified age group, sex and body weight. This margin means that the great majority of the group will have sufficient intakes if they research th t "safe allowance" level.

The Recommended Dietary Allowances are the levels of intake of essentialf nutrients considered in the judgement of the Committee of Dietary Allowance of the Food and Nutrition Board on the basis of available scientific knowledge to be adequate to meet the known nutritional needs of practically all healthy persons (Harper, 1980). A recommended intake is taken as the dietary intake thought to be sufficiently high to meet the requirements of almost all individuals in a group with speficied characteristics (Canadian Council of Nutrition, 1982).

Minimum requirementhas referred to the least amount of nutrient that will prevent clinical symptoms of deficiency or support a well defined biochemical response such as maintenance

of nitrogen levels, or a specified level of metabolite in blood or urine (Pike and Brown, 1967). Allowances is more accurate and implies the addition of an amount above the estimated requirement to cover both the variation among individuals and the loss of precision inherent in the estimated requirement. The difference between different standards are recommended due to different subdivisions of people of different age, sex and physiological groups using the foods available and preferred in different countries. The intake of an individual will vary from day to day or over many days or weeks.

(3) USES OF RDA:

The dietary allowances are most useful for dietary planning and for evaluating diets consumed by population groups. They serve as a basis for regulating food supply. In evaluating the results of dietary surveys standards serve as the yardstick by which the nutrient intake of a population group may be judged. Highly practical use of the dietary standard is in the development of food plans which are a translation of human nutrient needs into food or food groups that may be used conveniently by nonprofessionals in planning diets (Pike and Brown, 1967). They are used by international agencies for

comparing different underdeveloped countries to see which has greater need for aid, as the basis for a nutrient density index to express the nutritional quality of foods. For planning therapeutic diets or constitutional meals and as the denominator for nutrition labelling, (IUNS, 1982 and Harper, 1974). It provides a basis for food selection. In addition to being guides of human needs for nutrients, the RDA have become guides for regulatory agencies that are responsible for nutrition labelling, for regulation designed to ensure nutritional quality of foods and for development of new food products (Harper, 1980). They are used for assessing food intake of groups or individuals (Hamilton and Whitney, 1979).

(4) LIMITATIONS OF RDA:

Limitations of RDA are (1) Do not have to be eaten every single day. A low intake on a day can be balanced by eating more amount of than the recommendation on the next day. (2) Do not say that one cannot eat more of the nutrients than the recommended amount but do not indicate at what higher levels the toxic effects might arise. (3). Do not cover minor vitamins and trace elements. They assume that if the intake of the main nutrients is adequate and the diet is mixed, the

minor nutrients will take care of themselve. (4) Do not allow for interactions among nutrients. (5) It is for the oral intake of the usual foods and not for intravenous nutrition. (6) There is no allowance for illness or major stress in life and may be affected by a variety of drugs (IUNS, 1982). (7) Should not be used as the sole basis for assessing the nutritional status of individuals, since individual needs for energy and for various nutrients show wide variation (Dispatch, 1977). (8) Misused in assessing the adequacy of observed intakes of food (Murry, 1983).

5. NUTRITIONAL REQUIREMENTS OF MANUAL WORKERS:

The nutritional requirements of industrial workers in India have assumed added significance in the recent past. As the industrial workers are mostly drawn from the poorer section of the population, their dietary and nutritional status naturally reflects the nutritional status of the population from which they are drawn. The few diet and nutrition surveys carried out among the industrial workers also indicate that the nutritional status of this group at present is certainly not satisfactory (National Nutrition Advisory Committee, 1965).

Wilson and Mitra (1938) carried out Nutrition surveys on

about 1,600 children of industrial workers in Assam Jute Mills and observed a high incidence of vitamin A deficiency. A survey of the diet and health conditions of plantation labour in South India by the Nutrition Research Laboratories, Coonoor revealed a high incidence of vit. A deficiency both in adults and children and nearly 1/3rd of the subjects examined suffered from mild anaemia and exhibited signs of B complex deficiency. Their body weights were subnormal. In a nutrition survery conducted amongst factory workers at Bombay Demello et.al, (1950) found a high incidence of vitamin A deficiency amogg children. Their body weights were low and 50 per cent of the adult males had anaemia.

Nutrition surveys carried out by the Nutrition Research Laboratory in textile mills in Coimbatore, showed that the workers were grossly underweight. Deficiency due to Vit. A, was more common, but Vit B. complex deficiency signs were slightly less prevalent. Diet surveys among industrial workers have generally shown that though their calorie intake was low in only some of the surveys all of them uniformly showed a diet intake which was deficient in protective factors. Animal proteins formed a small per cent of their total protein

intake (National Nutrition Advisory Committee, 1965).

Surveys conducted by International Organisation also show that the bulk of working class families in under-developed countries consume diets which are unfortunately deficient in Calories, animal proteins and Calcium. The impact of this on the working efficiency is generally expressed through lack of enthusiasm, avoidance of work, a very increased susceptibility to disease and consequently, greater absenteeism and accident rates. Ramamurthy and Dakshayani (1962) reported that the average energy expenditure of poor class of people with average body weight of 46 Kg. engaged in heavy manual labour was 3025 Cals/day. In another study, Ramamurthy and Belavady (1966) reported that the daily energy expenditure of adult men (average body weight 44 Kg) engaged in heavy labour was 3020 Calories. Working efficiency and output are very much dependent on the health and physical fitness of the individual. Provision of nutritionally adequate diets for workers was quickly appreciated not only as an important forward step in social practice but also for increasing industrial efficiency

(Ramadasmurthy, et.al, 1983).

According to Swaminathan (1967) it is essential to develop low cost food products for supplementing the diets of industrial workers because the rate of wage of industrial workers in India is inadequate to enable them to purchase the foodstuffs required for a balanced diet. The provision of free meals, and snacks is of great economic benefit to employees and also helps to increase production by avoiding waste of time, increased fatigue and nervousness which may occur when workers have to go outside the work spot for meals.

In India and other developing countries inadequate food consumption, is mainly responsible for a reduction of the peoples capacity for work (Swaminathan, 1967). In order to improve th the working efficiency and output of the workers, adequate diets not only in calories, but also protein, minerals and vitamins must be made available (Nirmala and Mehta, 1985).

The effect of low energy diets on working capacity depends on the type and intensity of the work to be performed, the composition of the diet with respect to relative amounts of carbohydrate and fat and the length of time allowed for adaptation to the diet to occur (Horton, 1982).

Experimental Procedure

III - EXPERIMENTAL PROCEDURE

The experimental procedure for the present study entitled, "An evaluation of Recommended Dietary Allowance of ICMR (1981) for adult men with moderate and heavy work" consisted of the following steps:

A. Selection of the Area.

B. Selection of the subjects.

C. Collection of baseline data from the subjects.

D. Planning and standardisation of menus using the Recommended Dietary Allowances.

E. Feeding the subjects and evaluation and

F. Analysis of diets.

A. SELECTION OF THE AREA:

The subjects were selected from the Cheran Transport Corporation (CTC) Workshop of Coimbatore city. This Workshop was selected for the following reasons. It is situated very near to the College and the officials and the workers were willing to extend their co-operation for the study. There is a canteen in the premises of the Cheran Transport Corporation. It serves the workers lunch and dinner at subsidised rates on all the days. The availability of the

canteen facilities could help in carrying out the feeding experiments. The Managing Director of CTC was contacted before starting the study and the required permission to conduct the study was obtained.

B. SELECTION OF THE SUBJECTS:

In the CTC workshop 195 workers where attending to the work in three shifts. For convenience the subjects were selected from day shift group. Two groups of ten men for each group were selected for the present investigation. Of the two groups, one group of ten men were moderate workers like electrician, Tinker and Carpenter. The other ten men were heavy workers like mechanic, working in under chasis, tyreman, blacksmith and hammerman. All the subjects were in the age group of 25 to 40 years. Because of the limitations of resources and time only the vegetarian group was taken for the present investigation. Factors such as health, absence of diseases or infection and willingness to co-operate in the study were considered while selecting the subjects.

C. COLLECTION OF BASE LINE DATA FROM THE SUBJECTS:

From all the 20 subjects selected for the investigation, baseline data were collected through

1. Socio economic cum dietary survey

2. Food weighment survey and

3. Assessment of nutritional status.

1. SOCIO ECONOMIC CUM DIETARY SURVEY:

Since food consumption is influenced by various factors like socio economic status, education, type of dietary pattern, type of occupation, religion, availability of time and place for food preparation and daily meal pattern (Thimmayamma 1983), the socio economic background of the subjects was collected using a questionnaire as given in Appendix I.

2. FOOD WEIGHMENT SURVEY:

To ascertain the normal food habits of the population, in depth nutrition surveys should be conducted in which individual food intakes are measured (Derke, 1981). Hence a three day food weighment survey was carried out to find out their normal food intake pattern. For this purpose, five members from each group were randomly selected and three days food weighment survey was carried out. This was conducted both at home and at the CTC canteen, since their afternoon lunch was provided in the canteen. The total weight of the raw foods used for cooking, the total weight of the cooked foods prepared and

the amount of cooked food consumed by the subjects were weighed accurately for three days. The food waste and the food consumed outside were taken into account while conducting the survey. From the consumed quantities of cooked food, the raw food equivalents and the nutrient intake were calculated using the Food Composition Tables of the ICMR (1984).

C. ASSESSMENT OF NUTRITIONAL STATUS:

The body weights of all the subjects selected for the study were recorded using a portable balance correct to 0.1 Kg. For all the subjects, their blood haemoglobin level was estimated using the cyanmethaemoglobin method (Varley, 1980).

D. PLANNING AND STANDARDISATION OF MENUS USING THE RECOMMENDED DIETARY ALLOWANCES:

Three days menu was planned for the two groups of selected moderate and heavy workers consuming vegetarian diets using the food allowances given by the ICMR (1981) (Table I).

TABLE - I

BALANCED DIETS FOR ADULT MEN.

	Moderate work (Vegetarian) (gms)	Heavy work (Vegetarian) (gms)
Cereals	475	650
Pulses	80	80
Green leafy vegetables	125	125
Other vegetables	75	100
Roots and Tubers	100	100
Fruits	30	30
Milk	200	200
Fats and Oils	40	50
Sugar and Jaggery	40	55
Groundnuts	—	50

While planning the three days menu, cost of foods, their normal food habits, seasonal availability of foods, convenience of preparation, likes and dislikes of the subjects were taken into account as suggested by Devadas and Easwaran (1975). The nutrient content of all the diets thus planned were calculated using the Food Composition Tables of the ICMR (1984).

The recipes included in the planned menus were

standardised in the laboratory. Peckham (1974) states that a standardized recipe is one in which the amounts and proportions of the ingredients and the methods of preparation will consistently produce a high quality product.

E. EVALUATION OF THE MENUS THROUGH FEEDING:

The whole day's menu planned according to the RDA were tested on the two groups of workers selected. The food for twenty workers was cooked separately in the canteen itself and served. The investigator was present in the canteen throughout the six days during weighing, preparation and serving the food. Each subject was fed weighed quantities of all the items for a period of six days. The first three days were considered as adjustment period, while the next three days were used for data collection and the menu used for three days adjustment period was repeated for the data collection period. The menus were prepared by using the best methods of preparation by minimizing the cooking losses, and appetising and palatable dishes were served. During the experiment, all the raw ingredients were weighed and supplied for cooking by the investigator.

After cooking the food, the weight of total cooked food

was found out and the amounts to be served to each subject was determined. Weighed quantity of foods were served to the subjects for all the meals. The quantities initially served, to the subjects exactly met the ICMR recommended food allowances. When any extra amount was requested, weighed quantities were given and the plate wastes if any were also noted.

During the experimental period, the subjects were instructed not to eat any food item outside other than what was supplied to them.

F. ANALYSIS OF DIETS:

The whole day diets prepared for feeding were analysed in the laboratory for their nutrients namely proteins, iron, calcium, phosphorus, vitamin C, Thiamine and Riboflavin.

Results and Discussion

IV. RESULTS AND DISCUSSIONS

The results of the present study entitled "An evaluation of the Recommended Dietary Allowances of ICMR (1981) for men doing moderate and heavy work" are discussed under the following heads:

A. Socio economic background of the selected subjects

B. Dietary pattern of the selected subjects

C. Nutritional status of the subjects studied

D. Menus prepared for the study

E. Nutrients supplied by the planned menus

F. Analysed values of the planned diet in comparison with calculated values for the selected nutrients and

G. Mean food and nutrient intake by the selected subjects.

A. Socio economic background of the selected subjects:

The socio economic details of the selected subjects are given in Table.II, and the format used is given in Appendix-I.

TABLE - II

THE SOCIO ECONOMIC DETAILS OF THE SELECTED SUBJECTS

S.No.	Details	No. of subjects	Percentage
1.	Age in years		
	25 - 30	7	35
	31 - 35	5	25
	36 - 40	8	40
2.	Education		
	Middle School	5	25
	High School	15	75
3.	Type of family		
	Nuclear	15	75
	Joint	5	5
4.	Size of the family		
	Less than 2 members	3	15
	3 to 5 members	15	75
	6 to 8 members	2	10
5.	Income/month in Rs.		
	Less than 600	1	5
	601 to 700	7	35
	701 to 800	5	25
	800 and above	7	35
6.	Marital status		
	Married	10	50
	Bachelor	10	50

Out of the 20 subjects selected for the study a majority of them (40 per cent of them) were from the age group of 36 to 40 years.

Seventy five per cent of the subjects had education upto high school and only twenty five per cent had studied upto middle school. Among the 20 subjects 50 per cent were married and 50 per cent were bachelors. Majority of the subjects come from nuclear families and also their family size was small (i.e) within the number of three per family.

The total monthly income of the families of the selected subjects ranged from Rs. 500 to above Rs. 800. However only five per cent of the families had an income below Rs.600 / month which shows that they do not belong to very low income.

The expenditure pattern of the families is presented in Table III.

TABLE - III

THE EXPENDITURE PATTERN OF THE FAMILIES OF THE SELECTED SUBJECTS

Item	Range of expenditure (Percentage of total income)	Number of families	Percentage of families
Food	41 - 50	5	25
	51 - 60	3	15
	56 - 70	3	15
	71 and above	9	45
Clothing	0 - 5	6	30
	6 - 10	8	40
	11 and above	6	30
House rent	0 - 10	4	20
	11 - 20	13	65
	20 and above	3	15
Education	0 - 5	14	70
	6 - 10	6	30
Medicine	0 - 5	20	100
	6 and above	—	—
Fuel, light	0 - 5	5	25
	6 and above	15	75
Transport	0 - 5	20	100
	6 and above	—	—
Others	0 - 5	20	100
(Pan supari tobacco and drinks)	6 and above	—	—

The income of the families was spent on various items such as food, clothing, shelter, etc.

A majority of the families (45 per cent) spent more than 71 per cent of their income on food. This was because of their low income level. When the income was higher the percentage of expenditure was lesser for food which was observed in 25 per cent of the families.

Because of the residence in city areas 65 per cent of them spent 11 to 20 per cent of their income on house rent. Only 15 per cent of them spent more than 20 per cent of their income for their houses.

The fact that 30 per cent of them spent 6 to 10 per cent of their income on education indicated that their family members where given education at higher levels. In general the expenditure pattern indicated that they did not have a very low living standards of life.

The expenditure incurred on cereals by the selected families is given in Table IV.

TABLE - IV

EXPENDITURE INCURRED ON CEREALS BY THE SELECTED FAMILIES

S.No.	Per cent of total food expenditure	No. of families	Percentage of families
1.	Less than 50	13	65
2.	51 - 60	5	25
3.	61 - 70	2	10

A majority of the families, (65 per cent) spent only less than 50 per cent of their total food expenditure on cereals completely and also their economic status was slightly better off. The remaining 35 per cent of the families spent more income (51 to 70 per cent) on cereals. It might be due to their dependence on cereals for the bulk of the diet as commonly observed in most of the diet surveys among the very low income groups.

The expenditure incurred on food groups by the selected families is presented in Table V.

TABLE - V.

EXPENDITURE INCURRED ON OTHER FOOD GROUPS BY THE SELECTED FAMILIES

Item	Food expenditure in per cent				
	Nil	5	6 - 10	11 - 15	16 - 20
Pulses	—	—	35	65	—
Leafy vegetables	—	100	—	—	—
Other vegetables	—	35	65	—	—
Roots and Tubers	—	65	35	—	—
Oil and fat	—	15	75	10	—
Sugar and Jaggery	—	100	—	—	—
Fleshy feeds/eggs	—	10	40	35	15
Milk and milk products	—	25	25	50	—
Prepared foods	65	25	10	—	—
Beverages	—	100	—	—	—

The fact that 65 per cent of the families spent atleast 11 to 15 per cent of their food expenditure on pulses indicates that the requirement of pulses may be fulfilled partly if not satisfactorily.

The expenditure on green leafy vegetables which was only within five per cent of their food expenditure indicated that the inclusion of these vegetables were not upto the satisfactory level. When compared to the green leafy vegetables the expenditures on other vegetables and roots and tubers were found to be more.

Fifteen per cent of them spent 16 to 20 per cent of their income on fleshy foods. Fifty per cent of them spent 11 to 15 per cent of the food expenditure on milk and milk products. Eventhough a majority of them (65 per cent) spent less than five per cent of the food expenditure on prepared food items it was very discouraging to note the poor quality of the prepared foods purchased by them.

B. Dietary pattern of the selected subjects:

1) Daily menu

The daily meal pattern of the selected individuals is presented in Table VI.

TABLE VI

DAILY MEAL PATTERN OF THE SELECTED INDIVIDUALS

Meal Timing	Meal pattern
Morning	Coffee, left over rice and buttermilk/ Idli/Dosai/Uppuma etc.
Noon	Rice and Sambar, Poriyal, Buttermilk/ Rice, Pulikkuzumbu, buttermilk/some mixed rice-Tomato rice, dhal rice, Puliyotharai, curd rice with pickle and vegetables.
Evening	Tea
Night	Chappathi/Dosai/Uppuma etc./Rice and Rasam.

There was not much difference in the menu pattern of the selected families. All of them had only three meal pattern and forthe evening they just had either a cup of coffee of tea.

2. Mean food intake of the selected subjects through the home and canteen diets.

Three day food weighment survey was carried out on five subjects randomly selected from each group of moderate and heavy workers. During this period of survey the workers had two meals at home and one meal in the canteen, which was their regular practice of food intake.

The mean food consumption of the selected workers through the home and canteen diet is presented in Table VII with the individual values in Appendix 2.

TABLE VII

MEAN FOOD CONSUMPTION OF WORKERS THROUGH THE HOME AND CANTEEN DIETS (in grams)

Details	Cereals	pulses	Green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Milk	Oil and fat	Sugar and jaggery	Butter milk
Moderate workers	397	31	9	71	50	34	29	27	20	140
RDA	475	80	125	75	100	30	200	40	40	--
Percentage difference	-16.42	-61.25	-92.8	-5.33	-50	+13.33	-85.5	-32.5	-50	--
Heavy workers	406	41	9	65	80	31	57	28	26	150
RDA	650	80	125	100	100	30	200	50	55	--
Percentage difference	-37.53	-48.75	-92.8	-35	-50	+3.33	-71.5	-44	-52	--

Except the fruits all the other foods were below the Recommended Dietary Allowances in the diets of selected subjects. The main reason for the increased consumption of fruits was due to the inclusion of tomotoes in most of their preparations and not due to the consumption of other fruits. The highest percentage of deficit (92.8%) was noted in their intake of green leafy vegetables which is a common problem in India. This was due to their ignorance regarding the importance of green leafy vegetables in good health.

The next food which was deficient was milk and milk products (85.5% and 71.5%) followed by pulses (61.2% and 48.75%) indicating a deficient intake of good quality protein. The main cause for this is the high cost of milk and pulses.

Fats and oils were deficient to about 32.5 to 44 per cent and cereals to about 16.42 to 37.53 per cent. The least deficit was noted with regard to other vegetables (5.33%), but for heavy workers, the deficit was to about 35 per cent. In general the deficit was meagre with regard to other vegetables and cereals because in the dietary pattern of the low income families cereals form the bulk of the diet.

Roots and Tubers were deficit to about 50 per cent.

3. Mean Nutrient intake through home and central diets:

The following table presents the mean nutrient intake of the moderate and heavy workers assesed through three day weighment survey and their individual values presented in Appentix 3.

TABLE VIII

MEAN NUTRIENT CONSUMPTION OF THE WORKERS THROUGH HOME DIETS

Details	Protein gms	Calories kcal	Calcium mg	Iron mg	Vit. A β Carotene μg	Thiamine mg	Riboflavin mg	Niacin mg	Vit. C mg
Heavy workers	46.81	242	453.51	29.33	850	1.79	0.77	21.51	68.62
RDA	55	3000	400-500	20	3000	2.0	2.2	2.6	50
% difference	-11.23	-37.91	+0.87	+49.15	-71.83	-64.79	-17.15	10.61	+37.24
Moderate workers	40.05	1948	313.57	24.25	850	1.34	0.68	18.62	48.21
RDA	53	2600	400-500	20	3000	1.4	1.5	19	50
Difference %	-27.18	-30.42	-30.25	+21.25	-71.65	-[illegible].88	-[illegible]986	-1.98	-3.58

The deficiency observed in the intake of different foods was reflected in the intake of nutrients also.

Inspite of reduced intake of green leafy vegetables the calcium and iron intakes were more because of inclusion of the cereal ragi in their home diets which is encouraging. Due to the deficit of green leafy vegetables, pulses and milk and milk products the 'B' complex vitamins were lesser than the recommended allowances. Because of higher intake of tomatoes and other vegetables the ascorbic acid content of the diet was high when calculated. However this may not be true if the diets are analysed for vitamin C mainly due to the cooking losses.

The highest percentage of deficit was noted with B carotene because of lack of green leafy vegetables and milk and milk products.

Thus the home diets of the selected subjects were deficient in most of the nutrients like calories, protein, B carotene, thiamine, riboflavin and niacin.

C. Nutritional status of the subjects studies:

All the 20 subjects selected for the study were free from diseases or obvious deficiency signs. Their mean body weights and blood haemoglobin levels are presented in the Table IX

TABLE - IX

MEAN BODY WEIGHTS AND HAEMOGLOBIN LEVELS OF SELECTED SUBJECTS

Details	Weight (Kg)	Haemoglobin level (g / 100 ml blood)
Moderate workers	59.1	11.69
Heavy workers	64.6	13.45
Normal	55.0	13

The moderate workers had a lower blood haemoglobin levels (11.69 g/100 ml) when compared to the heavy workers (13.45 g/100 ml).

D. Menus prepared for the study:

Three days menu planned for moderate and heavy workers are presented in Tables X to XV.

TABLE - X

1st DAY MENU FOR A MAN DOING MODERATE WORK

Menu	Ingredients used
Breakfast:	
Chappathy	Wheat flour - 150 gms.
Dhal Masiyal	Red gram dhal - 40 gms.
Coffee	Sugar - 20 gms, milk - 25 gms.
Lunch:	
Rice	Rice - 175 gms.
Brinjal sambar	Red gram dhal - 35 gms, Brinjal - 25 gms.
Carrot poriyal	Carrot - 40 gms.
Araikeerai masiyal	Araikeerai - 125 gms.
Rasam	-----
Curd	Milk - 75 gms.
Tea:	
Coffee	Milk - 25 gms, Sugar - 20 gms.
Puffed rice	Puffed rice - 30 gms.
Dinner:	
Tomato rice	Rice - 150 gms, Tomatoes - 30 gms.
Curd rice	Curd (milk) - 75 gms.
Ridge gourd poriyal	Ridge gourd - 90 gms.
	For the whole day use 5 gm of bengal gram and 2 gm of curry leaves were used for seasoning. Used 40 gms of oil for breakfast, 20 gms of oil for lunch, and 40 gms of oil for dinner in the preperations. For the whole day 60 gms of onion was used. 10 gms in the breakfast, 30 gms in the lunch and 20 gms in the dinner.

TABLE - XI

II[nd] DAY MENU FOR A MAN DOING MODERATE WORK.

Menu	Ingredients used
Wheat Ravai Uppuma	Wheat Ravai - 150 gms
Chutney	Roasted Bengal gram - 15 gms.
Banana	Banana - 30 gms.
Coffee	Sugar - 20 gms, Milk - 25 gms.
Lunch:	
Rice	Rice - 175 gms
Mour Kozumbu	Curd (milk - 75 gms), Pumpkin - 20 gms, Red gram dhal - 5 gms.
Rasam	———
Amaranth poriyal	Amaranthus - 125 gms.
Tea:	
Coffee	Sugar - 20 gms, Milk - 25 gms.
Tapioca	Tapioca - 60 gms.
Groundnut	Groundnut - 25 gms.
Dinner:	
Rice	Rice - 150gms.
Ladies finger Sambar	Ladies finger - 20, Red gram dhal - 30 gms.
Lablab poriyal	Lablab - 35 gms.
Rasam	———
Curds	Curds (milk - 75 gms).

For the whole day used 5 gms of Bengal gram and 2 gms of curry leaves for seasoning purpose.

Used 20 gms of Oil for breakfast, 10 gms of Oil for lunch and 10 gms of Oil for dinner.

For the whole day 40 gms of onion was used 10 gms in the breakfast 20 gms in the lunch and 10 gms in the dinner.

TABLE - XII

III[rd] DAY MENU FOR A MAN DOING MODERATE WORK.

Menu	Ingredients used
Breakfast:	
Idli	Rice - 150 gms, Black gram dhal - 40 gms.
Coriander chutney	Coriander leaves - 75 gms
Coffee	Sugar - 20 gms, Milk - 25 gms.
Rice	Rice - 175 gms.
Brinjal Puliguzumbu	Brinjal - 25 gms, Tamarind - 15 gms.
Amaranth poriyal	Amaranth - 50 gms.
Carrot salad	Carrot - 500 gms.
Tea:	
Green gram sundal	Green gram - 35 gms.
Coffee	Sugar - 20 gms, Milk - 25 gms.
Dinner:	
Lime rice	Rice - 150 gms, Lime - 30 gms.
and curd rice	Curds - (milk) 75 gms.
Cluster beans poriyal	Cluster beans - 50 gms.

For the whole day used 5 gms of Bengal gram and 2 gms of curry leaves for seasoning purpose used 5 gms of oil for breakfast,5 gms for Tea, 15 gms for lunch and dinner for 15 gms.

For the whole day 50 gms of onions was used 20 gms for lunch, 15 gms for Tea and 15 gms for dinner.

TABLE - XIII

I[st] DAY MENU FOR A MAN DOING HEAVY WORK.

Menu	Ingredients used
Chappathy	Wheat flour - 150 gms
Dhal masiyal	Red gram dhal - 40 gms.
Coffee	Sugar - 25 gms, Milk - 20 gms.
Lunch	Rice - 250 gms.
Brinjal sambar	Red Gram dhal - 35 gms, Brinjal - 25 gms.
Rasam	-----
Carrot periyal	Carrot - 40 gms.
Araikeerai Masiyal	Araikeerai - 125 gms.
Curds	Curds (Milk) - 75 gms.
Tea:	
Coffee	Sugar - 30 gms, Milk - 25 gms.
Puffed rice	Puffed rice - 50 gms.
Groundnut	Groundnut - 50 gms.
Dinner:	
Tomato rice	Rice - 200 gms, Tomotoes - 30 gms.
Curd rice	Curds (Milk) - 75 gms.
Ridge gourd poriyal	Ridge gourd - 75 gms.

For the whole day used 5 gms of Bengal gram dhal, and 2 gms of curry leaves, for seasoning purposes.

Used 20 gms of Oil for breakfast, 20 gms in lunch and 10 gms for dinner.

For the whole day 60 gms of onion was used, 10 gms in breakfast, 30 gms in lunch, and 20 gms in dinner.

TABLE - XIV

II[nd] DAY MENU FOR A MAN DOING HEAVY WORK

Menu	Ingredients used
Breakfast:	
Uppuma	Wheat Ravai - 200 gms.
Chutney	Roasted Bengal gram dhal - 25 gms.
Coffee	Sugar - 25 gms, Milk - 25 gms.
Banana	Banana - 30 gms.
Lunch:	
Rice	Rice - 250 gms
Mour Kozumbu	Pumpkin - 20 gms, Red gram dhal - 5 gms. Curds (Milk - 75 gms)
Rasam	----
Amaranth Poriyal	Amaranth - 125 gms.
Tea:	
Tapioca	Tapoica - 60 gms.
Groundnut	Groundnut - 30 gms.
Coffee	Sugar - 30 gms, Milk - 25 gms.
Dinner:	
Rice	Rice - 200 gms.
Ladies finger sambar	Red gram dhal - 40 gms. Ladies finger - 30 gms.
Rasam	----
Lablab Poriyal	lab lab - 50 gms.
Curds	-- Curds (Milk)- 75 gms.

For the whole day used 10 gms of Bengal gram dhal and 2 gms of curry leaves for seasoning.

Used 20 gms of Oil for breakfast, 15 gms of Oil for lunch and 15 gms of Oil of dinner.

For the whole day 40 gms of onion was used, 10 gms in the breakfast, 20 gms in the lunch and 10 gms in the dinner.

TABLE - XV

III[rd] DAY MENU FOR A MAN DOING HEAVY WORK.

Menu	Ingredients used
Breakfast:	
Idli	Rice - 200 gms, Black gram dhal - 40 gms.
Coriander chutney	Coriander leaves - 75 gms.
Coffee	Sugar - 25 gms, Milk - 25 gms.
Lunch:	
Rice	Rice - 250 gms.
Brinjal Pulikuzumbu	Brinjal - 40 gms, Tamarind - 15 gms.
Amaranth Periyal	Amaranth - 50 gms.
Carrot salad	Carrot - 50 gms.
Rasam	------
Curds	Curds (milk) - 75 gms.
Tea:	
Green gram sundal	Green gram dhal - 35 gms
Coffee	Sugar - 30 gms, Milk - 25 gms.
Dinner:	
Lime rice	Rice - 200 gms. Lime - 30 gms.
Curd rice	Curds (Milk) - 75 gms.
Cluster beens poriyal	Cluster beens - 50 gms.

For the whole day used 5 gms of Bengal gram dhal and 2 gms of curry leaves for seasoning, used 5 gms of oil for breakfast and 10 gms of oil for tea (Sundal) and 25 gms Oil for lunch and 40 gms oil for dinner.

For the whole day 50 gms of onion was used, 20 gms for lunch, 15 gms for Tiffin and 15 gms for dinner.

Based on the food allowances of ICMR (1981), the menus were planned with the inclusion of all food groups. Considering the existing meal pattern, seasonal availability, cost time available for cooking, facilities available for cooking, and the likes and dislikes of the selected subjects, the planning was done in such a way that the total quantities of different ingredients used in a day were similar to the Recommended Daily Allowances given by the ICMR (1981).

Since the ICMR (1981) has not given any recommendation for fruits the 1968 recommendation for fruits has been used throughout the study. Regarding the use of oil and seasonings whole days allotments were weighed out and kept separately. They were distributed among the preparations as per the requirements.

For both the moderate and heavy workers the same menu was followed but for the increased quantities of some of the food groups like cereals, other vegetables, fats and oils and sugar and jaggery. Groundnuts were given only for the heavy workers as per the allowance. The total cost of a days menu was worked out to be Rs. 5.70 for moderate workers and Rs.6.80 for heavy workers.

The investigator aimed to supply the foods of good quality at meals since palatability and appearence of meals formed the two main factors on which the consumption patterns of an individual is based.

When compared with their normal menu pattern the newly planned menus included more number of items for example an additional vegetable in lunch as well as dinner and snacks during tea time.

E. Nutrients supplied by the planned menus :

The mean nutrients supplied by the planned diets is presented in Table XVI with the details of calculation in Appendix 4 (a to f).

TABLE XVI

NUTRITIVE VALUE OF PLANNED MENUS AS CALCULATED

Details	Protein (gm)	Energy k cal	Calcium (mg)	Iron (mg)	β-carotene (µg)	Thiamine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Moderate workers	69	2854	1030	71.86	5797	2.27	1.38	25.69	120.96
RDA	55	2800	400-500	20	3000	1.4	1.5	19	50
% difference	+25.58	+1.95	+129.00	+259.3	+93.26	+62.42	-8.28	+35.24	+141.92
Heavy workers	85.03	3836	1125	79.9	6760	2.94	1.49	35.066	125.03
RDA	55	3900	400-500	20	3000	2	2.2	26	50
% difference	+54.6	-1.6	+150.04	+299.5	+125.36	+46.87	-32.30	+34.64	+150.06

The above table shows clearly that the three days menu planned for the two categaries of people supplied more than the Recommended Allowances of Nutrients, for the two groups studied. The supply of all the nutrients were found to be in excess except riboflavin which was deficient to about 8 to 32.

The caloric content of the moderate workers was found to be in excess but it was slightly defficient (1.6 per cent) in the diet of heavy workers. The protein content of the diet was greater to an extent of 54.6 per cent, the excess amount of calcium varied from 129 to 150 per cent in both the diets. The iron content was greater than the RDA to an extent of 299 per cent.

Among the water soluble vitamins, vitamin C, content was greater than the thiamine and niacin content. But this might be lost during the preparation and cooking of foods. Thiamine

levels were higher from 8 to 32 per cent than that of the recommended allowance. Niacin was also higher to an extent of 35 per cent than the required quantities. Thus the planned diets were satisfactory in all the nutrients except for riboflavin.

F. Analysed values of the planned diets in comparison with the calculated values for the selected nutrients. :

Five grams of all the receipes prepared in the diets during the feeding experiment were homogenised in the laboratory and the samples were analysed for their protein, calcium, iron, thiamine, riboflavin and vitamin C contents.

Later the values were calculated for the quantities of one day's diet for all the three days for both the groups.

Table XVII gives the results of the analysis in comparison with the calculated values with the details in Appendix 5 and 6.

TABLE XVII

NUTRITIVE VALUE OF THE PLANNED MENUS AS ANALYSED IN THE LABORATORY IN COMPARISON WITH THE CALCULATED VALUES.

Details	Protein gms	Calcium (mg)	Iron (mg)	Thiamine (mg)	Riboflavin (mg)	Vitamin C (mg)
Moderate workers Analysed	66.6	938	60	1.98	0.97	16
Calculated Actual	69	1030	72	2.27	1.38	120
difference	-2.4	-92	-12	-0.29	-0.41	-104
per cent difference	-3.4	-8.9	-16.6	-12.77	-30	- 87
Heavy workers Analysed	82	1017	69.6	2.35	1.17	18
Calculated Actual	85	1125	79.9	2.937	1.49	125
difference	-3	-108	-10.3	-0.687	-0-32	-107
Per cent difference	-3.5	-9.5	-12.8	-19.9	-22	- 86

It was noted that all the values obtained in the laboratory were lower than the calculated values. In protein, 2.4 gm difference was noted. In calcium 92 mg to 102 mg difference, iron 12 mg to 10 mg differences were recorded. In thiamine 0.29 mg to 0.59 mg difference was noted. In riboflavin 0.41 mg to 0.32 mg, was noted. There was a greater loss in vitamin C, i.e about 104 mg to 107 mg.

The reasons for the decrease in nutrients on analysis might be due to the factors such as the variety of foodstuffs, the losses in the preparation of foods, cooking of foods, serving of foods, and more than these during analysis itself. Thus due to these factors the nutrients might be lesser on analysis in comparision with the calculated values. However as the nutrient supply of the diets were greater than the RDA all these would have been easily compensated and the fulfilment of the nutrient requirement would not been affected.

9. Mean food and nutrient intake by the selected [illegible]

During the feeding experiment (i.e after allowing three days adjustment period. The subjects were served the

recommended qantities of cooked foods for each meal. They were permitted to waste the extra food served and at the same time extra servings of any items were served as desired. But all these were recorded carefully for each subject during all meal times on all the three days. The mean food intake of the subjects in comparision with RDA is presented in Table XVIII with the individual values in Appendix 7 and 8.

TABLE XVIII

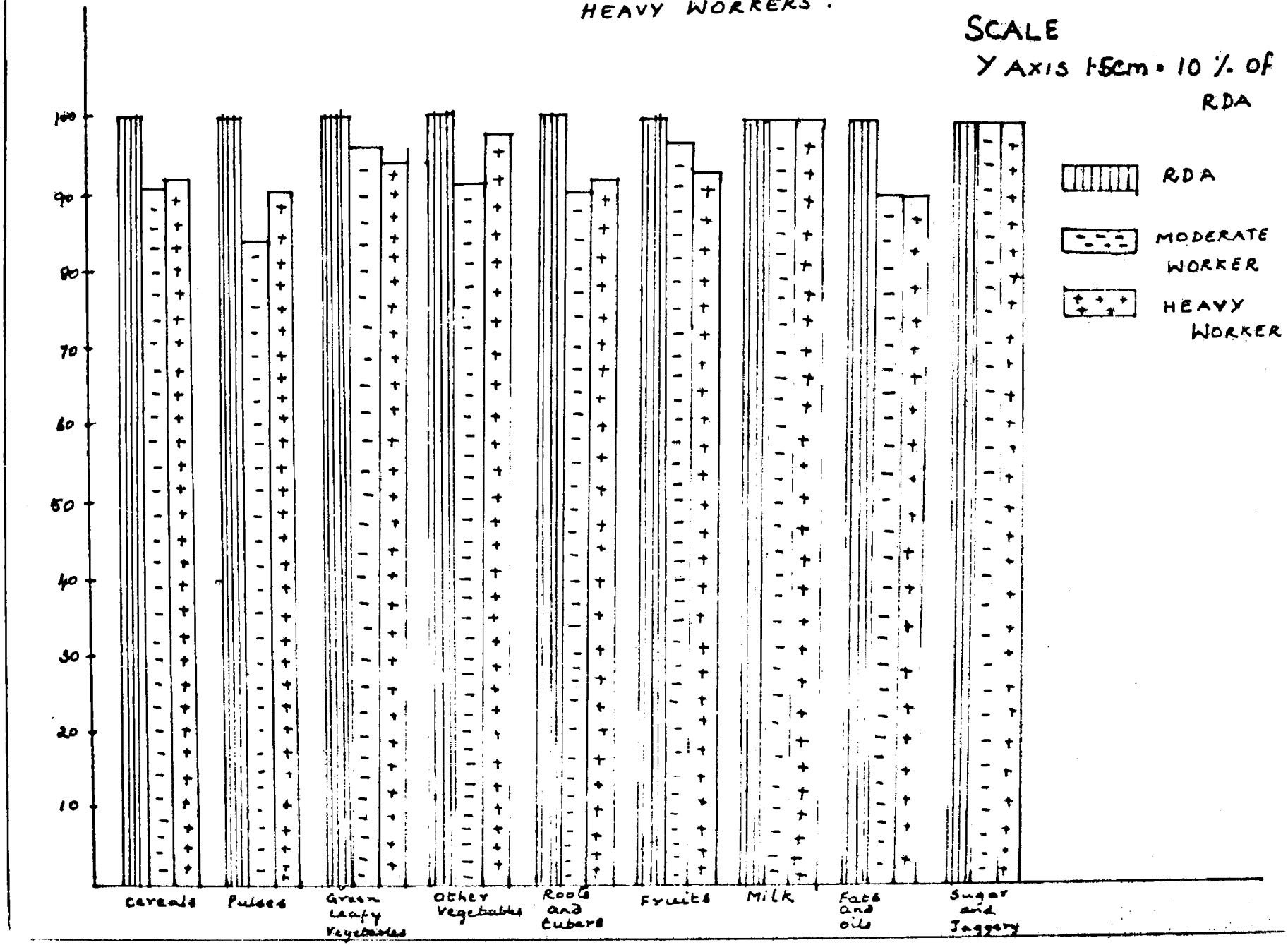
MENU FOOD CONSUMPTION OF THE SUBJECTS ON FEEDING EXPERIMENT

(in grams)

Details	Cereals	Pulses	Green leafy vegetables	Other vegetable	Roots and Tubers	Fruits	Milk	Oil and Fat	Sugar and jaggery
MODERATE Workers	437	70	116	71	90	28	200	30	40
RDA	475	80	125	75	100	30	200	40	40
% difference	- 8	-12.5	-5.6	-5.3	-10	-6.6	-	-10	0
Heavy workers	589	67	120	85	86	29	200	45	55
RDA	650	80	125	100	100	30	200	50	55
% difference	-9.4	-16.2	-3.97	-15	-12	-3.3	-	-10	0

For the heavy workers groundnuts was supplied on two days, and one day it was substituted with 30 gms of fats and oils.

COMPARISON OF MEAN FOOD CONSUMPTION OF MODERATE AND HEAVY WORKERS.



Cereals:

In the cereal consumption there was a deficit of 8 per cent in the case of moderate workers and 9.4 per cent in the case of heavy workers. Thus in both the groups the subjects were not able to consume the recommended allowances of cereals.

Pulses:

Though in both the groups the pulse consumption was lesser then the RDA it was greater by moderate workers. This might be due to the higher intake of cereals and inclusion of ground nuts in their (heavy worker's)diets.

Green leafy vegetables:

Except for a very little amount of deficit the subjects were able to consume the RDA of green leafy vegetables in their diets the shortage was from 3.97 to 5.6 per cent in which is not a remarkable quantity.

Other vegetables:

The consumption of other vegetables by the heavy workers was lesser than that of the moderate workers, which is proved by the higher per centage difference (15 per cent) in the

heavy workers as against (5.3%) the difference in the case of moderate workers.

The serving of roots and tubers were also found to be high in both the groups as they were not able to consume around 10 per cent of the RDA.

Fruits:

With regard to the consumption of fruits only one to two grams of fruits was lesser than the RDA in both the groups. This was mainly due to the inadequate cereal consumption in which the fruits like tomatoes and lime were mixed on two days diets. If this could had been given separately this inadequacy would not have been prevalent.

Milk and milk products:

The milk consumption was adequate in both the groups as per the RDA. This might be due to the practice of coffee consumption and adequate curds by the selected subjects.

Fats and Oils:

The consumption of fats and Oils was slightly lesser than the RDA in both the groups with a range of-4 to -5 gms.

Sugar and Jaggery:

It was observed that in both the groups the men consumed the entire quantity of sugar recommended. This might be due to the practice of coffee intake.

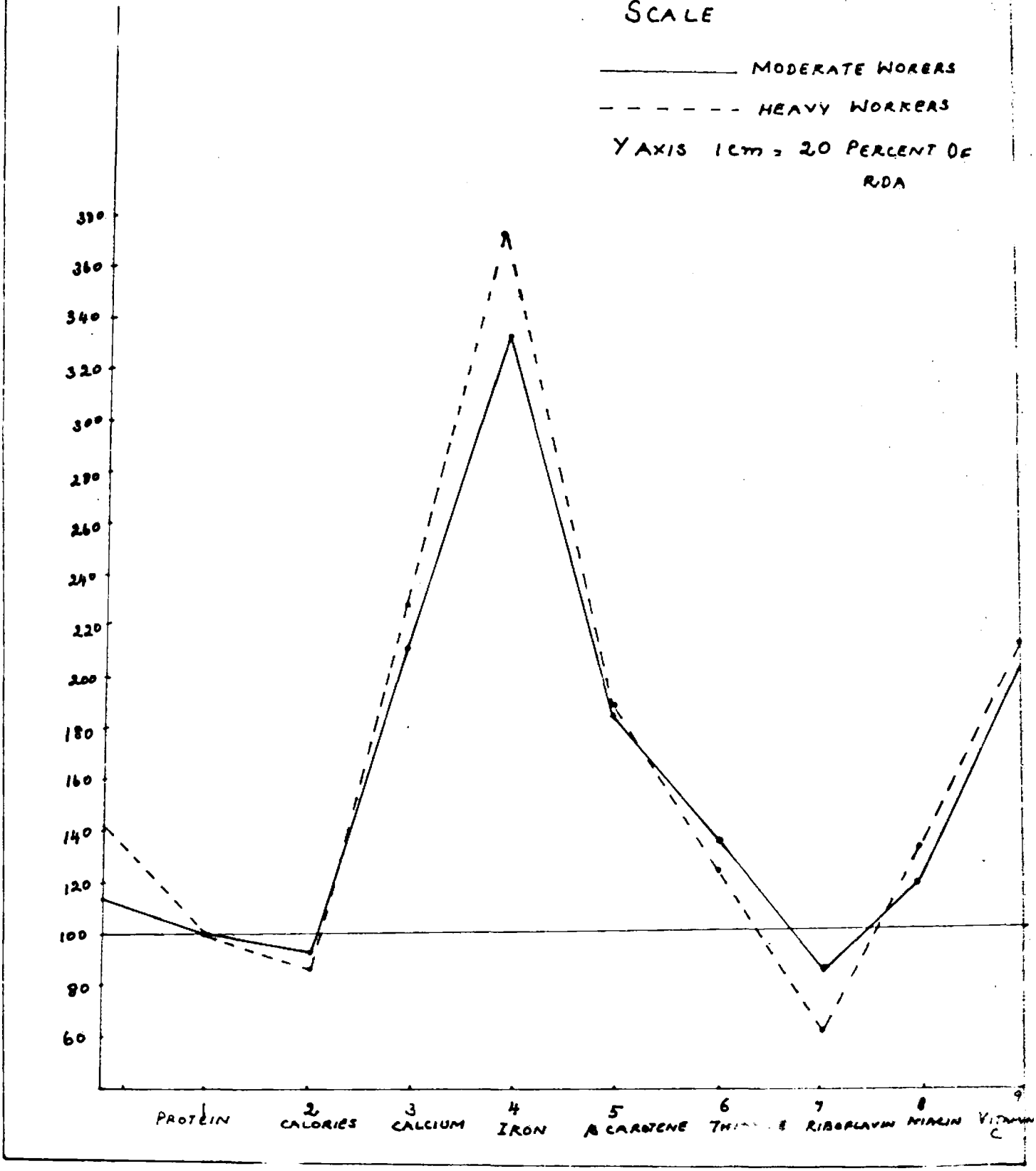
From the quantities of various foods consumed by the subjects the intake of nutrients were calculated. The values thus arrived at are compared with RDA in Table XIX, with the individual values in Appendix 9 and 10.

TABLE—XIX

MEAN NUTRIENT INTAKE OF WORKERS

Details	Protein (gm)	Energy k cals	Calcium (mg)	Iron (mg)	P y carotene (mg)	Thiamine (mg)	Ribo flavin (mg)	Nia cin (mg)	Vit-C (mg)
Moderate workers									
Consumed amount	64	2616	944	67	5481	1.9	1.31	22.73	111
RDA	55	2000	400-500	20	3000	1.4	1.5	19	50
Per cent difference	+16	-6	+109	+235	+83	+36	-12.6	+20	+122
Heavy workers									
Consumed amount	78	3349	1013	74	5505	2.49	1.34	34.48	117
RDA	55	3900	400-500	20	3000	2.0	262	26	50
Per cent difference	+ 42	-14	+125	+270	+84	+25	-39	+33	+134

Comparison Of Mean Nutrient Intake By Moderate And Heavy Workers With RDA Scale



Though the food consumption of the subjects was not very adequate it was surprising that the intake of almost all the nutrients except riboflavin and little amount of evergy were excessively consumed by the subjects. This is mainly due to the fact that the planned diets were having a high content of nutrients.

The excess observed in protein intake ranged from 16 to 42 per cent in the moderate and heavy workers. The deficit was around 6 to 14 per cent in the two groups.

Both the minerals, calcium and iron were high in both the groups.

The B carotene content was also high in both the diet groups ranging from 83 to 84 per cent which is very encouraging. Riboflavin was deficient in both the diets from 12.6 to 39 per cent which is a considerable quantity. Because this was deficient in the planned menu itself the chance of deficiency in the consumption had also increased. It is interesting to note that the other two B complex vitamins, thiamine and niacin were also consumed more than the recommended quantities. The increase was found to be

from 25 to 36 per cent in thiamine and 20 and 33 per cent in niacin. The vitamin C was also greater than that of the RDA. The increase was 122 to 134 per cent. But one cannot be very much satisfied with the increased amounts of water soluble vitamins. However after allowing for cooking losses one may get an adequate quantity of these nutrients.

Based on the foregoing discussions it could be concluded that the moderate and heavy workers in Cheran Transport Corporation were not able to consume all foodstuffs as per the recommended allowances. However the quantity of foods not consumable were very little i.e a maximum of 16 per cent.

The highest percentage of deficit was noted with pulses (12.5 to 16.25 per cent). Next was fats and oils 10 per cent 10, roots and tubers 10 to 12 per cent, cereals 8 to 9.4 per cent fruits 3.3 to 6.6 per cent and other vegetables from 5.3 to 15 per cent. The deficit was found with regard to roots and tubers and other vegetables mainly because these foods were incorporated in either cereal or pulse preparations only, otherwise these would have been consumed. The subjects were able to consume the required quantities of milk and sugar and jaggery.

Even though there was a slight deficiency in the consumption of various foods when compared with the recommended allowances, the nutrients were found to be sufficient because of higher nutrient content of the diet, thus ensuring the quality of the menus. The slight deficienty in the quantity may not affect the nutritional status of a person.

Though the results of the weighment survey showed deficient intake of all the foods as well as nutrients, through their routine diets the feeding experiment has proved that they would consume slightly more foods provided their economic conditions are improved and adequate. Nutrition education need to be imparted for the proper selection and preparation of food stuffs.

*****

Summary and Conclusion

V. SUMMARY AND CONCLUSIONS

In the present investigation entitled, "An evaluation of the Recommended Dietary Allowances by ICMR (1981) for men doing moderate and heavy work" had the main objective of testing the adequacy of the recommended food allowances of ICMR for men doing moderate and heavy work and consuming vegetarian diets. The nutrient contribution of the recommended diets was also studied for its adequacy.

Three days menu were planned for the two selected categories of people-moderate workers and heavy workers consuming vegetarian diets based on the RDA for foods. The calorie and nutrient supply of the planned diets were calculated. The three days menu were standardized in the laboratory. The cost of one day's menu was worked out to be Rs.5.70 for moderate workers and Rs.6.80 for heavy workers.

The groups of 10 men each, from Cheran Transport Corporation of Coimbatore were selected for the feeding experiment. The base line data were collected from the selected men through socio economic and diet surveys as well as food weighment survey. They were fed with the standardised menu for a period of six days giving freedom for food wastage as well as consumption of extra quantities of any item served. Records of their intake were maintained for period of last three days leaving an adjustment

period ofthree days in the beginning. Their mean food intakes were calculated and compared against the RDA. The prepared menus were also analysed in the laboratory for protein, calcium iron, thiamine riboflvin and vitamin C.

The following were the result:

1. The total monthly income of the selected men ranged from Rs.600/- to above Rs.800/-. A majority of the families (60%) spent 60 to 80 per cent oftheir income on food alone. A majority ofthe families (65%) of them spent only less than 50 per cent of the total food expenditure on cereals. The fact that 65 per cent of the families spent atleast 11 to 15 per cent of their food expenditure on pulses indicates that the requirement of pulses may be fulfilled partly. The expenditure on green leafy vegetables which was only within five per cent of their food expenditure indicated that the inclusion of these vegetable were not upto the satisfactory level.

2. The results offood weighment survey indicated that except the fruits all the other foods were below the RDA in the diets of selected subjects. The main reason for the increased consumption of fruits was due to the inclusion

of tomatoes in most of their preparations and not due to the consumption of other fruits. When the nutrient intake was calculated on thebasisof the basis of the food weighment survey, the highest percentage was noted with β carotene and the other nutrients that were deficient were calorie, protein, thiamine, riboflavin and niacin. The reason for the adequacy of the minerals were mainly due to the inclusion of ragi and other cereal in the diet.

3. When compared with the normal menu pattern of the selected men, the planned menus had more number of items in all the four meals of the day and the planned menus were balanced when compared to the home foods.

4. The planned menus were found to supply more than the RDA of all the nutrients excepting riboflavin which was found to be consistently deficient in all the planned diets. The calorie was deficit to an extent of 1.6 per cent for heavy workers and two per cent for moderate workers. The protein, calcium and iron contents of the diets for moderate and heavy workers were found to be in excess to an extent of 25 per cent and 54.6 per cent, 123 and 150 per cent, and 259 and 299 per cent respectively. The supply of β carotene was greater to an extent of 83 and 125 per cent and for vitamin C, 150 per cent excess when compared to RDA.

5. When the prepared diets were analysed in the laboratory for protein, calcium, iron, thiamine, riboflavin and vitamin C all the values were either lesser than the calculated values indicating the cooking losses as well as varietal differences.

6. With regard to the consumption of menu the following were observed.

(a) In both the moderate and heavy workers the cereal and pulse allowances of RDA was greater than their normal eating capacity. The deficit of cereal consumption was 6 and 9 per cent and the deficit of pulse was 12.5 and 16.2 per cent in moderate and heavy workers.

(b) The quantity of other vegetables, roots and tubers, green leafy vegetables, fats and oils were found to be slightly excess with very minor deficits in their diets. The deficit ranged from 3.3 to 12 per cent. The main reason for the deficit is due to inadequate intake of cereals and pulses in which preparation and all these vegetable taken were incorporated.

(c) The milk, sugar and jaggery consumption were found to be adequate in both the groups of men studied, which is mainly due to the coffee intake.

7. Though the food consumption was slightly lesser than the RDA, the intake of all the nutrients except calories and riboflavin were excessively supplied by the diets consumed by the subjects. This was because of higher nutrient content of the planned diets. The excesses observed were upon 16 and 42 per cent for proteins, 109 and 125 per cent for calcium, 235 and 270 per cent for Iron, 83 and 84 per cent for P carotene 36 and 25 per cent for thiamine, 20 and 33 per cent for niacin and 122 and 134 per cent for ascobic acid for moderate and heavy workers respectively.

It was concluded that moderate and heavy workers could consume all the foods to a great extent as per the recommended allowances, of foods. The supply ofnutrients by these diets was found to be very high, deviating very much from the recommended allowances of nutrients. Riboflavin and calorie requirements alone were not fulfilled by these diets. These could be overcome if more attention is paid to include riboflavin rich foods in the meal planning.

The major suggestion that could be made to the industrial canteen are

1. If the existing menus in the canteen can be slightly modified with the inclusion of increased quantities of foods

that are lacking in the home diets-namely pulses, green leafy vegetables, milk and milk products and fats and oils it would help them to get adequate nutrients.

2. While planning the menus for the canteen the selection of good quality of foods which are rich sources of vitamins and minerals would heep in fulfilling nutrient adequacy even if the quantity of foods are slightly less than the normal amounts.

3. Efforts can be taken to provide the tomato and some vegetables in the raw form to increase the vitamin C content.

Apart from these suggestions it is recommended that further research is needed to find out the bioavailability of cooking losses and other factors which prevent the availability of nutrients. Further testing of RDA with other age groups, as well as people with different income levels would be of great value to strengthen the present findings.

*****

References

REFERENCES

Achaya, K.T.
1979
"Pattern of fat intake in developing countries"
Indian Journal of Nutrition and dietetics.
Vol. 16, No. 5
PP 215-217

Aykroyd, W.R.,
Padmavdhan V.M.
and Rangamathan.S.
1963
"The nutritive value of Indian foods and the planning of satisfactory diets" National Institute of Nutrition, ICMR, Hydarabad, India
PP 16-17

Danik, M.D
1977
"Major nutritional problems"
Smarth Hind
Vol 21, No. 4
Page121

Bhattacharya.S
1982
"Nectar of the earth"
Homescience
Vol. 20, No. 8
Page 8

Dudhar, M.N,
Ravikumar,V.,
Sree Ramulu, U.S.
1976
"Milk for millions"
Homescience
Vol. 19, No. 7
PP 5, 10

Burton B.T
1976
"Human nutritional requirements"
Human Nutrition
III Edition, Published by H.J. Heie and Co. Megraw Hill, 1976, P. 153.

Charely, H.
1982
Food Science, II Edition, John Willey and Sons, Newyork, Chichester, Blisbanu, Toronto, Singapore.
PP. 210-407

Clarence, I.D.
1974
"Balanced diets for different regions ofIndia".
Nutrition.
Volume.8,
PP. 22-24.

Cravioto, J, and Periscardia, E.R
1976
"Mal nutrition in early child food"
Food and Nutrition
Volume 24, P.2.

Darke, S.J.
1981
"Assessing the nutritional status of the population". Nutritional problems in Modern Society,
Ed. by Howard, A.N. John Libbey and Co Ltd., London, PP. 128-131.

Davidson, S, and Passmore, R.
1971
"Human Nutrition and Dietetics,
Fourth Edition, Reprinted, E & S Living Stone, PP. 13-15.

Devadas, R.P. and Easwaran, P. 1975

"Recommended Dietary Allowances" The Manual on basic principles of Foods and Nutrition, PP 53-68.

Devadas, R.P. and Krishnamoorthy 1968

"Introduction" Indian Journal of Nutrition and Dietetics Volume 5, P. 3.

Devadas, R.P. Vijayalakshmi, R. and Mary Francis 1976

"Standardisation and Nutrient analysis of Nine Commonly used South Indian recipes". Indian Journal of Nutrition and Dietetics Volume 13, PP. 199-201

Devadas R.P. and Easwaran, P. 1975

"Recommended, Dietrary Allowances" The manual on basic principles of F Foods and Nutrition, PP 53-54

Devadas, R.P. Vijayalakshmi, R., and Charely, A 1980

"Nutritional Status of the expectant mothers and their offspring". Indian Journal of Nutrition and Dietetics Volume 17, No.8, PP 275-279.

Devadas, R.P 1983

"Food comes First" Journal of Homescience Volume 21, No.3-10, P-4.

Devadas R.P
1983
"Importance of good nutrition and the supply ofnutrients from foods". The School lunch Programme. P.5.

Devadas, R.P.
1984
"Food for man from the past to the future". The Indian Journal of Nutrition and Dietetics. Volume 21, No.8, PP. 271-279.

Dispatch
1977.
"A look at the dietary standard for Canada". Health and Welfare Canada, No. 39, PP. 1-4.

English, R
1982
"Dietary guidelines for Australians" Food and Nutrition
Volume 39, No.3, PP. 112-114.

Eleanor, N.P.
Mickle, S.J.
and Duke, C.M.
1985
"One day and 3-day nutrient intakes by individuals Nation wide Food consumption survey findings". Journal of American dietetic Association, Volume. 64. No. 12 PP. 313-321.

Fao
1977
"Dietary fats and oils in human nutrition Food and Nutrition. PP3

Ghosh, S. and
Mam Mohan
"Breast Feeding" Indian Journal of Nutrition and Dietetics.
Volume 15, No.8.
PP. 280-282.

Gopalan, C. and Narasinga Rao, B.S 1968 — Dietary allowances for Indians special report series, No.60 ICMR. Hyderabad, India

Gopalan.C Ramasastri.S.C., Balasubramanian 1971 — "Nutritive Value of Indian foods" National Institute of Nutrition ICMR, Hyderabad, India. PP 26-114

Gopalan.C Narasinga Rao, B.S 1974 — Diet and allowances for Indians special report series No.60 ICMR. Hyderabad, India

Gopalan. I. 1982 — "Better Nutrition of low cost" Nutrition. Volume 16. No.7 P. 21.

Gordon B.M. 1963 — "Why we Choose the foods we do" Nutrition To-day Vol. 18, No. 2 P. 8.

Harper. E.A. — "Recommended Dietary Allowances, Are they what we think they are?" Journal of American Dietetic Association. Vol. 64 No. 2 P. 154.

Harper E.A. 1980 — "Recommended dietary Allowances" Nutrition reviews Vol.38, No. 8 PP. 290-204

Hamilton E.M.N. and Whitney E.N. 1979 — "Improving your diet" Nutrition concept and Controversies west publishing Co. Minnesota. PP 301-306.

Hertzler D.A and Anderson H.L 1974 — "Food guides in U.S." Journal of American Dietetic Association Vol. 64. No. 1

Horrade B. 1981 — "Sprout and Cook" Journal of Homescience Vol. 19 No. 3 P 5.

Horton E.S. 1982 — "Effects of low energy diets on work" American Journal of Clinical Nutrition Vol. 35 PP. 1228 - 1233.

ICMR 1974 — "Nutrition value of pulses" NIN - Hyderabad - India Annual Report

ICMR 1976 — Nutrition Annual report of Director General P.65.

ICMR 1981 — Recommended dietary intake for Indians, ICMR 'New Delhi. P.2

IUNS 1982 — "Recommended dietary intake and allowance around the world". An introduction of ICNB Committee Report, Foods and Nutrition Bulletin Vol.4, No.4, PP. 34-43.

Jyotila, S.
1978
"Wonderful world of vegetable"
Journal of Homescience
Vol. 16, No. 8
Page 7.

Krishnamurthy. N
and Subbulakshmi P.A.L.
1976
"Metabolic profile of women,
college students"
Indian Journal of Nutrition and
dietetics Vol 13, No. 2 P 29.

King, M.A.E.,
Morley C.D.,
and Burgen P.A
1968
"Nutrition for developing countries
oxford universities.
PP. 6-10

Madhukar, R.S.,
Deepshikha Dutta,l
Mathad S.C
1982
"Process pulses for Better Nutrition"
Journal of Homescience
Vol. 20, No. 8,
P. 3.

Medved. E.
1973
"Planning"
The world of food
Corr and Co., PP. 5-6.

Murray Keith.T
1983
"Canadian dietary standards
past and present."
Vol.4, No.2 PP. 5-6.

National Nutrition
advisory Committee
1965
Report of the sub-Committee of the
National nutrition Advisory Committee on
Nutrit journal requirements of working
class families PP. 1-9.

Nagarajan. V
1983
"Nutrition at the door steps"
Journal of Home Science
Vol. 21, No.6, PP. 18-20.

NIN
1984
"Mineral Composition of Pulses"
Nutrition news.
Vol. 5 No. 2
P. 12.

Nirmala Bansal and
Usha Mehta
1985
"Study of dietary pattern of manual workers of Chickanwass village of Hisar".
The Indian Journal of Nutrition and dietetics.
Vol. 22, No.6, P.P. 243-246

NRC
1964
Recommended dietary allowances, sixth revised edition.
Report of food and Nutrition board.
P.P. 1-25.

NRC
1974
Recommended dietary allowances eighth revised edition food and nutrition board, NRC Washington D.C P.P. 1-60.

NRC
1968
Recommended dietary allowances
Reprint and circular series
Revised 1968, No. 129 NRC, Washington D.
P.P. 1-5.

Patwardhal V.N
1958
Dietary allowances for Indians Calories and proteins special report series, No. 35 I CMR

Patel. H.N and Waghmare S.K.
1972
Audio vesual aids as perceived and used by Mukhyasevikas of Applied Nutrition programme. Indian Journal of Homescience Vol. 6, No. 2. P. 114.

Paramjit Aujila, S.S. Miglani and A.J. Singh
1983
"A comparative study on the nutrients intake among different income, occupation and family size categories in rural areas of Punjab".
The Indian Journal of Nutrition and Dietetis.
Vol. 20 No. 4. P.P. 4-6.

Peckham G.C.
1974
"Foundations of food preparation "
3 Edn. Macmillan publishing co., Inc., New York, Macmillan Publishers, London, P.P. 9-10.

Philip T.E
1981
"Planning of Meals" Modern cookery for teaching and trade, Vol. 1
P.P. 111-120.

Pike, R.L., and Brown M.L.
1967
"Nutrition and integrated approach."
John Wiley and Sons Inc.,
P.P. 367-450.

Puri. R
Pritz and Gamra. S.R
1983

"Seasonal variations in nutrient intake of urban families".
Indian Journal of Nutrition and dietetics
Vol. 20. No.4, P.P. 270-275.

Ramadasmurthy. V.,
Lakshmi Kantham. M
Nadamuni. N.
and Mohanram. M
1983

"Nutrition profile and scope for nutrition education of industrial workers".
Indian Journal of Nutrition and dietetics.
Vol 20. No. 4. P.P. 118-120.

Ramanamurthy. P.S.V.,
and Nakshayani. R.
1962

Indian Journal of Medical Research
Vol 52 P. 804.

Ramanamurthy P.S.V.
and Belavady. B
1966

Indian Journal of Medical Research
Vol. 54 P. 977.

Rao. G.P.
Mallikarjuna. K.
and Rao GG.
1980

"Nutritional evaluation of some green leafy vegetables".
Indian Journal of Nutrition and dietetics.
Vol. 17. No. 1 P.P. 9-12.

Rao V.K.
1967

Journal of Nutrition and dietetics
Vol. 4 No. 3 P. 79.

Roberts L.G.
1958

"Beginnings of the recommended dietary allowances". Journal of American Dietetic Association.
Vlo. 3 No. 9 P. 903.

Shank E.R
1958
"Revised recommended dietary allowances"
Journal of American dietetic Associate
on Vol. 34, No. 9 P.910

Srikantia S.G.
and Malavady, B
1961
"Clinical and biochemical observations
in phyrnoderma"
Indian Journal of Medical Research
Vol. 49 P. 109.

Swaminathan M.S.
1981
"Brain power and freedom from hunger"
Proceeding ofthe Nutrition Society of
India Vol. No. 26.
P.P. 8-13.

Swaminathan M
1967.
The Nutrition and feeding of
Industrial workers in developing
countries.
Journal of Nutrition and Dietetics
Vol. 4 P.P. 131-142.

Sahni. N.S.
and Bhatt C.M.
1982
"Eat Well to live Well"
Journal of Homescience
Vol. 20. No. 4
P.P. 3-4

Shetty. R
and Palvardhan M.V
1981
Fruity Treatness
Journal of Homescience
Vol. 19, No. 9-10.
Page No. 16.

Thimmayamma B.V.S
1983
"Nutrition and welfare of the family"
Nutrition Vol. 17, No. 3.
P. 14.

Varley. H
Gowentock A.H and
Bell.M
1980
Practical clinical bio chemistry,
Vol. 1, fifth edition
P.P. 970-976

Vijayalakshmi P.
and Devaki. S.R.
1976
Nutritional status of expectant
mothers belonging to two different
income levels.
Indian Journal of Nutrition and
dietetics
Vol. 13. No. 3,
P.P. 62-65.

WHO
1969
A manual of developing countries in
the Western Public Region of the
W H O 7 Manual P.P.

White Head,
Roger. G
1980
Dietary Allowances of Energy and
Nutrients - Nutrition Planning
Vol. 3, No. 4.

Wilson H.E.C.
and Mitra D.D
1938
Indian Journal of Medical Research
Vol. 26, No.
P. 131.

Appendices

APPENDIX - 1.

A QUESTIONNAIRE USED TO ELICIT INFORMATION ON SOCIO-ECONOMIC BACKGROUND AND DIETARY PATTERN OF THE SELECTED SUBJECTS.

DIET SURVEY

1. Name of the investigator :

2. Name of the interviewee :

3. Name and address of the head of the family :

   a) Door No. :

   b) Address :

4. Income of the head of the family :

5. Composition of the family

   Type of the family : Joint / Nuclear

   Religion and Caste :

   Vegetarian/Nonvegetarian :

   Vegetarian but takes eggs :

S.No.	Name of member	Relation to the head of the family	Marital status	Age in years	Education	Occupation	Income per month

6. MONTHLY EXPENDITURE PATTERN

S.No.	Items	Rupees Spend/Month	Percentage of Income
1.	Food		
2.	Clothing		
3.	House rent - taxes		
4.	Education		
5.	Medicine		
6.	Fuel and Light		
7.	Pansuperi and Tobacco Alcoholic drinks.		
8.	Durable goods		
9.	Transport		
10.	Other services		
11.	Remittances (Debt repayment)		
12.	Savings.		

7.a) Do you maintain accounts for food expenditure : Yes / No.

If yes, in what form? : Daily / Weekly / Monthly

Written

Memory

7.b) Details of food expenditure:

Foods	Quantity purchases/ obtained/ month	Total cost Rs.	Normal frequently of purchase	Percentage of food expenditure
CEREALS:				
Raw rice				
Boiled rice				
Wheat				
Maida				
Jowar				
Bajra				
Maize				
Ragi				
Sago				
Tapicco				
Others(Specify)				
PULSES:				
Red gram dhal				
Black gram dhal				
Bengar gram dhal				
Green gram dhal				
Horse gram dhal				
Cow gram				
Others (Specify)				
ROOTS AND TUBERS:				
Potato				
Carrot				
Yam				
Colocasia				
Others (Specify)				

GREEN LEAFY VEGETABLES:

Amaranthus

Others (Specify)

OTHER VEGETABLES:

Brinjal

Beans

Pumpkin

Ladies finger

Tomato

Others (Specify)

FRUITS:

Plaintain

Guava

Papaya

Others (Specify)

NUTS AND OILS:

Gingelly Oil

Goundnut Oil

Cocoanut Oil

Vanaspathy

Others (Specify)

FLESHY FOODS:

Mutton

Fish (fresh)

Fish(Dried)

Chicken

Egg

Beef

Others (Specify)

MILK AND MILK PRODUCTS:

Milk

Curds

Butter Milk

Ghee

SUGAR AND JAGGERY:

Sugar

Jaggery

Others (Specify)

PREPARED FOODS:

Biscuits

Pickles

Papads

Sweets

BEVARAGES:

Tea

Coffee

Others (Specify)

8. Meal Planning:

Is planning done in advance?

Yes	No	Reasons

If yes, what is the basis for planning?

a) Total family requirements.

b) Money available and other items of expenditure.

c) Likes and dislikes of family members.

d) Any other.

9. DAILY MEAL PATTERN:

Days	Breakfast	Lunch	Tea	Dinner
First day				
Second day				
Third day				

10. Foods produced at home:

Are you possessing any of the following?

Kitchen Garden Poultry Dairy

If yes.

Items	Production per year No. or volume	Use of produce	
		By the family	Gifts or Sale

11. Methods of cooking:

Food items	Baking	Steaming	Frying		Stewing or roasting	Others
			Shallow fat	Deep fat		
Cereals						
Pulses						
Green Vegetables						
Eggs						
Meat						
Fish						
Others						

12. Foods preserved:

Food	Methods of preservation	Period which preserved	Problems encountered	Prepared food purchased from outside

13. In feeding who do you consider the most important person in the family:

	Individual	Reasons
First		
Second		
Third		

14. Satisfaction/Dissatisfaction with the way family is fed.

Satisfaction/Dissatisfaction	Reasons	Suggestions

APPENDIX 2

FOOD CONSUMPTION THROUGH HOME AND CANTEEN DIETS

(all in grams)

Detail	Cereals	Pulses	green leafy vegetables	other vegetables	Roots and Tubers	Fruits	Milk	oil and fat	sugar and jaggery	Butter Milk
Moderate Worker										
I	375	20	45	70	70	30	65	30	20	200
II	415	35	—	70	52	45	25	25	20	100
III	410	20	—	80	50	25	25	30	20	170
IV	380	20	—	65	50	25	15	30	20	130
V	415	80	85	90	38	25	20	25	20	100
	397	31	9	71	50	34	29	27	20	140
Heavy workers										
I	535	75	—	70	45	25	30	25	20	200
II	650	25	—	70	95	25	50	35	40	100
III	425	35	—	70	50	35	70	25	30	100
IV	300	45	—	70	60	30	50	25	20	150
V	370	25	—	70	60	30	65	30	20	200
	406	41	9	65	60	31	57	28	26	150

APPENDIX 3

Nutrient consumption of workers through the home and canteen

Details	Protein gms	Calories K.Cal	Calcium mg	Iron mg	β-carotene µg	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
Moderate worker									
S-1	41	1943	266	26	903	1.569	0.799	21.37	45
S-2	51	1861	395	29	798	1.437	0.654	17.22	54
S-3	36	1795	243	23	753	1.30	0.378	17.85	47
S-4	38	2193	351	21	852	1.115	0.719	17.12	47
S-5	43	1943	266	26	906	1.38	0.827	19.55	48
Mean	40.05	1948	313	24.25	850	1.36	0.677	10.62	46
Heavy worker									
S-1	50	2540	377	24	850	2.679	0.725	26.63	109
S-2	69	3412	875	48	1010	2.47	0.935	28.15	44
S-3	44	2033	312	22	990	1.246	0.7217	17.95	45
S-4	44	1919	353	25	851	1.446	0.80	18.67	47
S-5	37	2293	351	21	550	1.09	0.694	17.12	98
Mean	49.8	2421.2	453.5	29.8	850	1.360	0.677	18.62	48.2

APPENDIX-4

NUTRIENT VALUES AS CALCULATED ---- MODERATE WORKERS --1 DAY.

Details	Protein (mg)	Energy (K.Cal)	Calcium (mg)	Iron (mg)	βcarotene (µg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vit.C (mg)
Cereals	42.7	1796.5	112.75	33.55	43.5	1.5225	0.4225	20.85	--
Pulses	17.84	268	58.4	4.64	105.6	0.36	0.1525	2.32	--
Green leafy Vegetables	3.5	55	455	46.12	--	--	--	--	--
Other vegetables	0.725	18.75	18	0.6	43.25	0.01	0.0345	0.375	6.75
Roots & Tubers	0.468	54.6	56	1.6	765	0.064	0.02	0.54	13.2
Fruits	0.27	6	14.4	0.12	105.3	0.036	0.018	0.12	8.1
Milk	6.25	123.5	283.5	0.4	205.8	0.1	0.335	0.2	2.5
Oil and fat	--	300	--	--	--	--	--	--	--
Sugar and jaggery	--	160	--	--	--	--	--	--	--
Miscellaneous (Chillies Tamarind)	1.325	38.45	27.5	1.51	66.251	0.666	0.143	0.322	39.19
TOTAL	73.078	2882.8	1025.55	90.541	1604.6	2.7585	1.12	24.807	83.35
RDA	55	2800	400.500	20	3000	1.4	1.5	19	50
% difference	+ 32.86	+2.9571	+127.9	+352.705	.	46.506	25.33	+ 36.56	+66.7

APPENDIX-4

B) NUTRIENT VALUES AS CALCULATED FOR MODERATE WORKERS--II DAY

Details	Protein Gms.	Energy K.cal	Calcium (mg)	Iron (mg)	βCarotene (µg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vit. C (mg)
Cereals	33.1	1658.5	84.75	20.35	—	1.7925	0.3275	19.55	0
Pulses	19.04	343.6	57.35	4.38	03.95	0.3045	0.1045	7.84	0
Green leafy vegetables	5.0	56.25	496.25	31.87	6900	0.0375	0.375	1.5	123.75
Other vegetables	2.235	28.8	32.7	0.93	23.55	0.054	0.028	0.5	7.6
Roots and Tubers	1.255	121.15	47	1.15	11	0.005	0.613	0.183	16.1
Fruits	0.36	34.8	5.1	0.27	23.4	0.015	0.024	0.151	2.1
Oil and fat	—	360	—	—	—	—	—	—	—
Sugar and jaggery	—	160	—	—	—	—	—	—	—
Milk	6.25	123.5	283.5	0.4	205.8	0.1	0.335	0.2	2.5
Miscellaneous	1.78	0.82	46	5.2	52.8	8	0.014	0.14	0.6
Total	60.02	2915.05	016.65	67.17	7256.3	2.407	1.8175	30.29	152.25
RDA	55	2800	400.500	20	3000	1.4	1.5	19	50
% difference	+25.49	+4.10	+125.92	+225.85	+141.87	+71.92	+21.16	+59.42	+204.5

APPENDIX-4

C. NUTRIENT VALUES AS CALCULATED FOR MODERATE WORKERS--- III DAY.

Details	Protein gm	energy K.cal	calcium mg	Iron mg	Carotene µg	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
Cereals	30.4	1642.5	42.75	19	---	0.9975	0.2375	18.05	0
Pulses	19.2	272.4	11.2	6.56	32.8	0.356	0.188	1.64	0
Greenleafy vegetables	4.475	44	416.3	27.82	7314	0.0525	0.285	1.05	52.5
Other vegetables	1.95	14.0	69.5	2.475	117.5	0.055	0.0425	0.525	27.5
Roots & Tubers	1.35	52.5	60	1.7	952.5	0.06	0.02	0.55	1.6
Fruits	0.6	23.6	35	0.12	6	0.008	0.012	0.04	25.2
Milk	6.25	123.5	283.5	0.4	205.8	0.1	0.335	0.2	2.5
Miscellaneous	0.9	46.8	29.65	1.815	35.25	0.0285	0.069	0.240	17.1
Oil and fat	---	360	---	---	---	---	---	---	---
Sugar and jaggery	---	160	---	---	---	---	---	---	---
Total	65.125	2776.3	8040.4	59.89	8532.38	1.6575	1.19	21.995	127.3
RDA	55	2800	400-500	20	3000	1.4	1.5	19	50
% difference	+18.40	-1.2	+133.2	+199.45	+184.41	+18.39	-20.66	15.76	154.6

APPENDIX-34

D) NUTRIENT VALUES A COLCULATED FOR HEAVY WORKERS— 1 DAY.

Details	Protein g	Emergy K.cal	Calcium mg	Iron mg	β.Carotne µg	Thiamine mg	Reboflevin mg	Niacin mg	Vit. C. mg
Cereals	50.7	2251	157.5	38.58	43.5	2.32	0.46	0.48	25.6
Pulses	17.84	268	58.4	4.84	105.6	0.86	0.152	2.32	—
Green leafy vegetables	3.5	55	455	48.12	—	—	—	—	—
Other vegetables	0.735	18.75	18.0	0.6	43.25	0.01	0.0345	0.375	6.75
Root and tubers	0.468	54.6	56	1.6	765	0.064	0.02	0.54	13.2
Fruits	0.27	6	14.4	0.12	105.3	0.036	0.018	0.12	8.1
Milk	6.25	123.5	283.5	0.4	205.9	0.1	0.335	0.2	2.5
Miscellaneous									
(Chillies, Tamarind	1.325	36.45	27.5	1.51	56.251	0.066	0.143	0.322	39.15
Oil and fat	—	450	—	—	—	—	—	—	—
Sugar and Jaggery	—	220	—	—	—	—	—	—	—
Groundnut	13.1	285	38.5	1.55	0	0.195	0.065	11105	0
Total	86.31	3770.3	1085.75	96.51	1335.7	3.6348	1.2085	33.96	69.7
RDA	55	3900	400-500	20	3000	2	2.2	26	50
% age difference	+56.92	-8.22	+146.27	+382.55	-55.476	+81.74	-45.088	+30.61	+39.4

APPENDIX —4

B. NUTRIENT VALUES AS CALCULATED FOR HEAVY WORKER — II DAY

Details	Protein g	Energy k.cal	Calcium mg	Iron mg	Carotene mg	Thiamine mg	Riboflavin mg	Niacin mg	Vit.C mg
Cereals	45.2	2269	114.5	27.8	—	2.425	0.445	28.7	0
Pulses	17.84	278	58.4	4.64	105.6	0.36	0.152	2.32	0
Green leafy vegetables	5-0	65.25	496.25	31.87	6900	0.0375	0.375	1.5	123.75
Other vegetables	2.75	39.5	126.8	1.44	119.1	0.083	0.008	0.57	8.8
Roots and Tubers	1.255	121.15	47	1.15	11	0.065	0.613	0.183	16.1
Fruits	0.36	34.8	5.1	0.27	23.4	0.015	0.024	0.18	2.1
Milk	6.25	123.3	383.5	0.4	205.8	0.1	0.338	0.2	2.5
Miscellaneous	1.78	6.82	46	5.2	52.8	—	0.014	0.14	0.6
Oil and fat	—	450	—	—	—	—	—	—	—
Sugar and jaggery	—	220	—	—	—	—	—	—	—
Groundnut	13.1	285	38.5	1.55	0	0.195	0.065	11.05	0
Total	91.38	3920.4	1205	73.475	7399.75	3.173	2.021	42.16	153.85
RDA	55	3900	400-500	20	3000	2	2.2	26	50
% difference	+66.14	+256	+167.77	+267.37	+146.65	+58.65	-8.13	+62.15	+207.7

APPENDIX —4

F. NUTRIENT VALUES AS CALCUTED FOR HEAVY WORKERS —— IXI DAY

Details	Protein gm	Energy K.cal	Calcium mg	Iron mg	Carotene µg	Thiamine mg	Riboflavin mg	Niacin mg	Vit.C mg
Cereals	41.6	2259	58.5	26	—	1.365	0.325	24.7	0
Pulses	19.2	272.4	111.2	5.56	52.8	0.356	0.108	1.64	0
Green leafy vegetables	4.475	44	416.5	27.82	7314	0.0525	0.285	1.05	52.5
Other vegetables	2.16	17.6	72.2	2.61	128.3	0.061	0.059	0.66	29.3
Roots and Tubers	1.35	92.5	60	1.7	952.5	0.06	0.02	0.55	1.6
Fruits	0.6	23.6	36	0.12	6	0.008	0.012	0.04	25.2
Milk	6.25	123.5	283.5	x 0.4	205.8	0.1	0.335	0.2	2.5
Miscellaneous	1.625	54.05	37.5	2.475	37.8	0.01	0.015	005	33.75
Oil and fat	—	495	—	—	—	—	—	—	—
Sugar and jaggary	—	220	—	—	—	—	—	—	—
Total	77.41	3018.55	1084.9	67.715	8547.53	2.0045	1.2385	28.905	151.55
RDA	55	3900	400-500	20	3000	2	2.2	26	50
% difference	+40.74	-9.26	+ 141.27	+238.575	+184.91	+0.225	+43.704	+11.173	+203.1

APPENDIX - 5

NUTRITIVE VALUE OF THE PLANNED MENUS AS ANALYSED IN THE LABORATORY - IN COMPARISON WITH THE CALCULATED VALUES

Details	Protein gms	Calcium mg	Iron mg	Thiamine mg	Riboflavin mg	Vitamin. C mg
I Day (Analysed)	70	914	73	2.15	0.99	12
Calculated	73	1026	90	2.76	1.12	83
Percent difference	-4	-11	-19	-22	-11.6	-86
II Day (Analysed)	67	962	55	2.20	1.04	10
Calculated	69	1017	68	2.41	1.018	152
Percent difference	-3	-5	-19	-6	-43	-93
III Day (Analysed)	63	939	54	1.55	0.87	27
Calculated	65	1049	60	1.66	1.19	112
Percent difference	-3	-10	-9	-6	-27	-76

APPENDIX - 6

NUTRITIVE VALUE AS ANALYESD IN THE LABORTATORY ♂ HEAVY WORKERS

Details	Protein (gm)	Calcium (mg)	Iron (mg)	Thiamine (mg)	Riboflavin (mg)	Vitamin C. (mg)
I Day (analyed)	82	933	83	2.42	1.08	12
Calculated	86	1086	96	3.63	1.21	69
% defference	-4	-14	-14	-33	-10	-81
II Day (Analysed)	89	1190	86	2.85	1.44	10
Caluclated	91	1205	75	3.17	2.02	153
% Defference	-2	-8	-12	-10	-28	-93
III Day (Analysed)	75	1010	60	1.79	0.99	32
Calculated	77	1084	86	2.00	1.24	152
% difference	-3	-6	-12	-10.5	-20	-79

APPENDIX-7

MEAN FOOD CONSUMPTION OF MODERATE WORKERS (DURING THE FEEDING EXPERIMENT)

(in grams)

Details	Cereals	Pulses	Green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Milk	Oil and fat	Sugar and jaggery
S - I	437.80	69.85	118.22	75.51	83.84	26.75	200	36.83	40
S - II	442.22	73.6	119.82	89.44	85.38	30.89	200	37.16	40
S - III	427.57	67.98	119.82	68.11	87.01	28.08	200	37.8	40
S - IV	431	70.57	119.88	72.13	94.96	27.85	200	38.76	40
S - V	439.58	70.92	119.88	70.34	89.226	26.9	200	36.95	40
S - VI	451.54	69.62	120.02	72.14	92.56	27.57	200	56.95	40
S - VII	457.51	67.07	119.88	70.70	92.72	27.34	200	34.36	40
S - VIII	430.16	69.37	115.125	69.05	84.185	26.49	200	32.79	40
S - IX	433.69	70.9	113.93	78.27	95.03	27.06	200	30.55	40
S - X	443.70	69.29	113.93	71.7	94.46	27.42	300	35.28	40
Mean	437.58	69.917	118.05	71.33	89.93	27.63	200	36.41	40

APPENDIX—8

FOOD CONSUMPTION OF HEAVY WORKERS DURING THE FEEDING EXPERIMENT (in gms)

Details	Cereals	Pulses	green vegetables	Other vegetables	Roots & Tubers	Fruits	Milk	Oil and fat	Sugar jaggery	Ground nut
S - I	592.64	70.38	123.20	82.76	83.01	30	200	42.15	55	33.33
S - II	551.39	60.68	119.80	80.82	90.19	30	200	43.17	55	33.33
S - III	589.13	66.02	118.78	85.99	90.92	30	200	46.25	55	33.33
S - IV	588.48	67.81	116.04	88.51	83.04	29.53	200	45.62	55	33.33
S - V	578.31	70.90	119.62	91.10	77.83	27.54	200	38.82	55	33.33
S - VI	606.14	61.26	120.11	84.11	91.80	28.33	200	41.65	55	33.33
S - VII	600.01	71.215	116.31	85.99	86.97	28.94	200	45.42	55	33.33
S - VIII	609.29	68.94	123.53	93.79	91.54	28.33	200	49.83	55	33.33
S - IX	608.11	68.42	121.45	85.71	92.53	28.33	200	49.89	55	33.33
S - X	568.10	63.17	121.24	88.56	87.75	27.75	200	40.89	55	33.33
Mean	589.66	66.92	120.03	85.39	87.55	28.875	200	44.96	55	33.33

APPENDIX - 9

NUTRIENT INTAKE OF HEAVY WORKERS

Details	Protein gm	Energy K.cals.	Calcium (mg)	Iron (mg)	Caroyene Mg	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C. (mg)
S - I	84	3352	1026	75	5611	2.51	1.35	32.07	119
S - II	73	3183	997	71	5486	2,43	1.31	30.16	117
S - III	77	3366	1014	73	5504	2.5	1.35	31.86	118
S - IV	78	3377	993	72	5336	2.50	1.34	31.64	114
S - V	77	3268	1012	73	5438	2.47	1.30	56.98	118
S - VI	78	3363	1009	74	5496	2.52	1.35	33.44	118
S - VII	79	3410	1007	73	5373	2.54	1.36	32.08	117
S - VIII	80	3460	1039	76	5667	2.56	1.38	32.59	115
S - IX	78	3440	1026	75	5582	2.55	1.37	32.59	119
S - X	76	3273	1015	73	5555	2.44	1.33	31.34	119
Mean	78	3349	1074	74	5505	2.49	1.43	34.48	117

APPENDIX - 10

NUTRIENT INTAKE OF MODERATE WORKERS

Deatils	Protein (gm)	Energy K.cals	Calcium Mg	Iron (mg)	Crotene ug	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C. (Mg)
S - I	62.9	2627.7	944	67	5474	1.90	1.298	21.8	112
S - II	61.7	2656	951	68	5506	1.90	1.2959	31.137	111
S - III	64	2594	945	67	5529	1.87	1.29	21.424	111
S - IV	60	2605	953	67	5580	1.89	1.32	21.68	113
S - V	63.53	2612	947	67	5512	1.917	1.31	21.96	111
S - VI	63	2673	950	67.98	5644	1.95	1.33	22.3	112
S - VII	60	2584	948	67	5502	1.89	4.3	21.82	112
S - VIII	67	2536	929	65.7	5356	1.87	1.28	21.68	110
S - Ix	68	2630	945	66	5356	1.90	1.31	12.68	110
S - X	68	2633	931	67	5350	2.01	1.38	22.22	109
Mean	64	2616	944	67	5481	1.9	1.31	22.73	111