NUTRITION IN TAMIL NADU

RAJAMMAL P. DEVADAS,
M.A., M.SC., PH.D. (OHIO)
Principal, Sri Avinashilingam Home Science College,
Coimbatore-11

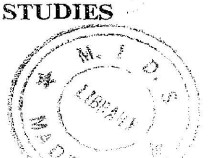
PUBLISHED BY

SANGAM PUBLISHERS, MADRAS - 600001

FOR

MADRAS INSTITUTE OF DEVELOPMENT STUDIES

WITH THEIR ASSISTANCE



Sangam Publishers, 11, Sunkurama Chetty Street, Madras-600001

© *Madras Institute of Development Studies*

First Published, November 1972

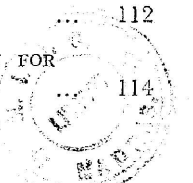
Printed in India
by Tax and Company Law Press,
84, M. K. N. Road, Guindy, Madras - 32

CONTENTS

Chapters		*Page*
	PREFACE BY DR. MALCOLM S. ADISESHIAH ...	v
I	INTRODUCTION—GOALS OF NUTRITION POLICY AND PLANNING FOR TAMIL NADU	1
II	PRESENT STATUS OF NUTRITION IN TAMIL NADU ...	10
III	CURRENT EFFORTS TO COMBAT MALNUTRITION IN TAMIL NADU	28
IV	CONCEPT OF NUTRITION PROGRAMMES	34
V	THE STRATEGIES FOR A TWELVE-YEAR NUTRITIONAL PLAN FOR TAMIL NADU	39
VI	ADMINISTRATION OF NUTRITION PROGRAMMES ...	57
VII	BUDGET FOR THE TWELVE-YEAR TAMIL NADU NUTRITION PLAN	62
VIII	NUTRITION RESEARCH	67
IX	AN INTEGRATED APPROACH TO NUTRITION PLANNING FOR DEVELOPMENT	76
X	INTER-DEPARTMENTAL COLLABORATION IN NUTRITION PROGRAMMES OF THE FUTURE	78
XI	EVALUATION OF NUTRITIONAL PROGRAMMES ...	81
XII	FOOD—ADULTERATION AND CONTAMINATION ...	86

Annexures

I	INTEGRATED NUTRITION FROM NURSERY SCHOOL THROUGH SECONDARY SCHOOL	98
II	CURRICULUM IN PRINCIPLES OF FOOD AND NUTRITION (BASIC COURSE FOR ALL COLLEGE STUDENTS MAJORING IN HUMANITIES)	112
III	CURRICULUM IN THE SCIENCE OF NUTRITION FOR COLLEGE STUDENTS IN SCIENCES	114



Annexures		*Page*
IV	Curriculum in Nutritional Education for Colleges of Teacher Education	117
V	In-service Teacher's Training Course for Nutrition Education in Schools	121
VI	Practical Nutrition	123
VII	Curriculum in Science of Nutrition for Medical Students	128
VIII	Curriculum in the Science of Nutrition for Students of Agriculture and Animal Husbandry	131
IX	Curriculum in the Science of Nutrition for Students of Food Engineering	134
X	Midday Meal Menu Pattern for Pre-school Children 3 to 6 Years of Age	137
XI	Results of Studies on the Midday Meals Scheme in Sri Avinashilingam Basic School ...	139
XII	Daily Food for Expectant and Nursing Mothers	146
XIII	Daily Food for Adolescent Girls and Boys ...	150
XIV	Budget Estimate for the Department of Nutrition	154
	References	156
	List of Tables	160
	Index	162

PREFACE

NUTRITION is part of health. The problems of nutrition are universal. They are found among well-fed as well as ill-fed persons, among affluent families and communities as well as among poor ones. A recent report in the United Kingdom states that the people there who go to bed every night after over-eating spend £100 million annually on slimming. In our country too, nutrition problems are found among the rich and well-to-do largely as a result of over-eating and eating the wrong foods. If this was the problem of nutrition, then the curious definition of nutrition, given in the first edition of the Encyclopaedia Britannica, in 1771, would seem to be adequate. Nutrition in the animal economy, it explains, is the repairing of the continuing loss, which the different parts of the body undergo. The motion of the parts of the body, the friction of these parts with each other and especially the action of the air would destroy the body entirely, if the loss was not repaired by a proper diet, containing nutritive juices; which, being digested in the stomach and afterwards converted into chyle, mix with the blood and are distributed through the whole body.

The problem of nutrition as analysed in this monograph has a double dimension. First, it is the end result of all the elements which determine and inter-act on the life of the child, the mother, the adult and the aged—physical, ecological and cultural. The physical factors include the quantity and quality of food production in the community, its distribution and delivery, the institutional frame-work and the physical and mental work involved for the individual. The ecological factors include the flora and fauna, the air and water surrounding the individual. The cultural elements refer to the educational background, dietary habits, values and traditions of the individual and the family and the general health and hygienic standards of the people, For the individual, nutrition is a function of all these varied forces.

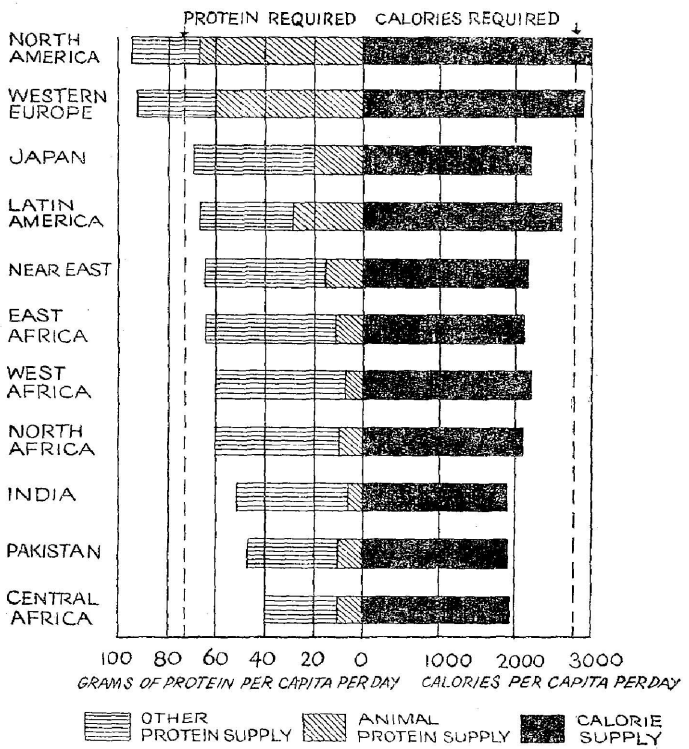
The other dimension is the level of living of the person, the community and the country. If nutrition is part of health,

malnutrition is a part of disease which is the tragic accompaniment of poverty. It is in the context of poverty—of a people living at or below the poverty line, which for this Country and State can be defined as the consumption of 2,200 calories—that the problem of nutrition takes on tragic overtones. Of the 540 million people living in this Country, one quarter, that is 130 million men, women and babies, go to bed hungry every night. If the present situation is not corrected, we would have 12 million hungry people in this State by 1980. Hunger results from insufficient food intake. Our National Sample Surveys for 1953, 1960 and 1964 show that this sub-normal food intake has had identical consequences on the poor families in all the three years: large families with low survival rate; a conservative, lethargic and quarrelsome temperament induced by starvation; a high rate of infant and maternal morbidity and mortality ranging from 60-70 per cent; mental retardation and brain damage to the pre-school child; the 25 millions who are ill at any point of time and suffer from derived ailments that can be causally traced back to bad feeding; 3 per cent of total working time or Rs. 800 crores lost in sickness and Rs. 400 crores being spent by the families on medicines. According to the cynical values that are then generated, a sick child who was mis-conceived, is ill-fed and unwanted is a greater monument to the folly—personal, familial and national—of malnutrition than the one which dies of hunger early in his doomed career.

This culture of poverty is not, of course, unique to India and Tamil Nadu. The following table devised by the Club of Rome Scientists in *The Limits to Growth*—A Potomac Associates book by Donella H. Meadows, Dennis L. Meadows, Jorgen Randers and William W. Bahrens III, Universe Books, New York 1972—and reproduced with their kind permission illustrates the current inequalities in the world protein and calorie intake.

The table shows that daily protein and calorie requirements are not being supplied to most areas of the world and that inequalities of distribution exist not only among regions, but also within regions. Lines indicating calories and proteins required are those estimated for North Americans. The assumption in that table is that if diets in other regions were sufficient to allow

people to reach full potential body weight, requirements would be the same everywhere.



Source: UN Food and Agriculture Organisation, Provisional Indicative World Plan for Agricultural Development (Rome: UN Food and Agriculture Organisation, 1970).

The United Nations Protein Advisory group tells us that twenty per cent of all children under five in Asia, Africa and Latin America suffer from protein malnutrition and twelve million of them die annually. By contrast it reports that improved diet in Japan has led to a two-inch increase in the average height of its children. The damage in the developing countries is more extensive because protein deficiency in pregnant and

lactating mothers, about seventy per cent of whom live in the rural areas, must add to this tragic toll. This is the vulnerable group in our vulnerable society—the pre-school child and the young mother. Protein deficiency between the ages of one and five in a child is irremediable. That is the time when its brain is formed and protein deficiency during that period can so irreparably damage its brain that no amount of good schooling or good food later can repair the damage. Of course, the underfed everywhere are vulnerable ; they are and ought to be the prior concern of any planning for a plan is only as strong as its people. But the light of well-being cannot be brought to the lives of 130 million men and women all at once. For the adult, aged and infirm, the State must be content to supplement piece-meal what they can do for themselves; their health and character today are a function of the conduct and habits of their childhood. The past for them is a prison-house. But the child and mother of today bound by ties of frailty are the pliant resources of the future; they represent an investment and are a feasible and an imperative priority whose character can become destiny.

The current nutritional situation of Tamil Nadu portrayed in the monograph is disturbing. According to the Diet Atlas of India reproduced in Table 2 of this publication, Tamil Nadu has the lowest mean per capita daily consumption of calories and proteins among the thirteen States listed—36 grammes for protein and 1,498 for calories as against the All-India mean of 53 and 1,985 and the allowance of 44 and 2,400 recommended by the ICMR. The 1961 Food Habit Survey in Tamil Nadu of the Census Department which shows a mean per capita consumption unit of 2,500 calories has a per capita requirement of 2,800. The National Sample Survey for 1969-70 records the consumption expenditure in Tamil Nadu according to which 55 per cent of the households spend less than 79 Paise per head per day which is the money equivalent of the minimal 2,200 calories and which marks off poverty from bare sufficiency. The calorie intake that obtains in the case of children below three years is 700 against the recommended 1,200 per day. For pregnant and lactating mothers, it is a third short of the recommended 2,500 to 2,900 calories. For the general adult population, it is 600 short of the recommended 2,200 calories. As a result of malnutrition, the average weight at

birth of a child is 2·73 kg. Infant mortality has been computed at 62·5 per thousand live births, one-third of these deaths being mainly due to nutritional disorders.

Against this background, the major nutrition programmes operating in the State are a valiant but ineffective attempt to stem the swelling tide. The *Kuzhanthaikal Kappagams* through its six variants feed about 90,000 pre-school children and 35,000 pregnant and nursing mothers. The midday meal school programme feeds 18·2 lakh school children for 200 days in a year. The 77 industrial canteens feed 30,000 children. The special nutrition programme feeds 1·15 lakh 6—30 months old children in tribal areas or urban slums. The health centres provide food for 35,000 children. The nutrition programmes in force thus cover over 21 lakh children, including a little less than three lakh pre-school children, out of a total of some 40 lakhs living below the poverty line. The 35,000 mothers who are currently projected represent less than a twelfth of those needing attention. Apart from this quantitative problem there exist problems of administration and of quality. Finally, the programmes are either sceptical of education for health and nutrition or there are not enough funds for them. What people can be taught to do for themselves is always greater than direct physical intervention which ameliorates but does not ennoble.

The nutrition programme proposed in the monograph assumes an effective food production and distribution network. The 59 per cent of total requirements of calories from rice, *cholam*, *cumbu*, wheat, *ragi*, and other cereals can be met for all the people in the State with the help of the new agricultural technologies. It is now necessary to extend this technology to bridge the protein gap in the State through intensified production of pulses, oilseeds, vegetables, fruits and through expanded animal and fish farming. This is rather important because of the popular trend to supplement deficit diets with protein or amino-acids. Lysin fortified bread or other amino-acid enriched foods constitute a good nutrition programme in the over-fed, affluent countries. For India and Tamil Nadu, where protein deficiency is a part of total energy deficiency, the effort should be to make available a sufficient cereal/pulse-based diet together with milk and eggs at the weaning age. Such a diet will meet

both the caloric and protein needs of the child, the mother and the adult. This points to the technological need to maximise the caloric and protein yield of our agricultural and other inputs. Again in a situation, where the food, that in the first place is not enough to go round, is also beyond the means of the majority, the production and technology programme must be accompanied by a mass distribution mechanism so that the foods reach the mother and the child in the poor sector. What is left undone by the price mechanism must be remedied by nutrition intervention.

The time-bound three-point programme proposed for the State covers nutrition and health education, feeding the target groups of pre-school children and pregnant and lactating mothers and the evaluation of the programme. Nutrition, as stated earlier, is part of health and is the result of constant and continuous education aimed at changing our food habits and family and individual living traditions. The monograph details the consequential educational programmes necessary for the school, college, teacher training institutions, adult and community education institutions and medical and other professional groups and a programme of nutrition research which will directly support the education and action programmes.

The feeding programme is directed at the vulnerable group of pre-school children and mothers. Through expanded *Kuzhanthaikal Kappagams* and pre-primary sections, creches, immunization and nutrition rehabilitation programmes, 47·7 lakh of pre-school children will be fed at a cost of Rs. 123 crores over the period 1972-83. This investment is a major responsibility for both the State and the Centre and is part of the anti-poverty priority to which the planning process is committed. The resources for the programme can be mobilised from the drives to be launched during the Fifth Plan, particularly from increasing surpluses to be found in the rural areas. A restructured school feeding programme is proposed for the Education Department. The programme for feeding pregnant and lactating mothers in the primary health and maternity and child welfare centres at a cost of Rs. 30 crores (not elaborated in this publication) should be added to this target feeding programme. The barest outline of a long term programme of nutrition for vulnera-

ble adolescents and adults has also been suggested to which the State will have to turn its attention after the Sixth Plan.

Finally, an inbuilt evaluation instrument in the whole programme will continuously test the delivery and the effects against the goals and feed-back the results in order to improve the performance of each specific programme and the effectiveness of the total effort. The evaluation design is also capable of taking stock of increments of standards and well-being that accrue to the masses of people through planned economic effort. In order to introduce a degree of uniformity in the evaluation of the different nutrition programmes based on varying criteria, a pro forma evaluation outline has been proposed. The study makes a strong plea for an integrated, autonomous administrative agency to be headed by a Director with five divisions under him—one each for Research and Planning, Education and Extension, Evaluation, Food Administration and Food Development and Processing. Such a sub-system should be part of an integrated administration of Health, Family Planning and Nutrition working in close liaison with the Departments of Agriculture, Education, Labour and Local Administration and Community Development in the State. At the district, Block, Primary health and mini-health centre levels, there will be both integration and unification of health, family planning and nutrition services.

There is a concluding section on food toxicants—exogenous as well as endogenous. Nutrition as analysed in the monograph presupposes foods that do not contain poisons themselves and are free from natural contaminants and injurious man-made additives. In a sense this section should be the starting point of the publication. In thestate, food is susceptible to contamination atall three stages of production, distribution and consumption. The dangers are particularly great in public eating places through which the major part of the nutrition programme is to be implemented. It is, therefore, proposed that health education of citizenry and school children be designed to deal with these hazards. The task of the educator could be made easier by severe deterrent punishment, sanctions for which already exist in the Public Health Acts, Tamil Nadu, against the deliberate habitual offender rather than, the ignorant one. Food analysts' laboratories forming part of the preventive health machinery in

the district and consumer associations need to be expeditiously established.

This publication is the result of studies and analysis of the nutrition situation in Tamil Nadu undertaken by Mrs. Rajammal Devadas aided by a group of specialists to help the State Planning Commission develop its Perspective Plan for the State in Health, Family Planning, Nutrition and Sanitation. This, the study has achieved. In her studies, Mrs. Devadas has received valuable help from several specialists in Health and Nutrition in various Departments of Governments, medical institutions, and voluntary agencies in the State and the Country, Unesco and the Tamil Nadu Nutrition Project staff. The statistical parts of the study have been aided by statistical specialists from the Government and the Madras Institute of Development Studies. She traces her inspiration to many international, national and State personalities, including the founder of her institution. One of them in particular—the Tamil Nadu Chief Minister, she has found necessary to quote:

> "இன்றைய அரும்புகள் நாளைய மலர்கள்", இன்றைய மழலைகள், நாளைய நமது மரபு காக்கும் மாண்புறு செல்வங்கள்.....பிஞ்சு வயதிலேயே சத்து மிக்க உணவைக் குழந்தைகளுக்கு வழங்குவது அவைகளின் முழு வளர்ச்சிக்கு இன்றியமையாதது"—

The views, judgments and conclusions set forth in the study are, however, entirely the responsibility of Mrs. Rajammal P. Devadas—the accepted nutrition specialist of Tamil Nadu and India. I commend the study to the attention of the appropriate departments of the State Government and subject specialists in the Country.

Madras,

29th June, 1972.

CHAPTER I

INTRODUCTION — GOALS OF NUTRITION POLICY AND PLANNING FOR TAMIL NADU

HUMAN nutrition is not simply availability and intake of food. Good nutrition and malnutrition are the end results of many interacting factors operating simultaneously and concurrently on the individual in the physical, ecological and cultural environment of the community. The amount of various foods and nutrients reaching the different segments of the population depend on food production, availability, logistics of distribution, cultural and economic systems, educational levels and food habits of the people. All these factors contribute towards the total health status. Nutrition is thus closely related to several aspects of human life. Not based on such an understanding, our present approaches towards the problems of health and nutrition are rather fragmentary, sporadic, intermittent and isolated, leading to duplication and avoidable waste in effort and expenditure. Integration of educational, medical, nutritional and public health, including family planning services is, therefore, imperative.

Economic growth is essential for the eradication of hunger and malnutrition. Increased per capita income that accompanies economic growth will not in itself, however, solve the problem of malnutrition. Wealth does not necessarily eliminate malnutrition though poverty prevents people from buying the food they need. Malnutrition in the early years reduces the productive capacity of adults (1). Physically, they lack the energy and stamina which are essential for satisfactory work. Furthermore, malnutrition might lead to stunted growth and mental retardation of the young. Chronic and severe malnutrition in childhood increases the chances of children becoming poor readers and poor writers (2). These, in turn, may lead to defects in neuro-integrative functioning, to school failure and subsequent subnormal adaptive abilities. This chain of events constitutes a vicious

cycle, which has a 'spiral' effect on society, causing a low level of adaptive functioning, non-application of modern knowledge to every day living, undesirable social customs, infections and insufficiency of food. All these factors contribute to malnutrition, which leaves a large pool of survivors who function in sub-optimal ways and become a drag on an already limping economy.

Malnutrition lowers a community's resistance to disease resulting in higher morbidity which has extensive social consequences. Accident rates are higher among the malnourished groups, who tire easily and quickly. Apathy, lethargy and lack of initiative are the common characteristics of poorly fed groups. In the past, this apparent sluggishness was frequently attributed to laziness, indolence, an attitude of fatalism or other so-called 'ethnic traits'. The FAO has reported that those countries with the lowest per capita daily protein and calorie consumption are also those with the lowest productivity (3).

Deficiency diseases are extremely insidious in that they sap the vitality of people to a considerable degree. Many people who presume that they are well may be victims of several deficiency conditions. Certain nutritional deficiencies, such as acute inadequacy of Vitamin A, which may ultimately result in blindness, limit productivity. In India, there are today at least one million cases of blindness attributable to this cause alone (4) (5). The blind become a drain on society with little or no opportunities to contribute to it. Such blindness could easily be prevented by spending a few paise on each individual. This minimum investment could avert large economic losses likely to accrue to the society due to the incidence of blindness which might seriously cripple the whole developmental effort. The medical costs necessary to treat the final effects of malnutrition, either through hospitals or health centres, are many times greater than the cost of providing the necessary nutrients to prevent malnutrition initially (6).

A solution to the problem of malnutrition is so urgent that it cannot wait upon a satisfactory level of economic growth (7). Neglecting it will mean holding back economic growth for an indefinite period. In fact, certain aspects of economic growth

could be achieved faster and more effectively, if nutritional programmes aimed directly at bettering the social conditions of people were undertaken. People have to be educated in the types and quantities of food that they and their children need, and on how to produce or procure nutritious foods at minimal costs.

Our efforts towards improving social conditions are being thwarted constantly by over-population. Since population explosion has been accentuated by an increase in life expectancy and fall in death rate, it may seem unbelievable that improved nutrition, which actually helps to save more lives, could aid in limiting the population (8). The fact is that a large number of people want to have more children than either they or society can afford in order to be sure that at least one or two will survive. Their fear is well founded because the infant and child mortality are still high in Tamil Nadu and in India. If measures were taken to increase the chances of the survival of the first two children as a result of better nutrition, parents might feel much less impelled to have further children, and would accordingly be far more psychologically receptive to the ideas and methods of family planning. The continuing thrust of the population explosion is far less due, than is often supposed, to ignorance or lack of contraceptive methods.

Malnutrition, especially Protein Calorie Malnutrition (PCM) and infections, have a synergistic influence on health specially of children. Hence it is essential to examine the various causal and co-existing factors responsible for malnutrition in communities, before a meaningful preventative programme can be chalked out.

In Tamil Nadu, the major causes of malnutrition are :

Low income and consequent low purchasing power ;

Ignorance of nutritional needs and lack of knowledge about commonly available nutritive foods. Certain harmful traditional habits, customs and beliefs regarding meals ;

Infections and infestations ; and

Other factors connected with poor food and living habits and household tensions.

Low Income

Judged by any parameter, the purchasing power of the majority of the people is low. The cost of foodstuffs, particularly of animal origin, such as milk, eggs, meat and fish is beyond the reach of many families. Furthermore, most families in the lower economic strata need to feed many members. The number of children per family is large — usually five. Besides these children, aged dependents — one or both of the children's grand parents, relatives such as widowed sister(s) and aunt(s), may live with the family. Hence a family may consist of 8 to 9 persons with only one member earning. Consequently families may not have even two square meals for all the members, far less, special foods for children.

However, in the so called lowest economic strata in cities inhabiting slums, often more than one member of the family earns Rs. 1—2 daily as labourer, casual labour, and a sweeper or a domestique. They can meet the basic necessities of food and clothing from their earnings. But it has been found that women of the lower economic strata in Madras city spend a sizeable part of their daily wages on non-food items such as cinema, tea and flowers. As for food, rice and a little *kozhambu* with or without small bits of fish for flavour are all that is consumed. No special food is provided for weaned infants except perhaps an occasional *Appam* or *Iddly*. Instead of milk, an apology for coffee is given which only depresses the appetite (9).

Ignorance

The ignorance of parents results in the following predisposing causes of malnutrition among infants:

Failure to breast feed adequately;

Over dilution of fresh or canned milk and baby foods to make supplies go longer;

Using unhygienic and wrong techniques in bottle-feeding; and

Failure to give any supplementary food; misuse of supplementary foods; unsuitable supplementary foods; starting the right ones too late; giving suitable foods

wrongly prepared and supplementary foods in inadequate quantities.

Even in the better off families, malnutrition among infants and children is common because of ignorance and certain traditions and beliefs about feeding. Some dietary habits which are rooted in local custom but still lead to malnutrition in children include :

Feeding children on arrowroot conjee, which contains practically no protein, over prolonged periods during and following an attack of diarrhoea.

Routine use of laxatives such as castor oil and milk of magnesia ;

The use of coffee, as diet instead of milk ;

Use of gripe water and tonics which can easily pay for less expensive but more nutritious foods ;

Starving prolonged fevers like typhoid and other illnesses ;

Cautionary exclusion of curds and fruit juices for fear of bringing on colds and coughs ; and

The belief that nutritious foods such as dhall, egg, meat, fish, groundnuts, Bengal gram and green leafy vegetables will cause indigestion.

Infections and Infestations

Infections and malnutrition constitute a vicious cycle, especially among children ([10]). Parasitic infestations cause and contribute to under-nutrition. A great deal of morbidity and mortality in the population of Tamil Nadu is due to infections taking a serious turn because of malnutrition. The common infections and infestations which affect the children of Tamil Nadu are :

Intestinal infections ;

Parasitic infestations ;

Respiratory infections, tuberculosis in particular ; and

Other infections like whooping cough and measles.

The major factors responsible for the severity of infections when they do occur are :

Poor nutrition ;

Poor environmental sanitation ;

Ill-ventilated and over-crowded houses ; and

Unhygienic habits.

Other Factors

Malnutrition among pre-school and school children is often due to the following remediable factors :

The eating of sweets and oily snacks, made and sold unhygienically ;

Inadequate lunch at school, rushing through meals, especially in the morning and at noon ;

Anxiety and tension during meals ;

Over-anxiety of elders about the child's eating habits ;

Disturbed parent-child relationships ;

Inadequate sleep and rest ; and

Inability of working mothers to look after their children.

Thus even under present conditions, at least 50 per cent of border-line cases of malnutrition occurring among children in Tamil Nadu — and for that matter among adults — can be prevented through dissemination of effective nutrition information and extensive distribution of low cost nutritious foods.

Combating Malnutrition

Combating malnutrition calls for a simultaneous, multi-pronged approach which involves :

Production of nutritionally valuable foods in adequate quantities ;

Making those foods available to all sections of the population by subsidising, where necessary, foods specially for vulnerable groups ;

Dissemination of knowledge regarding nutrition through all media of publicity ;

Improvement of environmental sanitation ;

Making available protected water supply ; and

Immunization.

Goals of Nutrition Policy in Tamil Nadu

The long term goal of the State Government is achievement of optimum nutrition for every single individual living in Tamil Nadu. The production and distribution of adequate nutritious foods, the augmentation of purchasing power in the hands of the the poor and the education of all the people affected by this programme and on the scale necessary for the achievement of the objective are formidable tasks indeed. The State should, therefore, define and delimit its time-bound plans clearly and unequivocally and set the tasks for each five-year period. Planning has to be with these clear tasks in view in order to benefit immediately the vulnerable sections of the population, namely, infants, toddlers, pre-school children, expectant and nursing mothers and adolescent boys and girls. The Plan must sow the seeds for general improvement in food habits. The overall objectives for nutrition planning in Tamil Nadu should, therefore, aim to:

Improve the expectation of life at birth and reduce infant, child and maternal mortality, by providing integrated educational, health, medical and nutritional services;

Raise the present nutritient intake of all segments of population to the levels recommended by the Indian Council of Medical Research (ICMR) with particular reference to the vulnerable sections—infants, weaning and pre-school children, expectant and nursing mothers and adolescent boys and girls, below the 'Poverty line' † ([11]);

Gear food production and distribution to the above objectives in such a way that all segments of the population become productive individuals, realising their full potentials for growth; and

Impart nutrition education to all sections of the population.

† Poverty line([11]) is the expression adopted by V. M. Dandekar in his book 'Poverty in India'. It is defined in terms of per capita consumption expenditure below which point it is impossible for a family to obtain sufficient food for maintenance. For Tamil Nadu, this expenditure is 79 Paise per capita which will supply 2,200 calories daily. Per capita includes adults and children.

The objectives outlined above can be realised by coordinated action programmes under a well knit Department of Nutrition, having specific goals, both immediate and long term.

Immediate

Immediate actions are required to:

Integrate nutritional feeding with all services needed by the pre-school child such as education and health care;

Impart nutrition education in all schools and colleges, to all mothers and children participating in feeding programmes and to planners, administrators and personnel in government and other departments;

Increase substantially the number of children in the 3 to 6 years age group fed through *Kuzhanthaikal Kappagams* (*Balwadies*) to cover 17.4 lakhs children from households below the 'Poverty line' by 1984. This is to be achieved by opening 12,500 *Balwadies* and attaching a pre-primary section to each of the 15,300 out of the 30,600 primary schools;

Organise 3750 Nutrition Rehabilitation-cum-Demonstration centres in different Districts to impart nutrition education to mothers of 3.75 lakhs severely malnourished children;

Reach 1.05 lakh children below 30 months age through pilot projects of Creches or Day Care Centres with nutritious weaning food;

Improve the nutritional feeding programmes for expectant and nursing mothers and increase their number from 33,540 to 4 lakhs, in such a way that those below the 'Poverty line' are covered to the greatest extent possible; and

Organise all the existing and new feeding programmes to provide for its beneficiaries at least one-third of the daily caloric and nutrient requirements.

Long Term

The long term goals are to:

Reach all sections of the population with nutrition education to improve their food habits through intervention

in the school and college curricula, professional programmes and extension and publicity activities. A complete network of nutrition and health education centres is needed to involve all categories of medical and health workers, school teachers, social workers, administratois, planners and leaders of the community so that they may, in turn, educate and involve every man, woman and child of the State;

Make available nutritious foods to all people, subsidising the prices where necessary;

Increase per capita consumption of calories and nutrients to the levels recommended by ICMR—by increasing and coordinating production efforts, and by streamlining distribution mechanisms; and

Plan and implement action-oriented research projects on nutrition which will help in finding ways and means of reaching the above goals expeditiously.

CHAPTER II

PRESENT STATUS OF NUTRITION IN TAMIL NADU

THE parameters used to define the present status of nutrition in Tamil Nadu are :

Consumption of calories, proteins and other nutrients by the different segments of the population ;

The dimensions of the population to be fed ;

Heights and weights of children ;

Morbidity due to malnutrition ; and

Infant and child mortality.

A knowledge of all these related parameters is an important basis for planning nutrition programmes. There has so far been no integrated approach to the study of all these variables. Nevertheless, there are many small geographically limited studies which provide a general picture of the current status of nutrition, in terms of one parameter or another, mentioned above.

Consumption of Calories by the Different Segments of the Population

A number of studies conducted between 1960-69 under the auspices of the ICMR, give an idea of the mean consumption of calories and nutrients in the different states. These studies have been summarised in the Diet Atlas of the ICMR (1971)([12]) and compared with ICMR's Recommended Allowances for Calories and Nutrients for Indians([13]) given in Table 1.

TABLE 1 — Daily Allowances of Nutrients for Indians

(Recommended by the Nutrition Expert Group in 1968)

Group	Particulars	Calories	Proteins (g)	Calcium (mg)	Iron (mg)	Vitamin A		Thiamine (mg)	Riboflavin (mg)	Nicotinic acid (mg)	Ascorbic acid (mg)	Folic acid (ug)	Vitamin B_{12} (ug)	Vitamin D (IU)
						Retinol (mg)	Carotene (ug)							
Man	Sedentary work	2400						1·2	1·3	16				
	Moderate work	2800	55	0·4 to	20	750	3000	1·4	1·5	19	50	100	1	
	Heavy work	3900		0·5				2·0	2·2	26				
Woman	Sedentary work	1900						1·0	1·0	13				
	Moderate work	2200	45	0·4 to	30	750	3000	1·1	1·2	15	50	100	1	
	Heavy work	3000		0·5				1·5	1·7	20				
	Pregnancy	+300	+10		40	750	3000	+0·2	+0·2	+2	50	150		
	(second half of pregnancy)			1·0								300	1·5	
	Lactation (upto 1 year)	+700	+20		30	1150	4600	+0·4	+0·4	+5	80	150		
Infants	0–6 months	*120per kg	2·3–1·8 kg*		1·0 mg	400	——							
	7–12 months	*100per kg	1·8–1·5 kg*	0·5 to	per kg						30	25	0·2	
Child	1 year		17	[0·6		300	1200							
	2 years	1200	18	0·4 to	15to	250	1000	0·6	0·7	8				200
	3 years		20	0·5	20									
	4–6 years	1500	22			300	1200	0·8	0·8	10				
	7–9 years	1800	33			400	1600	0·9	1·0	12				
	10–12 years	2100	41			600	2400	1·0	1·2	14	30 to	50 to	0·5 to	
Adoles-	13–15 yrs. Boys	2500	55	0·6 to	25	750	3000	1·3	1·4	17	[50	[100	[1·0	
cents	13–15 yrs. Girls	2200	50	0·7	35			1·1	1·2	14				
	16–18 yrs. Boys	3000	60	0·5 to	25	750	3000	1·5	1·7	21				
	16–18 yrs. Girls	2200	50	0·6	35			1·1	1·2	14				

* Kg of body weight

Table 2 gives the daily per capita consumption of calories and proteins in the different states.

TABLE 2 — **Mean per Capita Daily Consumption of Calories and Proteins in the Different States of the Indian Union** (12).

Number	Name of the State	Proteins in grams	Calories
1.	Andhra Pradesh	53	2040
2.	Bihar	56	1865
3.	Gujarat	54	1612
4.	Haryana	Not available	
5.	Jammu—Kashmir	63	2265
6.	Himachal Pradesh	Not available	
7.	Kerala	47	1842
8.	Madhya Pradesh	98	2779
9.	Maharashtra	68	2281
10.	Mysore	66	2220
11.	Punjab	84	2832
12.	Rajasthan	77	2044
13.	Tamil Nadu	36	1498
14.	Uttar Pradesh	66	2307
15.	West Bengal	48	1927
	All India	53	1985
	ICMR's Recommended Allowances (18)	44	2400

Tamil Nadu ranks lowest among the States with regard to the mean consumption of calories and proteins. The per capita food consumption in Tamil Nadu based on 114 surveys, conducted by the ICMR is given in Table 3.

TABLE 3 — **Per Capita Mean Daily Food Consumption in Tamil Nadu** (12).

Number	Food Items	Consumption in grams		ICMR's Recommended Allowances (18) in grams
1.	Rice	288	356	370
	Wheat	11		
	Other cereals	57		
2.	Pulses	16		70
3.	Milk and milk products	26		180
4.	Meat, fish and eggs	13		35
5.	Leafy vegetables	8		110
6.	Other vegetables	52		125
7.	Fruit	5		37
8.	Fats and oils	6		38
9.	Sugar, jaggery	6		40
10.	Condiments	20		Not given

Except for cereals, the intake of all other foods is much below the levels recommended by the ICMR. The staple diet consists of rice, cumbu, cholam or ragi to which, a few grams of red gram (dhall) are added in the preparation of *sambhar*. Some amount of black gram is consumed through *iddlies* or *dosais*. Consumption of green leafy vegetables is negligible. Consumption of other vegetables is seasonal—availability and the amount often being inadequate. Fats, oils, sugar and jaggery which are sources of calories are used in very small quantities for seasoning. Milk and milk products are scarcely taken, even though people are aware of the importance of these foods. Meat, fish and eggs are consumed rarely. Consumption of fish is somewhat better along the coastal areas.

The Statewide Food Habit Survey (14) conducted by the Census Department in 1961, was based on oral enquiry, involving recall. The consumption pattern as shown by that survey is given in Table 4.

TABLE 4—**Food Consumption Pattern in Tamil Nadu—1961.**

Number	Foods		Mean Consumption per Consumption Unit (CU) (grams per day)
1.	Rice and other cereals	...	577
2.	Pulses	...	37
3.	Vegetables	...	79
4.	Fruits	...	57
5.	Milk and milk products	...	68
6.	Sugar and jaggery	...	51
7.	Fish, meat and egg	...	17

This survey records a mean daily consumption of 2500 calories per Consumption Unit,† for Tamil Nadu. Although the caloric intake is adequate, the mean consumption of foods other than cereals is lower than the recommended levels.

† The number of men, women and children of different age groups in a household is converted into Consumption Units with reference to the caloric requirement of an average man, namely, 2800 calories taken as one Consumption Unit.
Therefore the figure derived on the basis of Consumption Unit is bound to be larger than that derived on Per Capita basis.

The National Sample Survey (NSS)([15]) has compiled data on monthly consumption expenditure. Table 5 gives the distribution of people spending different amounts per month in Tamil Nadu.

TABLE 5 — **Percentage Distribution of Population according to Monthly Per Capita Expenditure Classes in 1969-70 in Tamil Nadu ([15]).**

Monthly Per capita Expenditure Classes (in Rupees)	Percentage Distribution of Population		
	Rural	Urban	State
0— 8	0·1	0 2	0·1
8—11	0·8	0·2	0·6
11—13	1·7	0·7	1·3
13—15	2·5	0·9	1·9
15—18	6·9	2·9	5·3
18—21	12·1	4·1	8·9
21—24	11·5	5·6	9·1
24—28	13·3	9·4	11·8
28—34	17·1	13·3	15·6
34—43	15·7	15·9	15·8
43—55	9·5	18·9	13·2
55—75	5·7	12·6	8·5
75 and above	3·1	15·3	7·9
All classes	100·0	100·0	100·0

Judged by the consumption expenditure in Tamil Nadu, based on the National Sample Survey ([15]) nearly 55 per cent of the households spend less than 79 Paise per day per head, yielding minimum of 2200 Calories. Thus based on the 1972 cost of living index, 79 Paise represents the quantified poverty line.

In addition to knowledge of per capita food intake of a population, it is necessary to know the consumption pattern of its different segments, particularly the vulnerable ones, pre-school children and expectant and nursing mothers. Table 6 provides an abstract of many food intake studies conducted by Sri Avinashilingam Home Science College, Coimbatore.

TABLE 6—**Calorie and Nutrient Intake of Selected Groups in Coimbatore District.**

Group	No. of students	No. of subjects	Calories	Protein	Calcium	Iron	Vitamin A	Riboflavin	Vitamin C
Age in years				grams.	mg.	mg.	I. U.	mg.	mg.
0—2½	3	26	637	19	234	27	253	0·2	25
R.A.			1200	18	450	17	750	0·7	40
2½—5	11	79	868	25	218	16	378	0·9	17
R.A.			1400	21	450	17	900	0·8	40
6—10	22	184	1100	30	250	22	900	0·7	22
R.A.			1800	33	500	20	1500	1·1	40
11—12	11	87	1400	32	350	25	800	0·7	25
R.A.			2100	41	500	20	2250	1·2	40
13—16	14	110	1500	40	300	26	600	0·7	25
R.A.			2400	55	650	30	2250	1·3	40
16—21	8	53	1100	50	300	30	1100	0·8	25
R.A.			2600	55	550	30	2250	1·5	40
Expectant mothers	10	89	1600	55	500	30	700	1·0	15
R.A.			2500	55	1000	40	2250	1·4	50
Nursing mothers	14	123	1500	40	400	30	1000	0·8	17
R.A.			2900	65	1000	30	3450	1·6	89

R.A. = ICMR's Recommended Allowance [18]

When these levels of calories, nutrient intakes are compared with the all allowances recommended by the ICMR, deficiences in all respects are evident.

The foregoing analyses of earlier surveys indicate the need to increase the intakes of calories and nutrients. If the calorie gap is filled, the protein need is likely to be satisfied also. Of other nutrients, deficiency of Vitamin A is crucial in the State.

The Dimensions of the Populations to be Fed

The provision of adequate and nutritious food for an entire population would be a tremendous job in any country, but much more so in a developing one where food shortage is to be ascribed to low productivity (itself a syndrome factor) coupled with the

explosion of population. According to the Census of 1971, the population of Tamil Nadu is 41 millions. Based on the past trends of fertility and mortality and on certain assumptions of growth, the population of Tamil Nadu is expected to be 55 millions by 1986. Table 7 divides the population according to age groups for 1971, and lists projections for the years 1976, 1981 and 1986, based on a corrected natural growth rate.

TABLE 7—**Population Projections and Distributions in Tamil Nadu (Age Groups).**

(in hundreds)

Age (Years)	1971	1976	1981	1986
0— 4	59928	68473	68283	68708
5— 9	48606	56875	65560	65895
10—14	44427	47840	56128	64837
15—19	41237	43688	47168	55463
20—24	37786	40242	42788	46350
25—29	34068	36688	39250	41900
30—54	112935	126485	140488	154769
55+	32046	39473	47946	57437
Total	411033	459764	507611	555359

Source: Tamil Nadu Planning Commission—1972—Mimeographed.

In Tamil Nadu, as of 1971, there are 59·9 lakhs of children below 4 years of age. This number is expected to increase to 68·7 lakhs by 1986. There are 40 lakhs pre-school children in the 2 to 4 years age group and it is expected that these will increase to 46 lakhs by 1986. This most vulnerable segment requires immediate and intensive attention.

Experience in village surveys [16] shows that, for every 1000 population, there are approximately 15 expectant women at least 30 nursing mothers, making up a State total of 6·17 lakhs expectant women and 12·33 lakhs nursing mothers. This segment of the population also requires special and immediate attention.

Caloric and Nutrient requirements of the Population

Based on the ICMR recommendations set forth in Table 1[13] the total caloric and protein requirements of the entire population are worked out as in 1971 in Table 8.

TABLE 8—**Protein-Calorie requirements for Population of Tamil Nadu according to the ICMR Recommendation (1968)**

Age group (years)	Population (lakhs)	Daily Calorie Requirements (millions)	Daily Protein Requirements (tonnes)
Less than 1	10·6	795	2·01
1	9·4	1131	16·02
2	11·8	1414	21·21
3	11·8	1414	23·56
4— 6	31·4	4713	69·13
7— 9	29·4	5286	96·91
10—12	28·5	5982	116·80
13—15	26·1	6141	137·20
16—18	23·3	6068	128·36
18+Males	114·3	32017	628·36
18+Females	114·3	25156	514·55
	410·9	90117	1754·11
Adjustment for expectant and nursing mothers — addition —		1720	50·66
Total for one day		91837	1804·77
Total requirement*	for one year	33520505	658934·50

*This estimate has not made allowances for imperfect distribution, utilisation and absorption.

Calories and Protein from Cereals and Pulses

The calories and protein content of cereals and pulses produced in 1971 are set forth in Table 9.

TABLE 9—**Calories and Protein Available from Edible Portion of Total Cereal Production in Tamil Nadu (1970-71)** [13, 17]

S. No.	Cereals	Production (tonnes)	Protein (tonnes)	Calories (millions)
1.	Rice	5303400	271534	14637380
2.	Cholam	546800	45494	1526670
3.	Cumbu	321200	29807	927630
4.	Ragi	344900	20142	905020
5.	Varagu	234900	15597	580670
6.	Samai	88600	5458	241700
7.	Maize	19260	1710	52700
8.	Wheat	514	48	1420
9.	Other cereals	54390	4496	12746
10.	Bengal gram	1520	208	4320
11.	Red gram	19470	3473	52180
12.	Green gram	10540	2531	35220
13.	Black gram	12976	2491	36020
14.	Horse gram	51080	8990	131170
15.	Other pulses	13880	3220	4402
	Total	7023430	415199	19149248

Nearly 59 per cent of the State's total requirement of calories are met by cereals. The green revolution and the advances of science and technology made in the cultivation of paddy, wheat and some other cereals, holds out the hope that the calorie-gap can be bridged. The green revolution must extend to legumes, oil seeds, vegetables, fruit and fodder crops if the lack of proteins and other nutrients is to be made good. Protein from animal sources needs to be augmented through an integrated approach to the development of animal husbandry and fisheries alongside of and in a manner similar to the intensive development of the State's agricultural potential.

Mean Lengths or Heights and Weights of Children

The average weight of a child at birth in Tamil Nadu has been computed at 2·8 kg([18]). During the first four months, growth-rates of Indian children compare well with those of their counterparts in developed countries([19]). It is after six months of age, that growth lags behind. This is mainly due to malnutrition. According to Gopalan([20]), a recent country-wide nutrition survey of thousands of pre-school children showed that the heights and weights of 90 per cent were below the 10th percentile value of the North American children of corresponding ages.

Mean length or height and weight of children in Coimbatore District have been worked out in Table 10 by age and sex. 'Standard weight' in Table 10 refers to the desirable or ideal weight for a child of a specific age and stature. These standard weights for length/height and age were computed from measurements of thousands of children in various ethnic groups in the USA over a period of several years. The standard weight for length for children aged 7-36 months were adapted from Tables of Woodbury([21]). All other standard weights for height, age and sex were taken from Baldwin-Wood Tables([22]).

TABLE 10—**Mean Length/Height and Weight of Children in Coimbatore District and Percentage Attainment of Standard Weight for Length/Height, Age and Sex.**

Age	BOYS					GIRLS				
	No. in Group	Length/ Height (cm.)	Weight (kg.)	Standard Weight for Length (kg.)	Per cent of Standard	No. in Group	Length/ Height (cm.)	Weight (kg.)	Standard Weight for Length (kg.)	Per cent of Standard
Months 7— 9	52	69·6	7·8	8·4	92·9	40	66·5	7·2	7·7	94·0
10—12	48	71·2	7·7	8·9	86·3	42	70·8	7 8	8·5	91·8
13—18	91	75·4	8·6	10·0	86·0	86	71·2	7·7	8·6	89·5
19—24	86	80·0	9·6	10·7	89·7	80	79·9	9·5	10·7	88·8
25—30	96	83·4	10 6	11·8	89·8	68	82·6	10·0	11·1	90·1
31—36	36	85·7	10·8	12·3	87·8	27	79·5	10·0	11·5	86·9
Years 3	10	92·3	13·5	14 5	93·1	9	93·7	13·3	14·1	94·3
4	17	95·8	12·8	14·9	85·9	16	96·6	13·3	15·0	88·7
5	50	101·0	15·0	16·4	91·5	55	100·4	14·2	15·9	89·3
6	122	108·6	15·8	17·8	88·8	135	105·1	15·3	16·6	92·2
7	596	112·2	17·2	19·4	88·7	595	112·0	17·0	18·8	90·4
8	442	118·6	19·1	21·4	89·3	434	117·4	18·8	21·4	87·9
9	474	123·0	20·8	23·6	88·1	427	121·3	19·8	22·7	87·2
10	76	125·1	22·4	24·2	92·5	103	122·7	20·9	23·8	87·8
11	70	128·6	24·9	26·4	94·3	80	126·7	24·1	26·9	89·6
12	146	135·2	26·6	29·6	89·9	159	138·0	28·5	32·0	89·1
13	192	138·5	29·4	31·5	93·3	202	144·1	32·9	36·7	89·6
14	221	144·1	31·6	35·5	88·7	228	147·3	35·8	42·1	85·0
15	132	151·2	37·8	40·3	93·7	165	148·0	47·7	44·0	85·7
16	105	156·9	40·0	46·3	86·3	81	149·2	40·1	45·5	88·1
17	31	161·5	45·7	52·3	87·4	36	150·6	43·9	47·0	93·4
18	18	156·7	48·6	51·3	94·9	14	149·6	42·8	46·4	92·2
19	21	166·0	48·7	59·3	82·1	4	153·0	46·5	50·7	91·7

Sources : Sri Avinashilingam Home Science College and Sri Ramakrishna Mission Vidyalaya Maruthi College of Physical Education, Coimbatore District. } Unpublished data.

That the attainment in terms of standard weight for length/height is below 100 in all the age groups shows that the nutritional status of the population surveyed is below the recommended levels. The percentile attainment and standard weight for length/height and age would have been less if the Coimbatore children had been nearer to the Western length/height average.

Morbidity due to Malnutrition

Long continued dietary deficiencies are reflected in the poor growth of children and their falling easy prey to infections. The onset of nutritional diseases can be hastened or aggravated by the frequent occurrence of a variety of infections—bacterial, viral or parasitic—which deplete the already low nutritional reserves of individuals resulting in more severe malnutrition. Malnutrition and infection constitute a vicious circle each aggravating the other.

Women of child-bearing age form another vulnerable group with respect to nutritional stress. The deficiencies of the mothers are reflected in their children[23, 24]. The frequency of pregnancy and lactation further drain the nutritional reserves of the mothers.

The wide prevalence of different types of malnutrition in the community, primarily due to inadequate diets, results in high morbidity. In a study on morbidity, some 3,284 children below 10 years of age were found to have visited the peripheral clinic of the Institute of Child Health in Madras, for one ailment or another. The pattern of morbidity is shown in Table 11.

Considering each visit to the children's hospital as a case, 43,400 cases were registered among children below five years, out of a total of 56,788 cases. This shows the high morbidity incidence in children below 5 years.

Morbidity statistics received from 16 Primary Health Centres (PHC) spread over Tamil Nadu are presented in Table 12.

TABLE 11—**Morbidity Pattern among Children below Ten Years of Age in Tamil Nadu**

Disease	AGE IN YEARS					AGE GROUPS		
	1	2	3	4	5	1—3	6—10	1—10
	Per cent							
1. Ear, Nose and Throat Ailments	48·47	41·72	41·84	45·07	50·44	44·50	46·72	44·03
2. Gastro-intestinal and Liver Disorders	25·63	28·25	25·58	22·41	18·96	23·90	18·59	22·99
3. Protein-Calorie Malnutrition—(PCM)	4·58	3·30	2·25	1·60	1·34	2·62	0·37	2·10
Vitamin A	0·50	0·66	1·06	1·64	0·75	0·94	0·99	0·97
Vitamin B	1·70	3·11	2·82	3·38	4·28	2·97	4·79	3·91
Vitamin D	0·04	0·30	0·16	0·16	—	0·14	0·02	0·12
Anaemia	—not available—					1·24	1·76	1·37
4. Infectious Diseases	3·08	2·88	3·51	3·75	2·97	3·18	2·60	3·04
5. Skin Infections	13·14	14·66	18·13	15·70	14·20	15·22	16·88	15·58
6. Miscellaneous	2·99	5·15	4·81	6·31	6·07	4·95	7·34	5·48
TOTAL	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Source: Research Dissertation of Dr. Jayam, Institute of Child Health, Egmore, Madras.

TABLE 12—Morbidity in Selected Rural Areas of Tamil Nadu

(Cases treated from 1st January 1971 to 31st December 1971)*

Diseases	1 year			13 months to 5 years			6 to 11 years			12 to 16 years		
	A	B	C	A	B	C	A	B	C	A	B	C
		%	%		%	%		%	%		%	%
Nutritional marasmus	1540	14·0	5·3	1800	16·3	4·4	1385	12·6	3·4	2074	18·8	4·7
Kwashiorkor	2321	31·3	8·0	2159	29·1	5·3	1778	24·0	4·4	503	6·8	7·1
Vitamin A deficiency	2570	15·1	8·8	4391	25·8	10·7	4189	24 6	10·3	2778	16·4	6·3
Other vitamin deficiencies	3277	9·8	11·2	4681	14·1	11·4	5168	15·5	12·7	6342	19·0	14·3
Iron deficiency anaemia	1223	5·5	4·2	2396	10·9	5·8	3070	13·9	7·6	3930	17·8	8·8
Intestinal parasites	298	3·0	1·0	2344	23·4	5·7	2378	23·7	5·9	2300	22·9	5·2
Gastro-enteritis	1967	13·4	6·7	2803	19·0	6·8	2925	19·8	7·2	2233	15·1	5·0
Other nutritional diseases	651	7·4	2·2	1280	14·6	3·1	1370	15·7	3·4	1937	22·1	4·4
Tuberculosis	140	5·3	0·5	290	11·1	0·7	318	12·1	0·8	528	20·1	1·2
Typhoid, diphtheria and poliomyelitis	103	15·4	0·4	129	19·3	0·3	89	13·3	0·2	62	9·3	0·1
Meningitis and encephalitis	112	20·8	0·4	117	21·7	0·3	119	22·1	0·3	53	9·8	0·1
Hepatitis and other liver diseases	441	11·2	1·5	593	15·1	1·4	505	12·8	1·2	693	17·6	1·5
Others	14539	11·4	49·8	18135	14·3	44·1	17307	13·6	42·6	21005	16·5	47·3
Total	29182	11·3	100·0	41118	15·9	100·0	40601	15·6	100·0	44388	17·1	100·0

A—Total cases

B—% Total cases of the particular disease

C—% Total cases in the particular age group

* *Source:* Information from 16 Primary Health Centres, covering several districts of Tamil Nadu.

A distinct pattern of morbidity for rural areas emerges when these data are collated with those in Table 11. Nearly 48 per cent of the cases treated in PHC's are directly associated with malnutrition. The incidence of nutrition-related morbidity is high in the age groups 1-5 and 6-11 years in both urban and rural areas.

A sample survey of 2,000 children examined in 12 districts of Tamil Nadu during the years 1968-69 and 1969-70 by the Directorate of Health, Government of Tamil Nadu, is summarized in Table 13.

TABLE 13—**Incidence of Malnutrition among Children**

Sign of malnutrition	Per cent
Vitamin B complex deficiency Angular stomatitis	20·0
Vitamin A deficiency	5·0
Skin conditions	4·5
Anaemia	1·0
Vitamin C deficiency	0·5

Data from another study on 39,084 school-going children in Coimbatore District are presented in Table 14.

TABLE 14—**Percentage of Pupils suffering from Various Defects/Diseases in Selected Secondary Schools in Coimbatore District during 1970-71 (25).**

	Urban		Semi-Urban		Rural		Total	
	Number	%	Number	%	Number	%	Number	%
Number of children examined	28565	100·0	5710	100·0	4809	100·0	39084	100·0
Malnutrition	9827	34·4	2673	46·8	2307	48·0	14807	38·0
Anaemia	1067	3·7	194	3·4	240	5·0	1501	4·0
Skin	1126	3·9	259	4·5	168	3·5	1553	4·0
Teeth and Gums	6752	23·6	693	12·1	664	13·8	8109	21·0
Throat	490	1·7	155	2·7	140	2·9	785	2·0
Eyes	2342	8·2	290	5·1	233	4·8	2865	7·3
Ear	181	0·6	62	1·1	46	1·0	289	0·7
Speech	69	0·2	17	0·3	8	0·2	94	0·2
Heart	320	1·1	75	1·3	54	1·1	449	1·1
Lungs	320	1·1	63	1·1	45	0·9	428	1·1
Abdomen	3131	11·0	476	8·3	317	7·0	3924	10·0
Nervous System	116	0·4	49	0·9	46	1·0	211	0·5
Other defects	2824	10·0	704	12·3	541	11·2	4069	10·4

Note: Nearly 38 per cent of the secondary school children examined were victims of malnutrition.

Data from another series of nutrition surveys carried out in some parts of Tamil Nadu from 1954-1971 are presented in Table 15.

TABLE 15—**Percentage Prevalence of Nutritional Deficiency Signs in Tamil Nadu**

Group and place	Number Examined	Vitamin A Deficiency	Vitamin B Deficiency	PCM	Anaemia
Pre-school children:		%	%	%	%
Poonamallee	305	7·0	4·0	26·6	N.A.
Tiruchirapalli	516	3·5	3·0	22·2	N.A.
Madurai	520	1·7	4·0	23·4	N.A.
School children in:					
Tamil Nadu Sample survey 1970	20300	7·1	9·4	N.A.	2·5
Pre-school children:					
Alamarathupatti	35	34·3	11·4	N.A.	N.A.
Munnailakottai	40	32·5	7·5	2·9	N.A.
Thusur	70	20·1	30·1	4·5	N.A.
Kanavaipatti	22	4·5	13·1	N.A.	N.A.
North Thaamaraikulam	153	2·0	2·0	0·6	21·6

N.A. : Not Available.

The nutritional deficiencies most observed were those of calories, protein and Vitamin A and B complex vitamins. Nutritional anaemia was prevalent among 56 per cent of the expectant mothers surveyed.

Infant and Child Mortality

Infant mortality is an indicator of the health status of a community. Much infant mortality is caused by malnutrition in the mother during pregnancy and during the first few weeks of the infant's life. The registered infant mortality rate in Tamil Nadu was 62·5 per thousand live births in 1969[26]. Nearly one-third of the total mortality is accounted for by children

below five years, of whom 50 per cent died within the first year. Table 16 presents data on mortality among children below 10 years, and is derived from a study conducted at the Institute of Child Health in Madras.

TABLE 16—**Main Causes of Mortality among Pre-school Age-group in Madras**

	Incidence of Mortality		
	All children	Pre-school age-group	Percentage of pre-school children
Number of children examined	2061	828	40·0
1. Gastro-enteritis	639	228	35·6
2. Respiratory infections	496	110	22·0
3. Marasmus	251	97	38·6
4. Kwashiorkor	122	112	92·0
5. Other nutritional disorders	129	55	42·6
6. Tuberculosis	114	58	51·0
7. Typhoid, diphtheria and poliomyelitis	44	31	70·5
8. Meningitis and encephalitis	95	29	30·5
9. Convulsive disorders	50	25	50·0
10. Encephalopathy	121	83	68·6

Forty per cent of the deaths were among the pre-school age group, and 90 per cent of those deaths were due to Kwashiorkor.

Another study of 21,100 cases treated in the Institute of Child Health in Madras in 1971 relates mortality to primary and secondary causes some of which are shown in Table 17.

TABLE 17—**Total Number of Children with Malnutrition treated in Madras Institute of Child Health during 1971**

Disease	Total Incidence		Treated as primary condition	
	Total treated	Total deaths	Total treated	Total deaths
Vitamin A deficiency—keratomalacia, xerophthalmia	5	1	1	—
Other manifestations of Vitamin A deficiency	3	—	—	—
Vitamin A deficiency unspecified	88	14	2	—
Ascorbic acid deficiency	2	—	2	—
Rickets—active Vitamin D deficiency	43	7	10	—
Other vitamin deficiency states unspecified	17	15	2	—
Protein malnutrition	471	157	389	149
Nutritional marasmus	414	136	169	62
Other unspecified nutritional deficiencies	2234	564	218	27
Iron deficiency anaemia	57	2	43	—
Anaemia unspecified	220	55	84	17
Total	3554	951	920	255

The incidence of moderate and severe malnutrition was observed in 17 per cent of total admissions; cases of severe malnutrition constituted 25 per cent of all cases of malnutrition and 4·3 per cent of the total number of admissions.

A figure of 4·3 per cent for the proportion of severe malnutrition cases to total admissions indicates a wider prevalence, since mild malnutritional cases are not generally admitted to hospital unless they suffer from secondary infections or other ailments. In a random study of 1,043 consecutive cases who attended an out-patient department, only 251 cases (24 per cent) did not show any symptoms of malnutrition.

All these studies, though limited, throw light on the enormous dimensions of the problem of malnutrition. Viewed from any angle—consumption patterns, anthropometry, morbidity rates and mortality figures—the problem is staggering. Overcoming malnutrition through concerted and co-ordinated planning and implementation of projects involving the co-operation of all departments and agencies concerned is, therefore, of paramount importance.

CHAPTER III

CURRENT EFFORTS TO COMBAT MALNUTRITION IN TAMIL NADU

MANY feeding programmes have been launched and are in operation under the auspices of the Central and State Governments and voluntary agencies in Tamil Nadu. The chief feeding programmes are described below under five headings.

1. The Kuzhanthaikal Kappagam (Balwadi) Programmes

There are different types of *Kuzhanthaikal Kappagams* based on feeding programmes for pre-school children. In some, expectant and nursing mothers are also fed. Those operating at present are:

(a) CARE (The Cooperatives for American Relief Everywhere) Feeding Programme: Under the Department of Women's Welfare and Directorate of Rural Development, there are at present 1707 *Kuzhanthaikal Kappagams* scattered throughout the State. The CARE Feeding Programme is operating for 300 days in a year benefitting 61,000 children and 30,000 expectant and nursing mothers in 1,000 of these pre-schools.

(b) Demonstration Feeding Programme: The Central Government's Demonstration Feeding Programme is being implemented in 84 *Kuzhanthaikal Kappagams* of 28 selected Community Development Blocks. In each *Kuzhanthaikal Kappagam* under this feeding programme, 30 pre-school children and 20 children, 6 to 30 months of age, are fed at a cost of 15 Paise per meal; and 30 expectant and nursing mothers at a cost of 25 Paise per head per day. Nutritious foods that are locally available are used in this feeding programme.

(c) Integrated Child Welfare Demonstration Project: In the Integrated Child Welfare Demonstration Project at Poonamallee,

2,100 toddlers and pre-school children are given midday meals, at a cost of 10 Paise per child per day.

(d) Family and Child Welfare Project: In four Family and Child Welfare Projects, with six pre-schools each, 760 children are fed at a cost of 20 Paise per child per day.

(e) Applied Nutrition Programme (ANP): In 181 pre-schools which come under the scope of the Applied Nutrition Programme (ANP), 7,240 pre-school children and 1,810 expectant and nursing mothers are given ANP-produced eggs and vegetables, when available, to supplement their meals. This programme is assisted substantially by UNICEF—United Nations Children's Emergency Fund—through the State Government.

(f) Other Kuzhanthaikal Kappagams: In 400 *Kuzhanthaikal Kappagams*, where neither CARE nor Demonstration Feeding Programmes operate, children are given puffed rice, roasted Bengal gram or other snacks.

2. Tamil Nadu Midday Meals Scheme

The Tamil Nadu Midday Meals Scheme operates in 30,603 elementary schools in the state. The scheme provides midday meals to 16·2 lakhs of pupils for 200 days in a year. The Harijan Welfare Department and the Corporation of Madras have their own schemes for supplying midday meals to two lakhs of children.

The State Government's share is limited to the recurring expenditure not exceeding six Paise per meal per child. The Local Committee has to meet the balance of recurring expenditure of not less than 4 Paise per meal per child and the entire non-recurring expenditure.

Impressed by the working of the scheme, CARE improved the nutritional contents of the school meals by supplying 100 grammes of Bulgar wheat per child for 100 days, 8 grammes of oil per child for 200 days, and 30 grammes of corn soya milk (CSM) a protein-rich, blended food, per child for 200 days.

3. The Industrial Nutrition Programme

The Industrial Nutrition Programme comes under the purview of the Department of Labour in the Government of

Tamil Nadu. The programme is applicable only to pre-school children of industrial workers and their wives who are expectant or nursing. In November 1971, there were 77 industries catering for 29,913 beneficiaries, more than 50 per cent of whom were pre-school children. The number of beneficiaries was reduced to 18,267 by January 1972, mostly because of the mounting costs of food preparation which the managements found difficult to meet.

For the Industrial Nutrition Programme, the CARE in Madras, donates Bulgar wheat at the rate of 100 grammes per head for 150 days, CSM 100 grammes per head for 150 days, and 10 grammes salad oil per head for 300 days.

4. Special Nutrition Programme

A special nutrition programme sponsored by the Central Government and implemented by the Department of Women's Welfare provides daily three slices of bread weighing 75 grammes per child. Only children who are 6 to 30 months old and live in tribal areas or in urban slums are eligible to benefit from the programme—and it now extends to 1,51,629 children.

5. Primary Health Centres (PHC)

With the help of CARE, 354 Primary Health Centres, 289 Municipal Health Centres and 101 Backward Area Centres are distributing food to 35,630 children. CARE contributes 100 grammes of wheat and CSM and 10 grammes salad oil per child for 300 days.

On-going Nutritional Feeding Programmes

The nutritional feeding programmes described above are summarised in Table 18.

TABLE 18—**On-going Feeding Programmes in Tamil Nadu**

S. No.	Feeding Programmes	No. of centres	No. of feeding days per year	No. benefitted	
				Children	Expectant and nursing mothers
1.	*Kuzhanthaikal Kappagams:*				
	(a) CARE	100	300	61000	30000
	(b) Demonstration	84	300	4200	2520
	(c) Integrated Child Welfare	50	300	2100	—
	(d) Family and Child Welfare	24	300	760	—
	(e) ANP	181	100	7240	1810
	(f) Others (snacks)	368	100	14720	—
2.	*Primary Schools* Midday Meals in schools including those under Harijan Welfare and the Corporation of Madras	30663	200	1820000	—
3.	*Industrial Canteens*	77	—	29913	—
4.	*Special Nutrition*	280	250	151629	—
5.	*Health Centres:*				
	(a) Primary Health Centres 354				
	(b) Municipal Health Centres 280	735	300	35630	—
	(c) Backward Areas Centres 101				
	Total			2091192	34330

The feeding programmes mentioned above are functioning under many handicaps which restrict their efficiency. Studies conducted by Sri Avinashilingam Home Science College[27] reveal the shortcomings listed below.

Kuzhanthaikal Kappagams (Balwadies)

In some *Kuzhanthaikal Kappagams* the following problems were noted:

Food was not prepared properly;

The quantity was often insufficient for the number of children assembled at the feeding centre, whether or not they were enrolled;

A considerable number of children did not receive the food regularly;

The impact of the feeding programmes of the *Kuzhanthaikal Kappagams* has not been measured;

Difficulties were experienced in the transport on food from the Range Office to the *Kuzhanthaikal Kappagams*;

The Budget for feeding appeared to receive low priority from the sponsors;

Irregular provision of funds;

Lack of co-operation from the public and parents; and

Absence of nutrition education.

School Midday Meals Scheme

Problems connected with the School Midday Meals Scheme include

Inadequacy of funds. Grants from the Government were inadequate and some schools were in debt because they had to meet the expenditure on food;

Irregular supply of funds because of a heavy burden on the teachers to collect funds, and on the public to donate regularly;

Failure of Panchayats to meet their obligations caused schools to incur debts and even to maintain false accounts;

Scarcity of water;

Unhygienic water supply;

In many schools, teachers and pupils cooked food taking time off from formal teaching and learning;

Infestation of foods with weevils, other insects and rodents due to lack of storage facilities;

Difficulties in the transportation of CARE food to the village from the Range Centre. The expenditure of time, money and effort involved was enormous;

Inadequate kitchen facilities. Without kitchens, any space-sheds, class rooms or verandahs were used for cooking and serving food ;

Absence of training for teachers in the managerial and nutritional aspects of the school meal programme ;

No facilities for school gardens such as land, water, fertilisers and pesticides ;

Limited cooperation from parents and the public ;

Lack of provision to feed all the hungry children ; and

Absence of nutrition education.

CHAPTER IV

CONCEPT OF NUTRITION PROGRAMME

A NUTRITIONAL feeding programme has many aspects of which serving the food at the centres is only one. The meal service should be a tool for developing good food habits for health, good manners such as thoughtfulness, consideration for others and should generally serve as a foundation for good citizenship. An efficient nutrition programme should comprise of :

(1) Nutrition and health education ;

(2) Feeding target groups ; and

(3) Evaluation.

1. Nutrition and Health Education

The central objective of any nutrition and health programme should be to improve the total well-being of the population which is achieved by effecting desirable changes in food habits and patterns of living. In order to change the habits of the people, they must be motivated intensively through organised, consistent, continuous and convincing educational efforts.

(a) Intervention in the School and College Curricula : Nutrition education has to start from early childhood. Young children can be reached as a group in the *Kuzhanthaikal Kappagams*. They are captive and receptive audiences. Nutrition education must start from there and continue through primary, middle and secondary school years, adolescence and adulthood. Annexure I describes how nutrition education can be imparted effectively in the existing situation by amendment of the curricular frame-work at various levels. At higher levels of education all students in the colleges majoring in the humanities or in basic sciences should be required to take a short course in nutrition. The curriculum suggested for students of humanities is given in Annexure II and that for science students in Annexure III.

(b) Intervention in Teacher Education: In order to incorporate nutrition education in the school curriculum, suitably trained and motivated teachers are required. Accordingly all centres of teacher education need to be reoriented to this effort. All colleges of teacher education should offer a full course in nutrition education as outlined in Annexure IV. The existing teachers should be given short orientation-training during summer vacations by the proposed Department of Nutrition, utilising existing nutrition bureaus, cells, medical and home science colleges and other institutions as appropriate. The contents for such a course are suggested in Annexure V.

(c) Intervention in Community and Publicity Programmes: The available media of publicity—newspapers, magazines, the cinema, the radio, films, posters, exhibitions, fairs and camps—all currently used in the service of citizenship and health education, family planning, the green revolution, national savings campaigns and the Community Development Programme need to be geared to the needs of nutrition education directed at the masses of people.

The job chart of all extension and health workers in rural and urban areas should include educating families in nutrition and health. For this purpose, a provision should be made for the employment of extension officers in Nutrition at all levels from the State to the village and they should be exposed to suitable nutrition education. A practical course for the village and block level nutrition workers is outlined in Annexure VI.

(d) Intervention in Medical Programmes: The role of diet in the treatment of disease, nutritional education and follow-up of patients need to be further emphasised in training for hospital work.

It is, therefore, necessary to establish nutrition clinics and appoint dietitian-cum-nutritionists at least in the District and Taluk Headquarters hospitals if not in the primary health centres. Medical and para-medical personnel need orientation in nutrition education. Their curricula need to be revised (in the manner suggested in Annexure VII) so as to incorporate nutrition education in it.

(e) Intervention in Other Professional Programmes: Since advances in nutrition are impossible without increasing food production, and improving processing and distribution, all the inter-related sectors such as agriculture, animal husbandry and food technology which have a bearing on nutrition should have their training programmes suitably revised and enlarged. A series of lectures over 32 hours in the course of five to six days, should be sufficient to give the necessary orientation as outlined in Annexures VIII and IX.

2. Feeding Target Groups

As recommended by the Seminar on Nutritional Feeding in the Fourth Plan ([27]), nutritional feeding programmes should be considered as components of the total development of the individual. They are fundamentally for development, and *not* given in *charity* or for *relief*. Assistance for nutritional feeding should be worked into the community's own arrangements for wealth transfers of this kind and into its institutions for education and extension. The economic, nutritional adequacy, hygienic and educational factors should be kept in view, while planning feeding programmes.

(a) The Economic Aspects: Any feeding programme, to be successful, must be continuous, regular and nutritionally adequate. Feeding must be carried out on the specified days without any break for whatever reason—absence of the workers, festivals, special drives or visits, or other, continuity can be ensured only when the supplies are dependable, the administrators and workers at the operational levels realise the importance of continuity in feeding, and the functionaries are allowed to work without disturbance and financial anxiety.

(b) Nutritional Adequacy: Nutritional adequacy can be ensured by feeding adequate quantities of foods regularly. Regularity in timing and the pattern of feeding is essential for promoting growth and maintaining the health of the participants, inspiring them with confidence and developing good food habits.

For a long time to come, feeding efforts will have to be limited to the most vulnerable sections of the population living below the 'Poverty Line' and to one meal a day except in creches where

children of working mothers are cared for the whole day. Within these limitations, the supplementary meal served at the centre should make up the deficits in calories and protein as estimated in Table 19 and also provide a minimum of one third of an individual's daily requirements as computed by the ICMR (18).

TABLE 19—**Caloric and Protein Deficits and Needs of Selected Vulnerable Groups in Tamil Nadu**

Group	ICMR's Recommended Requirement		Mean Deficit/Day	
	Calories	Protein (grams)	Calories	Protein (grams)
Infants—(6 Months to 11 months)	900	16	430	3·6
Toddlers—(12 Months to 23 months)	1200	18	648	5·4
Pre-schoolers—(24 Months to 36 Months)	1200	18	604	3·9
Pregnant Women	2500	55	1387	4·0
Nursing Mothers	2000	65	1470	27·0

Source : Sri Avinashilingam Home Science College, Coimbatore.

Children aged from 12 to 23 months may be the most undernourished. They may have a greatly diminished supply of breast milk and have very little additional supplementary food. Menus costing within 20-25 Paise per child per day to meet one third of the ICMR's recommended allowances are given in Annexure X for Infant Feeding Programmes and *Kuzhanthaikal Kappagams*.

(c) Hygienic Aspects : For feeding programmes to fulfil their objectives, it is imperative to ensure the necessary facilities, optional sanitary conditions, hygienic handling of food and adequate protected water supply. Feeding programmes should be initiated only where these conditions are fulfilled.

(d) Educational Aspects : Feeding programmes in pre-schools and other educational stages should be utilised as tools for teaching nutrition in a practical manner. They should also become 'Result Demonstrations' to parents and the community. The dining halls and canteens of educational institutions can be used to disseminate messages of nutrition through (clean and balanced) menus; these demonstrations can be supplemented by verbal messages delivered through posters, pictures and displays.

3. Evaluation

Evaluation is an integral part of any programme from its inception. It gives in general a sense of direction in the programme towards the desired goal just as self-criticism which internal evaluation implies gives it the necessary thrust. Evaluation is not a formality to be gone through at the terminal point, but should be so built into the operations of the system to maintain the programme and ensure its lasting success.

Many development and feeding programmes have failed because they lacked specifically defined goals and proper evaluation from the beginning. There is no evidence of evaluation in any of the on-going feeding programmes in Tamil Nadu, except for the belated, terminal evaluation of ANP. The few research studies carried out in the Sri Avinashilingam Home Science College [28] shed encouraging light on the acceleration of growth, sociability, attendance, health status and performance in school-children who participated in the School Midday Meals' Scheme. Some results of these studies are set forth in Annexure XI. Such evaluation needs to be planned as part of feeding programmes, using available expertise.

CHAPTER V

THE STRATEGIES FOR A TWELVE-YEAR NUTRITIONAL PLAN FOR TAMIL NADU

CONSIDERING Tamil Nadu's urgent need of and its resources for development and the limitations imposed on the system by given conditions the following integrated strategies of nutritional improvement are recommended for adoption during the 12-year Perspective Plan period (1973—1984).

(1) Nutrition programmes for children below 30 months of age ;

(2) Nutrition programmes for children between $2\frac{1}{2}$ and 6 years of age ;

(3) Nutrition programmes for expectant and nursing mothers ;

(4) Nutrition rehabilitation programmes for severely undernourished children and their mothers ;

(5) Nutrition programmes for school-children of 6 to 12 years of age ;

(6) Nutrition programmes for adolescent boys and girls aged from 13 to 18 years ; and

(7) Nutrition programmes for adults.

A Department of Nutrition has to be created for implementing these strategies with the co-operation of the concerned and related departments. The justifications for the strategies proposed are offered below under appropriate headings.

1. Nutrition Programmes for Children below 30 Months of Age

Nutritional requirements of infants are high because babyhood is a period of rapid growth and development. During the first year of life, the baby must gain considerably in weight and length, teeth must be cut and bones mineralized, certain systems

of the body must complete their growth and the body composition modified.

Weight at birth comprises about 80 per cent water, 8 per cent protein, 5 per cent fat and 7 per cent minerals and carbohydrate. The last mentioned proportion will remain stable throughout life, protein will rise to about 17 per cent, fat to 15 or 16 per cent and water will have decreased to about 60 per cent by the time the baby is six months old[30].

The head of a new-born is disproportionally large for his body. His arms and legs are short and practically useless at first. His skeleton is mainly cartilage or gristle and water, and only the central sections of his long bones are mineralized. These must be calcified gradually as he grows during childhood. He will cut six to eight teeth in his first year, these and the rest to make up his deciduous set to 28, must be cut and calcified from root to crown. The final calcification will be complete in his young adulthood[30,31].

A healthy, full-term baby is able to digest and absorb food and to excrete waste and gastric juices from his digestive tract. His kidneys function to eliminate waste products from his blood stream. He needs relatively more to drink than an older child or adult. He can suck but is not yet ready to chew and swallow solid or semi-solid food. His eyes do not focus properly, and his senses of smell and taste have yet to be developed. He has a larger number of red blood cells, each containing more haemoglobin than he will have at any time later in life[32].

During the first six months, a healthy, full-term baby gains an average of 180 grammes in weight a week. By six months, or earlier, he has doubled his birth weight; by twelve months he should have trebled it. He will increase his birth length by 50 per cent by the end of the first year. Head, chest and other circumferences of the body will have made similar gains[22]. His arms and legs will increase in length and strength as he grows and develops.

The natural food for the first few months of the baby's life is mother's milk, but it provides little or no excess of any

nutrient for future store or to make good a deficiency that may exist. The baby of an anaemic mother may not have stored sufficient iron as a foetus to supply his current needs until foods to supply iron are added to his milk diet which is low in this mineral. Vitamin A and calcium stored in the foetus may soon need augmenting in greater amounts than are present in breast-milk. A source of Vitamin D needs to be added to the baby's milk in the early months of life to enable him to absorb the calcium from his diet. Milk is not a source of ample Vitamin C or thiamine. An undernourished mother eating largely carbohydrate-high foods, might transmit infantile beri-beri to her baby through her thiamine deficient milk(33). In any case, after the first six months, milk in the quantities in which it can be drunk by the infant, becomes progressively less nutritionally adequate as the sole food.

It is a wise practice to start supplementary feeding about the third month of a baby's life. Three 'golden rules' for infant feeding are:

Introduce only one new food at a time to ascertain the baby's reaction to each new food;

Give new foods in small amounts at first, to minimize results of harmful reactions; and

Be sure that food given to a baby is smooth in texture, bland and non-irritant to taste and digestion, appropriate in quantity and temperature and chemically harmless.

By starting supplementary feeding early in a baby's life say at six months of age, he will have become used to a variety of foods—strained soup made from cereals and pulses, strained leafy vegetables and carrots, pureed fruit and fruit juice, potato, ripe banana, and curds. These will augment his milk feeds, and their quantities can be increased according to the growing child's needs. Egg, first as yolk only, then the whole egg, lean meat and fish may be added to the diet during the latter part of the first year of life—or before, if the baby can tolerate the foods and if the parents can afford them. A convenient source of Vitamin D for infants, toddlers and others who may need it, is cod-liver oil, but it is dangerous to exceed the prescribed dose as the Vitamins D

and A contained in the oil could accumulate in the recipient to cause serious harm.

By twelve months of age, the child should be eating practically all the foods of the family. In his second and third year of life, the quantities of the foods he knows will be gradually increased, and perhaps a few foods may appear in a form that is novel to him—grated raw carrot, lettuce, leaves, and whole peeled apple. Milk available to the toddler and older child may be insufficient for their needs, but such beverages as groundnut milk, reinforced with calcium carbonate—such as is spread on betel leaves—and ragi malt help to make up a deficit of milk.

The growth of a child of one to two years of age, is less rapid than it was in the first year of life. Weight gain in the second year will be 25 to 20 per cent of the twelve month's weight, the gain will decline by 10 per cent in the third year. Gain in height is about 10 to 8 per cent of the previous twelve month's height each year. It is noteworthy that the height of a two year old child is practically half of what it will be when adulthood is reached. So under-nutrition during the first two years of life may cause a permanently sub-optimum stature in the individual. The nutrition programmes described below may help to prevent this stunting in children of families living below 'Poverty Line' in urban and in rural areas.

(a) Creches in the Rural Areas: Programmes for reaching children below 30 months in the rural areas are extremely important. At present Demonstration Feeding, Daycare Centres or Creches attached to *Kuzhanthaikal Kappagams* are taking care of children in this age group. The feasibility of expanding this service needs to be explored. The establishment of at least 3,500 Creches with feeding programmes is suggested for the 12-Year Plan Period. With 30 children in each Creche, 75,000 children would be covered. Eventually the programme will be extended to all the eligible children in this age group.

(b) Creches in the Urban Areas: The efforts of different industries have to be co-ordinated to start *Kuzhanthaikal Kappagams* and Daycare Centres, both within the factory and in the industrial areas. As this is likely to improve productivity

and labour relations, provision of creches can be required by labour laws. It has been estimated that industry could help to cover 50,000 children in this way.

(c) Special Nutrition Programmes for Children Below 30 Months in Urban and Tribal Areas: In urban areas, including slums, there are many unrecognised pre-schools, besides those run by municipalities and corporations. It is necessary to strengthen and co-ordinate their efforts in feeding children, particularly, those in the slums, and areas where lower economic groups live. The Crash Nutrition Programme of distributing Modern Bread, or, any other modified scheme, for children below 3 years, should be integrated into a system, for actually feeding the children in suitable centres at these places. It is understood that the Crash Nutrition Programme is catering for 1·52 lakhs of children. Sponsoring agencies, such as the Department of Social Welfare, should make efforts to double this number in urban and tribal areas.

2. Nutrition Programmes for Children between $2\frac{1}{2}$ to 6 Years of Age

The period of $2\frac{1}{2}$ to 6 years of age in a child continues to be one of physical and mental change and personality development. The rate of growth of the arms and legs is often greater than the growth of the trunk. From about 18 months to three years, growth of muscle accounts for about 50 per cent of the child's gain in weight. With increasing motor control, the active child develops more muscles also as he runs, climbs, slides and swings. As his legs grow longer, his centre of gravity shifts upward away from the ground, and more muscles of the back, buttocks and thighs are needed to hold his body upright(32). The growth of muscles is more rapid than the growth of other tissues and will continue at that rate until the child is ready for the growth spurt of adolescence.

The skeleton of a pre-school child strengthens rather than lengthens, as minerals deposit around the cartilage of bone at a faster rate than bone can lengthen. The bone is composed of tiny, complex crystals, mainly of calcium and phosphorus, which are set in a honey-comb fashion around a framework of cartilage. The honey-comb structure gives strength and an enormous

surface area to a relatively small amount of bone material—as much as 3000 square metres to 30 grammes[32].

It can be seen by the pattern of growth in a pre-school child, that his diet must include ample quantities of protein-high foods, good sources of calcium and iron and adequate amounts of vitamins. Caloric needs are relatively lower than they were in the rapid growth period of babyhood, but sufficient must be provided for his steady growth and for his highly active life.

A good diet for a pre-school child will stand him in good stead as a protection against infectious diseases of childhood, to which he is apt to be exposed. Good nutrition may not lessen his susceptibility to infections, but it will help his resistance to them. Infectious disease in a poorly nourished child may cause or contribute to severe malnutrition. The need for a viable nutritional status of pre-school children has been foreseen by the Government of Tamil Nadu which aims to provide nutritional feeding programmes for pre-school children of families below the 'Poverty Line'.

There are 79 lakhs children below six years in Tamil Nadu; of these, approximately 85 per cent are below the 'Poverty Line'. This means, the feeding programmes will have to cover nearly 40 lakhs children among whom 17·3 lakhs are likely to be below three years of age.

(a) Using Existing Kuzhanthaikal Kappagams under Different Agencies: A single programme to feed pre-school children in the *Kuzhanthaikal Kappagams* is of paramount importance. This would integrate the efforts of ANP, CARE, Demonstration Feeding and the Family and Child Welfare and other schemes of the Women's Welfare Department. It should cover all the 1,707 *Kuzhanthaikal Kappagams* functioning in the State with a uniform programme of feeding, care and education. Except for the 584 *Kuzhanthaikal Kappagams,* where only snacks are given, all others have some feeding programme or another. The cost of food varies from 10 to 20 Paise per child per day.

As an integrated feeding programme has to be developed immediately, it should indicate:

The quantities of protein and calories to be given daily;

The weekly menu, based on local foods;

The cost of the foods;

The cost of all other overheads to support the cooking and feeding operations with no dependence or voluntary contributions; and

The provision being made for health care.

3. Nutrition Programmes for Expectant and Nursing Mothers

It is not always realized that in human beings, the 40 weeks of gestation is a period of the most rapid growth and development known. The reproductive cycle affects nutritional status and nutrient requirements of the mother considerably, and nutrition has a great influence upon the outcome of pregnancy.

Many studies have shown that the nutritional status of a woman before conception affects the issue of pregnancy as much as it does during the period of gestation([23]). Complete undernutrition may cause amenorrhea and inability to conceive. Stillbirth and premature birth rates, neo-natal and maternal death rates, all tend to be as proportionally high as the nutritional status of mothers is low. Birth weight, on the other hand, is low if the mother's nutrition is poor.

Pregnancy has three morphological phases: the pre-implantation period extending for about two weeks after conception; the period of the embryo, lasting from the second to the eighth or ninth week, and the period of the foetus which lasts until child-birth. Each phase of pregnancy has its own nutritive requirements and its own physiological disturbances. The endometrium is prepared for the ovum in the pre-implantation period. In the period of the embryo, the implantation of the fertile ovum causes many hormonal changes, major construction of many embryonic organs and tissues and sensory organs of the embryo cause it to be most susceptible to unfavourable environmental conditions, which might cause congential malformations and possible abortion([32]).

The disturbed physiological state of the mother, during the embryonic period, usually upsets the digestive system with

nausea, loss of appetite, a reduction in food consumption and loss of weight. Vomitting further reduces food intake and increases weight loss. The metabolic changes of the embryonic period are reflected in the period of the foetus by the level of maternal blood and urine components, the loss or retention of nutrients, the composition and development of the foetus and of the placenta(33).

The placenta functions to provide the foetus with maternal nourishment and for returning the end products of the foetal metabolism to the mother's blood stream for excretion. At the beginning of the period of the foetus, the placenta is fats and lipids if the mother is sufficiently well nourished. The lipid materials are gradually released to the foetus. After an initial fall to a subnormal level, the basal metabolic rate of the mother increases steadily to 13 per cent of her pre-pregnant rate as her weight and thyroid functions increase. The mother will need extra food to supply her quickened basal metabolic rate.

During the latter half of pregnancy, the protein intake of the mother should be increased by 20 per cent over her pre-pregnant requirements. She needs the extra quantity for protein synthesis of the foetus and of her uterus. Moreover, she needs to accumulate about 4·5 kilograms of protein to take care of losses in child-birth and in preparation for lactation. Maternal demand for increased calcium during pregnancy can be judged from the fact that the body of a healthy, full-term baby contains about 24 grammes of calcium at birth. The most rapid increase of calcium in the foetus occurs from the 34th to the 40th week of gestation(32).

The expectant mother's need for iron increases greatly during the latter part of pregnancy. In a normal pregnancy, the mother will need to absorb and utilize 700 to 1000 milligrams for her own and the foetal requirements(34). It is not surprising that anaemic women become more so during pregnancy; that a considerable percentage of maternal mortality in India is due to anaemia(35) and that a baby born of an anaemic mother is likely to suffer from anaemia.

A deficiency of ascorbic acid during pregnancy may hinder the growth and development of the foetus. When the maternal

diet is short of this vitamin, the mother will transmit what she has to the foetus, to the detriment of her own health. The average concentration of Vitamin C in the blood of a new born infant is two to four times that in the mother's blood([34]). As with Vitamin C, so with Vitamin A and carotene, the mother will deprive her body to supply the foetus. Lack of Vitamin A during gestation may cause bones and teeth of the child to be imperfectly formed. A deficiency of one or more of the B complex vitamins during gestation may prevent the proper use of ingested foods to supply energy, to provide body-building materials, and to regulate essential processes of the body.

If the nutritional status of the pregnant woman is adequate, her period of gestation and child-birth is unlikely to be traumatic, and a full-term, healthy baby of a reasonable birth weight is only to be expected. In this manner the baby will have a propitious start for its growth and development which should progress satisfactorily with an adequate supply of breast milk and a timely addition of supplementary foods.

During lactation, the nutrition requirements of the mother increase progressively over her pregnancy need, with two exceptions; her calcium requirement is unaltered and her need for iron returns to that of her pre-pregnant status. Additional calories and nutrients are required by the mother for milk production which should increase steadily to meet the needs of the fast growing baby. The amount of milk produced should be a response to the baby's demand which varies considerably from infant to infant. By the time a baby is six months old, he may require about one litre of breast milk per day. This quantity will supply 720 calories, 11 grammes of protein, 280 milligrammes of calcium and 1370 I.U. of Vitamin A, as well as lesser amounts of other nutrients. Unless a nursing mother has a substantial diet, she will produce milk at the expense of the calories and nutrients her body requires; she may not be able to produce milk adequate in quantity and quality for her baby, and she may lose weight and health.

It is far more costly to the nation to allow maternal malnutrition to exist than it is to prevent its occurrence. Thus a strategy of the Tamil Nadu Government is to provide nutrition

programmes for expectant and nursing mothers existing below the 'Poverty Line'.

Educational and feeding programmes for expectant and nursing mothers have to be organised with health care and pre- and post-natal attention. Therefore, the nutritional aspects of these groups should be the responsibility of the Health Sector, where it is planned to appoint additional nutritionists. The nutritional requirements and details of menus and their cost for expectant and nursing mothers are given in Annexure XII.

4. Nutrition Rehabilitation Programmes

Nutrition Rehabilitation Programmes are necessary to educate the mothers on the common signs of malnutrition among pre-school children, and to motivate them how to ameliorate malnutrition by simple, low cost, local nutritious foods. Nutrition Rehabilitation Centres can serve as Demonstration Centres to show parents how nutritious diets can improve their children's health within a few months. Mothers can be educated in proper methods of feeding children.

Ten villages can be selected from every Community Development Block. In each village, 30 children can be fed at a time to promote their nutritional status to levels of normalcy within four months. Thus, about 100 children can be rehabilitated in each village per year. Simultaneously, there must be intensive publicity, through the radio and other mass media, of the results of such rehabilitation.

After functioning in demonstration villages for a year, the demonstration team can move on to other villages. A team of 10 *Balasevikas* will thus be able to cover a block in 6 or 7 years. For the entire State, 3,750 *Balasevikas* would accordingly be required. Public Health personnel would follow up the progress of the rehabilitated children by weighing them once a quarter. The scheme should include facilities for further rehabilitation of a mother and child when the child's poor weight-gain indicates the necessity for additional rehabilitation, with nutritional advice and guidance. The scheme could cover 3·75 lakhs of children annually.

5. Nutrition Programmes for School Children of 6 to 12 Years of Age

The pattern of growth of a young primary school child is much the same, for two or three years, as the older pre-school child, previously described. Until the growth spurt of adolescence starts, the school child will gain about 8 to 10 per cent of the previous annual weight each year, and height will increase by a steady five centimetres annually, muscles will continue to develop and calcification of bones and teeth is to be expected. The last bone to calcify is a small one in the wrist. This calcification takes place in the 12th year of a boy's life and a year or so earlier in a girl. In contrast, the final calcification of the third molar will be completed in young adulthood. If the young primary school child has been eating ample food to supply the requirements of calories and nutrients, the girl or boy should be able to store fat, ready for use in the adolescent growth spurt, when the quantities of food eaten may not quite meet the calorie requirement of such rapid growth. The girl will prepare for her adolescent growth at about the ninth or tenth year of life; the boy some two years later.

Programmes providing midday meals in primary schools should provide much more than the nutritional requirements of children. The focus of the programmes should be on nutritional education woven into the integrated curriculum of nutrition, outlined in Annexure I. Integrated nutrition education includes experiences for children in learning self-reliance and service to others. The nutrition programmes of the Tamil Nadu Government aim to provide these experiences by encouraging children to grow foods for themselves and others in school gardens and boxes, and to learn service to self and others at meals.

Tamil Nadu is ahead of all other States in its Midday Meals Scheme which is in operation in 30,603 elementary schools, catering to 18·2 lakh pupils for 200 days in a year. The concept, objectives and operation of the Tamil Nadu school lunch programme are generally satisfactory ([29]). However, the scheme needs to be strengthened in terms of nutritional and health orientation and education.

The current Midday Meals Scheme needs to continue with improvements in nutritive quality and nutrition education.

Incorporating nutrition education is even more important for permanent results than the earlier objective of improving the school attendance. One of the effective methods of imparting nutrition education and improving the health status of children is through well planned nutritious menus for the school lunch. The Tamil Nadu Midday Meals Scheme receives valuable food donations from CARE, a subsidy of six Paise per child per day from the State Government and a donation of four Paise per child per day from the public. Utilising these provisions, Sri Avinashilingam Home Science College has planned adequate lunches. Table 20 gives the quantities of foods used in those menus and their cost.

TABLE 20—**Cost, Quantity and Nutritive Value of Foodstuffs Used per Child per Meal**

Food item	Unit price per kg. Rs. P.	Quantity (grams)	Cost per meal Rs. P.
*Rice or	1·25	100	0·062
Bulgar wheat	1·10		Free from CARE
Red gram *dhal*	2·10	20	0·042
Greens (Amaranthus, tender)	0·20	50	0·010
C.S.M.	Not available	30	Free from CARE
Jaggery	1·80	10	0·018
Papaya	0·40	20	0·008
Oil	3·50	8	Free from CARE
Total			0·140

*Since rice is used only on alternate days, the cost of rice per day comes to 6 Paise, making the average cost of the school meal 13·6 Paise per child per meal.

Nutritive value

Calories	667 to 678	Vitamin A	5480 I.U.
Protein	19 to 20 g.	Thiamine	0·4 to 1·1 mg.
Calcium	416 mg.	Riboflavin	0·5 mg.
Iron	26 mg.	Ascorbic acid	73 mg.

The weekly menu for the school lunch is given in Table 21.

TABLE 21—**Weekly Menu in Sri Avinashilingam Basic School Midday Meals**

Days		Menu
Monday	...	Tamarind rice, Greens poriyal Tomato/Papaya*, CSM payasam*
Tuesday	...	Wheat uppuma, Greens kootu Tomato/Papaya, CSM payasam
Wednesday	...	Dhal rice, Greens poriyal Tomato/Papaya, CSM payasam
Thursday	...	Wheat uppuma, Greens kootu Tomato/Papaya, CSM payasam
Friday	...	Lime rice, Greens kootu Tomato/Papaya, CSM payasam
Saturday	...	Wheat uppuma, Greens kootu Tomato/Papaya, CSM payasam

* Any seasonal low cost raw vegetable or fruit—Guava, Nellikai, Mango Carrot, or Sprouted gram.

* Corn Soya Milk.

6. Nutrition Programmes for Adolescent Boys and Girls

The nutritional needs of children from infancy to puberty have been carefully considered by expert groups, and wherever possible, feeding programmes have been launched to help meet these needs in India. On the other hand, nutritional requirements of adolescents have received scant attention, except perhaps when the adolescent is also a mother. Yet boys and girls grow faster in adolescence than at any other time except in infancy. The nutritional needs of an adolescent youth are higher than at any other time of his life; those of an adolescent girl are exceeded only during pregnancy and lactation.

A moderate acceleration of growth in adolescence may amount to a 12 per cent to 15 per cent increase in weight, and 7·5 to 10 centimetres in height, a year. The growth spurt usually starts and ceases two chronological years earlier in girls than in boys. The maximum growth in adolescent girls generally occurs between the ages of 10 and 15 years, then growth declines at 16 to cease in height soon afterwards. In boys, the growth spurt is usually from 12 to 17 years with a decline at 18 years followed by a cessation of growth in height.

Within this general pattern of growth, boys and girls vary widely, depending upon heredity, body build and environmental influences. Some may never reach their growth potentialities, nor even have a significant spurt of growth; some start and stop their adolescent growth earlier than others. Chronological age and physiological age do not always coincide.

Adolescent growth in weight and height does not always synchronize with physiological change and development in the body. All the systems of the body, except the nervous and lymphatic systems, undergo change. Endocrine glands develop and produce sex hormones. Fat is usually converted to energy for growth; muscles increase in size and strength, especially in boys; calcification of bones is completed in adolescence; bones increase in length and density, and finally the epiphyses of long bones close to end growth in height. Some calcification of teeth continues through adolescence to be completed in young adulthood, when the roots of the third molars are finally calcified[31].

The physical and physiological change and development in adolescence are sufficient to cause strain, and to increase greatly the nutritional requirements of the adolescent. The stress of psychological, emotional and social change and development may further increase the nutritional demands of the body, by causing loss of nutrients, especially of protein and calcium[24]. The loss of blood in menarche increases the strain and nutritional needs of an adolescent girl, for whom motherhood may emphasize the stress and her nutritional vulnerability. An adolescent's requirements of calories and all nutrients are relatively greater than those in earlier childhood and in adulthood.

Adolescent boys and girls, therefore, need more food—and of good quality—than their younger brothers and sisters. They need more protein, calcium, iron, riboflavin and ascorbic acid than their adult counterparts. Boys between the ages of 16 and 19 years need more calories than active young men; their daily diet should be similar in quantity and quality to that of a 'reference' woman when she is a nursing mother. The greatest nutritional need of the adolescent girl occurs from 12 to 15 years of age, and declines to the needs of an active young woman at

about 16 or soon after, unless she is pregnant or lactating, when her requirements of calories and all nutrients are increased ([13, 35]). Annexure XIII details the quantities of foods at minimum cost which will meet the daily nutritional requirements of adolescent boys and girls.

Thus, adolescence is second only to infancy and very young childhood in nutritional vulnerability. Development programmes might greatly increase the health and working capacity of the nation, if meal and nutritional education programmes were organized for adolescent boys and girls in high schools, in training establishments and in work canteens. Their eating habits are closely connected with those of future families and with the national economy. Therefore, educational programmes during this stage should include nutrition as outlined in Annexure I.

7. Nutrition Programmes for Adults

Calories and nutrients requirements except of Vitamin A, and iron for women, diminish slightly after the peak period of growth in adolescence. Demands for protein, calcium, ascorbic acid and Vitamin A remain constant during adulthood. The iron needs of men are constant but decrease a little in women after menopause. In general, requirements of calories, thiamine, riboflavin and niacin decrease as age increases. Each twenty years of adult life requires fewer calories than the preceding twenty years, thus less of the B-complex vitamins.

The nutritional status of an adult reflects present food habits, previous dietary history and future health and efficiency. Good eating habits throughout life ensure and prolong vigorous years of adulthood, retarding the decline and decay of later years. Poor eating habits in earlier years may result in harmful effects on the body—some remediable, some lasting and others that get worse([32]).

Adults are not static—physically, physiologically or psychologically. All systems, organs and cells of the body need calories and nutrients daily for their maintenance and renewal. Muscles long continue to develop and to function efficiently into well nourished adulthood. Each used red blood cell is normally

replaced with a new cell every three months; each cell of the liver should be renewed every seven days; the minute micro-villi of the intestinal mucosa should be renewed daily; osteoclasts continually erupt calcium and phosphorus salts of bones, which osteoblasts should simultaneously renew. The replacement and renewal of cells can take place efficiently only if the diet is adequate. Adverse changes that occur in growing old are due less to aging itself than to malnourished cells and organs, which become unable to maintain themselves adequately or to function efficiently(30).

Statistics in India indicate that 60 per cent of the population are underfed(36). Nourishment to the cells and organs of the underfed must be insufficient for renewal and proper functioning. During 1964 more than 4·5 million people were treated for malnutrition in hospitals and dispensaries; of these patients 3,511 died(36); a costly waste of lives, medicine and treatment. The average monthly cost of medicines and medical services has been calculated as 85 Paise per person; loss of production in terms of man/work/day was reckoned as 97 Paise per month in towns and 105 Paise in villages(36). Loss of life and production, cost of sickness and medical care are negative factors in national development. Lives could be saved, work capacity increased, and sickness prevented if people had adequate diets.

Undernourished people with poor physique cannot contribute fully to national economy; moreover, the intellectual development of an underfed population is generally lower than that of a well nourished people(37). Malnutrition undermines mental aptitude and alertness and is often the cause of accidents at work and at home. Heavy physical work requires considerable energy, which will draw on reserves of the body if the diet is deficient in calories. First, the store of glycogen will be depleted, then the body fat. Fat catabolized for energy in the absence of carbohydrates produces toxins injurious to the individual. When surplus body fat has been consumed for energy, proteins of the body must be sacrificed, causing loss of muscles and weight, and impaired enzyme systems(38).

That better diets are able to increase production has been demonstrated in several countries(1). Construction on the Pan

American Highway in Central America increased from 1·8 to 5·9 cubic yards daily within a few months of the labourers receiving well balanced meals thrice a day. A public works project in Costa Rica showed an increase of 917 cubic metres of earth moved, per man daily, as a result of better daily meals and improved environmental sanitation. The production turnover of migrant workers in a Madagascar Sugar Factory showed a tenfold increase as a result of adequate meals being served in the works canteen.

The Department of Labour in the Government of Tamil Nadu has an industrial nutrition programme for pregnant and lactating wives of industrial workers and for their pre-school children. This programme might be further exploited to supply low cost, adequate meals in works canteens, and to provide nutritional education, particularly for men and youths, whose education in this regard has frequently been neglected.

The eating habits of the bread winner are usually very influential in patterning the family diet. Men often do the family marketing, and some cook meals when their wives are indisposed. If the *pater familias* is convinced that the vulnerable groups in his family need certain foods in sufficient quantities for their health and development, he is likely to make an effort to provide these foods and to adjust his eating habits for the good of the family.

In planning an overall nutrition programme for Tamil Nadu, the per capita daily food requirements of adults as well as children need to be considered. The Indian Council of Medical Research[13] has tabulated suitable kinds and quantities of daily food for vegetarian and non-vegetarian adults, by sex and activity. The tables make useful references for planners of agricultural production and nutritional programmes. Although men are not so nutritionally vulnerable as their children and child-bearing wives, they are important people to keep well-fed, for their own sake, the sake of their families and for full national development.

Food for All

The Government of Tamil Nadu is fully conscious that the quantity and quality of food produced in the State must continue to increase in order to supply the needs of the expanding

population. Shops and markets must be kept well stocked with locally produced, nutritious foods of which some may need to be subsidised by the Government in order to maintain their prices at reasonably low levels.

The provision of ample food is not enough to ensure that the nutritional status of the population is raised to and maintained at an adequate level. In addition to nutrition programmes for vulnerable groups living below the poverty line, programmes of nutritional education for all people must be continuously organized and evaluated. Only then can adequate nutrition become the birth right of all citizens, rich and poor alike.

CHAPTER VI

ADMINISTRATION OF NUTRITION PROGRAMMES

THE question of an appropriate organizational structure for planning and implementing nutritional programmes in the State has been engaging the attention of planners and nutritionists for some time. Today nutrition programmes are implemented by different Departments of Government, for whom nutrition programming is not the first priority among their many responsibilities. This has resulted in a multiplicity of schemes covering the same segment of population, with different menus, nutrient and caloric contents and costs. This has occurred because the departments started these programmes as and when funds became available from different sources without their feasibility or likely impact being taken into account. If all the nutritional efforts are pooled and implemented in a coordinated manner, after studying the need, acceptability and logistics of continuous distribution in adequate quantities, the programmes should then bring forth the desired results.

At present, the midday meals programme is not a major activity of the schools, nor is there an emphasis on nutrition education. A number of different types of feeding programmes are organized by the Women's Welfare Department, which has many other responsibilities other than feeding. It must be difficult for the Women's Welfare Department to give wholehearted attention to the feeding programmes. Similarly, the feeding programmes under the Public Health Department have a low priority in the gamut of health activities. Feeding programmes in the industrial organizations controlled by the Labour Department do not receive all the necessary attention that they require. The Applied Nutrition Programme implemented in a phased manner is one of the many activities of the Rural Development Department. The evaluation of ANP shows that the programme requires greater direction than is possible with the

present structure. It has been observed that the ANP in some blocks and villages was discontinued after the United Nations' and Governmental support was withdrawn at the conclusion of the five-year target period. These experiences demonstrate the need for a strong administrative machinery for the planning, organisation and implementation of the nutrition programmes. This is in keeping with the present thinking of the World Bank and the National Planning Commission who would like to see Nutrition Cells or Units established in the State and panchayat headquarters because of the important role of nutrition in development activities. New activities in the field of nutrition need, therefore, to be formulated and implemented. The proposed organisation for nutrition development should be structured in such a way that it draws its personnel from the following disciplines: Normal and clinical nutrition; Food technology; Food administration; Biostatistics; Nutritional and Extension Education.

If the selected services are available from all these disciplines in a 'package' with the framework of one organization, then it will be possible to plan nutrition programmes effectively. In order to realise this objective, setting up a Department of Nutrition or a Nutrition Development Corporation by the Government of Tamil Nadu with five divisions and complementary staff at district, block and village levels is absolutely essential. The organizational structure of the proposed department has been schematised in the Chart. The budget estimates for the proposed structure are set forth in Annexure XIV.

Administrative Chart of the Proposed Tamil Nadu Department of Nutrition

Chief Minister

Minister for Nutrition and Other Portfolios

Secretary for Nutrition and Other Departments

Director, Department of Nutrition

Joint Director, Department of Nutrition.

DY. DIRECTOR
Research, Planning and Programmes Division.
To coordinate all the research activities in nutrition in the State

DY. DIRECTOR
Education, Extension and Publications Division.
To administer ANP, all Training Programmes, Publication and Publicity.

DY. DIRECTOR
Evaluation Division.
To coordinate evaluation of all nutrition programmes in the field and to help planning and research.

DY. DIRECTOR
Food Administration Division.
To administer feeding and educational programmes in the *kuzhanthaikal kappagams*, ensure food supplies and to coordinate all the feeding programmes.

DY. DIRECTOR
Food Development and Processing Division.
To develop new foods, to study their feasibility, and to organise supplies.

→**District Nutrition Officer**←

Block Nutrition Extension Officer

Village Nutrition Workers (3)
[One for Ten Balasevikas]

Balasevika

MADRAS. N. I. O. S. LIBRARY

Division 1—Research, Planning and Programmes Division

The Research, Planning and Programmes Division is designed to coordinate all the nutrition research activities in the State through a Consultative Committee which will enlist representatives from the different research and teaching organizations. This division will design, sponsor and fund research activities for Nutrition Development. It will be responsible for drawing up the Perspective Plan for Nutritional Development in the State and detailed action plans for implementation.

Division 2—Education, Extension and Publications Division

The Education, Extension and Publications Division will take over all the activities of the ANP, now administered by the Directorate of Rural Development. This Division will integrate its activities with the Nutritional Feeding Programmes now administered by the Departments of Education and other agencies. It will conduct nutritional training programmes for medical, paramedical and all other personnel who are engaged directly or indirectly in nutrition activities. It will be associated with the training of ANP workers in the Rural Extension Training Centres and be responsible besides for the production of publicity materials and the dissemination of nutrition information generally. In this endeavour, it will coordinate the information from publicity units available in different departments and it will use all the media for publicity. It will extend the ANP throughout the entire State during the 12-year Plan Period.

Division 3—Evaluation Division

The Evaluation Division will assess all nutrition programmes in the field continuously. This division will take over a data bank relating to nutrition now being compiled by the Tamil Nadu Nutrition Project and keep it uptodate. It will render statistical service needed by the other Divisions of the Department of Nutrition.

Division 4—Food Administration Division

The primary responsibility of the Food Administration Division will be to run the *Kuzhanthaikal Kappagams* and arrange for all the integrated services needed for child development—

education, feeding, immunization and other health services. Further this Division will be responsible for rendering technical advice and coordinating the feeding programmes undertaken by different departments and institutions. It will advise on suitable menus and help to expedite the procurement of food in the quantities required.

Division 5—Food Development and Processing Division

The Food Development and Processing Division will evaluate available technology and manufacturing processes for foods and will select foods suitable for the use of young children. Starting with weaning foods, it will commission and guide food development research calling on other agencies for help where necessary.

Field Level Staff

The Department of Nutrition will have the complementary staff needed to implement the programmes at the Regional, District, Block and Village levels as will be seen from the chart and budget estimates.

CHAPTER VII

BUDGET FOR THE TWELVE-YEAR TAMIL NADU NUTRITION PLAN

AMONG the strategies described in Chapter V, those pertaining to children below six years in the lowest economic strata will cost a total sum of Rs. 123 crores spread over the period of twelve years, benefitting 4·77 million children. The entire responsibility including the budget for the maternal nutrition programmes will be borne by the Health sector. Programmes for school children will be financed by the Education Department. The estimate of Rs. 123 crores has been derived as follows :

1. Kuzhanthaikal Kappagams/Pre-Primary Sections

(*a*) At least 20 Paise per child per day are needed to provide $\frac{1}{3}$ of the daily caloric requirement (400-500 cal.) and 10 grammes of protein. The feeding should be for not less than 300 days in a year.

(*b*) Each *Kuzhanthaikal Kappagam*/Pre-primary section will have 60 children.

(*c*) The minimum staff for a *Kuzhanthaikal Kappagam*/Pre-primary section will consist of one *Balasevika* and two Ayahs. The minimum wages suggested for the *Balasevika* are Rs. 80 per month to be ultimately raised to that of a primary school teacher and for the Ayah, Rs. 20.

(*d*) The rent for the building and contingencies will cost Rs. 37 per *Kuzhanthaikal Kappagam*/Pre-primary section per month.

(*e*) The non-recurring cost for utensils and accessories will be Rs. 300 per *Kuzhanthaikal Kappagam*/Pre-primary section.

Unit Cost

Recurring :

			Rs.
(*i*) Wages for *Balasevika*	Rs. 80×12	=	960·00
(*ii*) Wages for two Ayahs	Rs. 20×12×2	=	480·00
(*iii*) Feeding cost including fuel—20 Paise per child per day	Rs. 0·20×60×300	=	3600·00
(*iv*) Rent & Other contingencies	Rs. 37×12	=	444·00
	Total		5484·00
	or		5500·00

Non-Recurring :

For utensils and accessories 300·00

2. Creches

(*a*) Creches with 30 children each will be attached to *Kuzhanthaikal Kappagams*. An additional ayah will be posted to each creche. The *Balasevika* will have an additional remuneration of Rs. 20 per month for minding the creches.

(*b*) In order to provide one-third of the daily caloric and protein requirement, 20 Paise per day per child have been provided. Feeding will be for 300 days in a year.

(*c*) For contingencies each creche is allotted Rs. 12 per month.

(*d*) For non-recurring expenditures, Rs. 300 are provided for each creche.

Total Cost

Recurring :

			Rs.
Honorarium for *Balasevika*	Rs. 20×12	=	240·00
Wages for Ayah	Rs. 20×12	=	240·00
Feeding charges	Rs. 0·20×30×300	=	1800·00
Contingencies	Rs. 12×12	=	144·00
	Total		2424·00
	or		2450·00

Non-Recurring :

For utensils for each creche 300·00

3. Nutrition Rehabilitation Programmes

Recurring :

			Rs.
(*a*)	Wages for *Balasevika*	Rs. 80×12 =	960·00
(*b*)	Wages for Ayah	Rs. 20×12 =	240·00
			1200·00

		Rs.
(*c*)	Feeding Charges (100 children in batches of about 33 each for 100 days) Rs. 0·20×100×100 =	2000·00
(*d*)	Contingencies =	250·00
	Total	3450·00

Non-recurring :

For utensils and accessories per centre	300·00

At the rate of 10 centres for each Community Development Block, 3,750 centres will function each year. The total recurring expenditure will be Rs. 120·38 lakhs per year.

These centres will cover in, eight years, 30 lakhs of malnourished children. Thereafter, if nutrition education has been effective, the need for sponsoring such centres will cease.

Total Cost for the Tamil Nadu Twelve-Year Perspective Plan 1973—1984

I. Kuzhanthaikal Kappagams/Pre-primary sections :

Rupees in lakhs

	Recurring	*Non-Recurring*	*Total*
1. Two years for Fourth Plan	536·71	13·05	549·76
2. Fifth Plan	3397·15	32·63	3429·78
3. Sixth Plan	6333·02	32·63	6365·65
	10266·88	78·31	10345·19

II. Immunization Programmes :

1.	Fifth Plan	45·99
2.	Sixth Plan	67·55
	Total	113·54

III. Creches :

Rupees in lakhs

	Number of Creches	Recurring	Non-Recurring	Total
1. Two years of Fourth Plan	500	12·25	1·50	13·75
2. Fifth Plan	2000	49·00	4·50	53·50
3. Sixth Plan	3500	85·75	4·50	90·25
	6000	147·00	10·50	157·50

IV. Nutrition Rehabilitation Programme :

Rupees in lakhs

	Number of Creches	Recurring	Non-Recurring	Total
1. Two Years of Fourth Plan	3750	258·76	11·25	270·01
2. Fifth Plan	3750	646·90	—	646·90
3. Part of Sixth Plan	3750	129·38	—	129·38
Total :	11250	1035·04	11·25	1046·29

V. Total Plan Outlay for 12 Years :

Rupees in crores

1. *Kuzhanthaikal Kappagams*	103·45
2. Pre-Primary Sections and Creches	1·58
3. Immunization	1·14
4. Nutrition Rehabilitation	10·46
5. Administration (Vide Annexure XIV)	6·24
	122·87

VI. Population that will be Covered through—

Numbers in lakhs

Kuzhanthaikal Kappagams/ Pre-primary section	16·68
Creches	1·05
Nutrition Rehabilitation	30·00
Total :	47·73

COST OF KUZHANTHAIKAL KAPPAGAM/ PRE-PRIMARY PROGRAMMES

Rs. in lakhs

Year	NUMBERS			RECURRING COST		
	Kuzhanthaikal Kappagam	Pre-primary	Total	Kuzhanthaikal Kappagam	Pre-primary	Total
1972—73	2607	1275	3,882	140·78	68·85	209·63
73—74	3507	2550	6,057	189·38	137·70	327·08
				330·16	206·55	536·71
1974—75	4407	3825	8,232	237·98	206·55	444·53
75—76	5307	5100	10,407	286·58	275·40	561·98
76—77	6207	6375	12,582	335·18	344·25	679·43
77—78	7107	7650	14,757	383·78	413·10	796·88
78—79	8007	8928	16,932	432·37	481·95	914·33
				1,675·89	1,721·25	3,397·15
1979—80	8907	10200	19,107	480·98	550·80	1031·78
80—81	9807	11475	21,282	529·58	619·65	1149·23
81—82	10707	12750	23,457	578·18	688·50	1266·68
82—83	11607	14025	25,632	626·78	757·35	1384·13
83—84	12500	15300	27,800	675·00	826·20	1501·20
				2,890·52	3,442·50	6,333·02
			Grand Total :	4,896·57	5,370·30	10,266·88

NOTE: 1. *Kuzhanthaikal Kappagam* @ 900 numbers per year.
2. Pre-primary sections @ 1275 numbers per year.
3. Number of children per *Kuzhanthaikal Kappagam*/per Pre-Primary—60.

CHAPTER VIII

NUTRITION RESEARCH

Current Research Efforts

SEVERAL research projects need to be sponsored to support nutrition development programmes and strategies. The research activities of some institutions in Tamil Nadu, i.e., Sri Avinashilingam Home Science College, Coimbatore, Christian Medical College, Vellore, Women's Christian College, Madras, Institute of Child Health, Madras, Madurai Medical College, Gandhigram Rural Institute, Voluntary Health Centre, Madras, are reviewed below.

SRI AVINASHILINGAM HOME SCIENCE COLLEGE, COIMBATORE

Studies on infant weaning foods through feeding trials with infants;

Development and evaluation of protein quality of nutritional supplements for pre-schoolers;

Formulation of low cost nutrient-rich supplements for children. Mixtures of oil seeds and commonly consumed pulses—red gram, black gram, green gram, groundnut and sesame—as supplements to rice diets;

Conducting feeding trials with pre-school and primary school children to test the growth promoting qualities of the newly developed supplements, pulses and grams, and vegetable protein mixtures such as the Indian Multipurpose Food, CSM and their combinations;

Testing the efficacy of vegetable portein mixtures of sesame and green grams for the treatment of Protein Calorie Malnutrition;

Assessment of the supplementary value of some indigenous vegetables such as Amaranth and mixed jungle greens to rice diets;

Determination of carotene utilisation by children from carrots with varying dietary protein sources;

Evaluation of hybrid strains of rice, maize, wheat, *cumbu* and *cholam*, with regard to nutrient content. Changes during food preparation and acceptability;

" Take home food " demonstration trials with mothers;

Testing conditions favourable for nutrition education and the efficacy of different methods;

Conducting nutritional status studies—diet and nutritional status of expectant and nursing mothers with infants, pre-school, school children, adolescent boys and girls and adults in different income groups;

Estimates of metabolic patterns for different groups of people;

Analysing nutrients in raw and cooked food preparations;

Studies on feeding programmes—school lunch and special nutrition programmes;

Evaluation of the ANP; and

Experimenting with novel protein foods—leaf protein concentrates.

INSTITUTE OF CHILD HEALTH AND HOSPITAL FOR CHILDREN, MADRAS

Studying kwashiorkor in its clinical aspects;

Conducting trials with vegetable proteins;

Making nitrogen balance studies in kwashiorkor;

Conducting pancreatic enzyme studies in kwashiorkor;

Making studies on fat balance in kwashiorkor;

Studying intra-cellular electrolytes in kwashiorkor;

Studies on keratomalacia and on vitamin absorption in kwashiorkor;

Determining serum retinol and albumin in cirrhosis of the liver;

Studies on human lactation; and

Nutrition surveys among children in the Institute's Hospital and in the urban slums.

CHRISTIAN MEDICAL COLLEGE, VELLORE

Evaluating protein quality in mixtures of legumes;

Infant feeding trials with weaning supplements. Supplementation of groundnut protein isolate in meals for pre-school children;

Absorption and availability of nutrients—Comparison of the supplements—Indian Multipurpose Food and groundnut Protein Isolate for pre-school children;

Trials with children suffering from kwashiorkor—Treatment with milk protein, milk protein blends, moderate protein, high caloric diets and processed fish protein;

Calcium balance studies on children accustomed to low calcium intake; and

Studies in the prevention of Vitamin A deficiency. Vitamin A therapy in children with kwashiorkor.

WOMEN'S CHRISTIAN COLLEGE, MADRAS

Studies on the effects of vegetable protein foods and Amaranth supplementing rice diets as tested on young albino rats;

Determining availability of Vitamin C from *nellikai* and drum-stick leaves in the diet of college women;

Studying the interrelationship between Vitamin C, iron and calcium and between carbohydrates and thiamine;

Studies on leaf protein concentrates;

Studies on the biological availability of calcium, phosphorus, iron and carotene from edible green leaves;

Nitrogen balance studies; and

Studying the basal metabolic rate of girls of 9—16 years age.

MADURAI MEDICAL COLLEGE, MADURAI

Studies on Vitamin A—malnutritional blindness;

Nutritional rehabilitation of severely malnourished children through low cost indigenous food supplements; and

Nutrition education.

GANDHIGRAM RURAL INSTITUTE, MADURAI

Formulation of protein-rich foods for infants ; and

Popularization of low cost indigenous nutritious foods in the villages.

Future Research

Research endeavours in the immediate future must become responsive to the social problems of alleviating hunger and malnutrition. Studies in the following broad areas of research will help to fulfil this goal.

Nutrient requirements and metabolism of different segments of Indian population in various stages of life ;

Methods suitable for assessing the nutritional status of communities ;

Family size and nutritional status ;

Food quality, composition and safety ;

Food patterns and habits ;

Evolving desirable food service systems ;

Ecology of nutrition ;

Methods suitable for nutrition education in the urban and rural areas ;

Testing diets prescribed in indigenous medical systems ;

Evaluation of sponsored nutrition programmes.

Nutrient Requirements and Metabolism

Nutrient requirements and metabolism can be studied in the following ways :

Determining the optimum amounts of calories and nutrients required for growth, and maintenance of physical and mental-well being. Food sources and cost will be determined ;

Effects of variables such as activity, stress and disease on the needs for special nutrients and calories ;

Minimum and maximum range of nutrient requirements for all stages of growth, maintenance of health and

reproduction. This information is needed by administrators, planners and agriculturists for planning targets of food production;

Effects of oral contraceptives on nutrient requirements and utilisation;

Effects of genetic variables in foods on nutrient needs and utilisation; and

Inter-relationships between various levels of different nutrients in meeting requirements.

Methods of assessing Nutritional Status

Simple methods are needed to assess the nutritional status of individuals and population groups in the villages. Health is not only freedom from disease but a condition of positive, physical, mental and social well-being. For the attainment of this goal, normal standards and targets must be identified. Norms are to be set as standard criteria of good nourishment; these must be dependable and valid. The following areas require special investigation

Definition of nutritional status and methods of its evaluation;

Relationship between physical, mental and emotional health and nutritional status;

Refinement of methods for measuring nutritional status as indicators of acute and sub-clinical nutritional deficiencies;

Evaluation of nutritional status of individuals and selected population groups (rural, economically disadvantaged, nutritionally vulnerable groups, viz., pre-school children, expectant and nursing mothers);

Correlation of nutritional status with dietary intake and other variables; and

Continuing investigation of all possible venues for improving the nutritional status of the population with special attention to the needs of the disadvantaged segments of society.

Family Size and Nutritional Status

It has been shown that, for any given level of family income, among the low socio-economic groups, the larger the family size, the poorer is the nutritional status.

An assessment of the probable impact of family planning on the nutritional situation under the present levels of family income and food availability would be a valuable tool for an integrated social policy. If the successful implementation of the family planning programme would result in a significant increase in food availability and nutritional status, the resulting gains would be taken into consideration in future planning.

Food Quality, Composition and Safety

The following aspects of quality, composition and safety of foods need to be studied :

The nutritive value of many of the high yielding varieties of cereals and pulses have to be determined. These data will be useful in identifying varieties which are to be released to farmers for large scale cultivation ;

Standardisation of recipes for household use ;

Estimation of cooking losses ;

Development and refinement of methods for determining food composition of raw and cooked foods ;

Composition and nutritive value of raw and cooked foods, their wholesomeness, palatability and cost of foods which are widely consumed and the new hybrid strains of cereals and pulses ;

Development and evaluation of protein food supplements from local sources ;

Factors affecting wholesomeness in storing, preparing, holding and serving food on home and institutional scales ;

Effects of commercial food processing and packaging methods on final food quality, nutritive value, safety and cost ;

Determining consumer needs and desires for food in new forms. Market for partially and fully prepared " ready to eat " foods ;

Relationship between extent of processing, marketing quality of final product, consumer acceptance and economics of utilisation in homes and feeding establishments ; and

Problems of adulteration of food. Consumers' role in solving these problems.

Food Patterns and Food Habits

Studies of food patterns and habits of communities will include

Understanding values held by various population groups concerning food; ways in which these values are mediated through food practices;

Methods of motivating people to modify eating habits;

Evaluating techniques which are effective in motivating people to change their eating patterns;

Estimation of distribution and use of misinformation about foods, methods of counteracting misinformation;

Relationship between food and psychological and emotional needs; and

Effects of sensory perception, psychological and environmental factors upon food acceptance and dietary habits.

Evolving Desirable Food Service Systems

In order to evolve desirable food service systems the following will be studied:

Factors which determine the cost, acceptability and nutrient contribution of meals in catering institutions;
Role of dietitians in institution management;
Standardised recipes for large scale cookery; and
Nutrition education in hostels and hotels.

Ecology of Nutrition

Studies on ecological factors associated with nutrition will include

Factors influencing food intakes. Identification of factors which determine food attitudes, preferences and practices with special emphasis on the social, cultural, religious and economic factors;

Effects of short or long term nutritional deprivation on different aspects of health and human capacities;

Relation between pre-natal nutrition and early diet of the child, to mental and physical well-being throughout life;

Relation between pre-natal nutrition and subsequent health of the mothers;

Nutrition and infection;

Nutrition and working efficiency; and

Economics of nutrition (cost of malnutrition).

Methods Suitable for Nutrition Education

Methods suitable for nutrition education can be examined through

An analysis of all the curricula of welfare, extension and educational programmes with a view to incorporating nutrition education in them;

Development and evaluation of curricula for different groups;

Testing different methods singly and in combination for teaching nutrition;

Production and evaluation of nutritional teaching aids and literature;

Assessing the effectiveness of innovative educational campaigns for disseminating nutrition information; and

Techniques for measuring the effectiveness of nutrition education.

Testing Diets Prescribed in Indigenous Medical Systems

Diets prescribed in indigenous medical systems can be studied by

An analysis of the dietary prescriptions in indigenous systems of medicine; and

Estimating the effects of diets used in the indigenous systems.

Evaluation of Sponsored Nutrition Programmes

The impact of sponsored programmes such as the Applied Nutrition Programme and those providing meals for infants, pre-school and school children, on their nutritional status needs to be assessed.

Research work in different institutes has demonstrated that by creating awareness and motivating rural communities, effective programmes of nutritional rehabilitation could be organised and implemented by the village communities themselves, using local food resources with no dependence on outside support. Such efforts need to be widened and strengthened on a permanent basis.

CHAPTER IX

AN INTEGRATED APPROACH TO NUTRITION PLANNING FOR DEVELOPMENT

Tamil Nadu Nutrition Project

THE Tamil Nadu Project on Nutrition Planning for Development is designed to identify and assess factors which have a bearing on child and maternal nutrition. The findings of this study will help to fix priorities while implementing the immediate and long term strategies for nutrition intervention and development.

Analytical methods employed in this study seek to investigate and establish the inter-relationships between agricultural production sub-systems, food processing and marketing practices on the one hand, and consumer food habits and the preference sub-system as related to the nutritional intake of the target population in Tamil Nadu on the other. This will be the first time a " Systems Approach " is being made to the study of nutrition in India. Upon completion, the concepts developed in this State investigation could be utilized with modifications throughout the country in planning for nutrition development.

It is expected that this systems approach to nutritional planning will accomplish

The Development of a data bank and a system of data processing and recovery, including information on three major food sub-systems—agricultural production, food processing and distribution, and the consumer participation—which will have continued usefulness in planning programme analysis and the evaluation of nutrition operation proposals ;

The development of a " systems model " for food and nutrition in Tamil Nadu, adequate for the analysis of one or

more simple nutrition intervention proposals, and capable of further development into a model and analytical methodology having broad applications in simulation exercises and predictive functions as well as in programme evaluation and as a support for decision making ;

Testing the early phase of the model and data system by analysis and evaluation of a number of proposed interventions which have been suggested, and the amendment of the data systems suggested by the experience gained in these tests ;

To the fullest extent possible before the end of the project, the evaluation of existing feeding programmes and nutrition-related problems of concern to the several departments of the Tamil Nadu Government which are cooperating in the study ;

Completion of two action-oriented sub-projects incorporated in the Work Plan, the " Take Home Food Test " and the " Continuous Processing and Distribution Demonstration ". Completion of the latter includes product identification, acceptability testing and operational planning ; and

The transfer of the data bank and data processing technology to a newly created institutional setting, to make use of data regularly maintained and constantly up dated. The Tamil Nadu Nutrition Project, which has these objectives in view, is open ended and will modify its approach and methodology in the light of circumstances and new knowledge generated in the course of the study.

It is conceived as an analytical and planning study with the expectation that, if contemplated successfully, it would lead rapidly to feasible, well-planned intervention projects based upon critical selection from among various options disclosed by the study.

CHAPTER X

INTER-DEPARTMENTAL COLLABORATION IN NUTRITION PROGRAMMES OF THE FUTURE

NUTRITION is a multifaceted discipline, intimately related to agriculture, animal husbandry, fisheries, health, education, rural development and social welfare. Therefore all the Departments dealing with these subjects have a vital role to play in coordinating nutrition activities and furthering the goals of nutritional programmes.

Agriculture, Animal Husbandry and Fisheries

The Departments of Agriculture, Animal Husbandry and Fisheries will

- formulate production plans and targets based on nutritional needs, in collaboration with the Department of Nutrition;
- encourage farmers to increase quality, and quantity in food production by giving them incentives such as a " nutrition premium ";
- test new varieties and strains for nutritive value and acceptability before release for large scale cultivation, taking the help of the Department of Nutrition and local home science colleges;
- appoint nutritionists on the governing bodies of agricultural universities, councils and boards;
- promote household gardens, poultry and livestock units and pisciculture; and
- supply milk and milk products and eggs at concessional prices to school canteens.

Education Department

The Education Department will

introduce topics on nutrition in the curricula at all levels of education, including that for teacher training ;

scrutinise science text-books for topics in nutrition for authenticity and bring out new books on nutrition ;

increase the number of children fed in the Midday Meals Scheme. Interest College Planning Forums, Rotary Clubs, Social Service Associations and National Service Corps to assist the School Midday Meals Programmes by raising funds ;

organise sale of good milk for hostels and canteens on a non-profit basis ;

insist that dietitians should be in charge of large catering institutions like hostels ;

produce films on nutrition ;

maintain health and nutrition records in schools on cumulative basis ;

allot marks for the health status of pupils in internal evaluation ; and

urge colleges and universities to take up study of nutrition projects.

Public Health Department

The Public Health Department will

employ dietitians in large hospitals ;

map out the areas where malnutrition is highly prevalent and organise ameliorative measures on an emergency footing ;

give orientation in nutrition in the training of medical and para medical personnel ;

enforce food laws effectively ; and

organise a 'Nutrition Week' along with related drives for Family Planning, etc.

Rural (Community Development) Development Department

The Rural Development Department will undertake to

give in-service training in nutrition to all functionaries ;

organise intensive nutrition drives in conjunction with campaigns for Family Planning, Small Savings and increase kitchen gardens and poultry units ;

publicise low cost nutritious recipes ;

use mobile nutrition units for nutrition education ; and

establish community food preservation and baking centres.

Social Welfare Department

The Social Welfare Department will

organise nutrition education on activities in *Mahalir Manrams* and young women's clubs ;

organise competitions in production, food storage, cooking and food preservation ;

promote nutrition education in all welfare and relief activities ; and

depute all field workers for refresher training in nutrition.

CHAPTER XI

EVALUATION OF NUTRITIONAL PROGRAMMES

EVALUATION is a process of arriving at a considered judgment, and is essential to planning and implementing programmes(38). Fundamentally, the purpose of a programme is the focal point of its evaluation; to achieve the purpose, specific objectives must be set; to attain the objectives definite goals must be reached. The purpose of the Tamil Nadu Department of Nutrition is, during the next twelve years, to improve the nutritional status of the population, especially that of the most nutritionally vulnerable groups. This purpose has been indicated by five parameters defining the present state of nutrition in Tamil Nadu. Four of the parameters clearly suggest broad objectives to be met, and goals to be reached annually, in order to attain definite nutritional improvement in the twelve-year period.

The first parameter is the consumption of calories, protein and other nutrients by the different segments of the population. The average daily consumption of protein and calories in Tamil Nadu is 36 grams and 1498 respectively. A broad objective would be to increase the consumption to the standard allowances suggested—44 grams of protein and 2400 calories daily—during the next twelve years. The goal to achieve the objective might be an increase of $\frac{2}{3}$ of a gram of protein and 75 calories each year. The data given in Table 2 on the present levels of intake of calories and nutrients can be used for formulating definite objectives and goals of nutrition programmes for specific vulnerable groups.

Similarly, the third parameter—heights and weights of children—can be used to form objectives and goals for improved growth acceleration over a given period of time, by sex and age from birth through adolescence. Weight for height and age of women might be another indicator for evaluation.

The final parameters stated are the relationship between malnutrition and child morbidity and mortality. The appropriate tables of data show that the objective of reducing these rates is imperative. Still birth, premature birth, and maternal mortality are rates that urgently need to be reduced. Their reduction, too, might be a specific objective, with feasible goals to be achieved annually.

An independent coordinating administration, "Nutrition Department" has been suggested to bring an integrated approach to problems of nutritional improvement. Five Divisions are included in the plan of administration; each will require uniform evaluation of specific goals and objectives, and each must select the most appropriate indicators for evaluation, depending upon the activities and changes to be measured.

Criteria frequently used for measuring effort or activity include training of personnel; preparation of educational material; participation in various activities, clinics, garden projects, clubs, feeding programmes, demonstrations; the percentage of the population served; the quantities of food consumed; seeds distributed and gardens established; increase in food production and information offered to the public. These measurements become more precise and meaningful if taken at the beginning and throughout the programme routinely, in a uniform way and over a period of time sufficiently long for careful examination of the results (39).

Direct or indirect measurements of change related to food practices require a long period of time. Criteria generally used are: changes in mortality and morbidity statistics, anthropometric and dietary changes, changes in attitudes towards food, changes in nutritional knowledge and nutritional status, changes in food production and distribution, changes in food handling and food preparation practices, and requests for further nutritional services (39).

The methods and procedures for obtaining data for evaluation include: analysis of statistics—health, agriculture, trade and commerce, employment—interviewing and visits; records and reports; observation of markets, eating places, changes in

attitudes and food practices; taking of anthropometric, dietary and clinical data, training of personnel and number of the population served (39).

Many of the criteria, methods and procedures mentioned above can be and have been used for evaluating nutrition education as such (40). Successful methods and aids used in teaching need careful and detailed documentation in order to share the results and findings with the rest of India and other countries. Lack of coordination and publicity has often prevented the full exploitation of successful methods and aids used in nutritional education. The Divisions of Education, Extension and Publication, and of Evaluation planned to be included in the Department of Nutrition will cooperate to prevent such situations.

In order to achieve uniformity in such a diversity of criteria, methods and procedures for evaluation, a tabular presentation *pro forma* of formal evaluation is outlined. It can be readily adjusted to most of the data likely to be used in the assessment of nutritional programmes.

Outline of Pro forma for Evaluation of Nutritional Programmes

Period (1 to 12).....from the month of.....19.....to.....19

.....Report from.....(name).....date.....Place.....

	Baseline Data	Target for Period of Report	Achievement of Targets
			(Number and percentage of target of achievement)
I. *Vital statistics:*			
Objectives: Reduction of rates of			
Neonatal mortality			
Infant mortality			
Child death (ages)			
Maternal mortality			

Still births
Premature births
Birth rate
Morbidity rate
Malnutrition diseases listed

II. *Nutritional Status*

(of target groups)

III. *Anthropometric measurements :*

(Length or height and weight by age and sex.)
Percentile attainment of standard of target groups

IV. *Food Production :*

Objectives : To increase the number of

(a) Kitchen gardens
School gardens
Community gardens
Home gardens

(b) Type of fruits and vegetables grown
Green leafy vegetables
Carrots
Pumpkin
Tomato
Citrus fruit
Pineapple
Guava
Mango
Papaya
Other vegetables
Other fruits

(c) Poultry units
School
Community
Home

(d) Egg production
School Community
Home

V. *Food Consumption:* Objectives: To increase number/attendance/days	No. established (A)	No. of beneficiaries (B)	No. of feeding days (C)	Targets of period of report (A)	(B)	Achievement of targets (C)
(a) Feeding programmes (by type and target group)						
			Percentage Attendance of Participants			
		(D)	100%			
			75-99%			
			50-74%			

Objective: To control or increase quantities of foods served in feeding programmes	Quantities of foods served	Targets	Achievement of targets
(b) Types of feeding programme			

VI. *Training and Education:*

1. Long-term staff trained
2. Short-term staff trained

Nutritional curricula	No. of institutions	No. of students
Integrated nutrition in schools		
Home science in high schools		
Inservice teachers' training		

VII. *Changes in food habits*
Dietary surveys

CHAPTER XII

FOOD—ADULTERATION AND CONTAMINATION

THE basic right of people to adequate diets must be equal to their right to safe food if the nutritional status of the population is to be materially improved. Without proper precautions, food may become a hazard to health through adulteration, contamination, spoilage and putrefaction. Of these, adulteration must be totally eradicated, and the other evils minimized or prevented.

Fraudulent Food Practices

The Consumer Guidance Society of Bombay staged an exhibition in March 1971, showing many kinds of food adulterants, fraudulent weights and measures, and foods most commonly adulterated, which comprise 33 per cent of foods eaten in India today (1).

Common adulterants of food include the deliberate addition of sand, grit, dirt, waste products, such as used tea leaves, and cheap " foreign " starch to cereals, pulses and spices, also water to milk and curds, in order to make up the required weight or measure of the food that is adulterated. Another practice is removing fat illegally from whole milk and its products to the detriment of their quality.

Criminally harmful food adulteration practices include adding powdered glass to sugar and salt; combining mobile oil or argemone oil with edible oil; incorporating iron filings with *suji* (*ravai*) and *kesari dhal* with lentils; mixing horse dung with spices, and using unsafe and prohibited compounds for colouring foods. *Metanil* yellow, sometimes used illegally for colouring *laddus* and *barfis* might cause cancer in the consumer, as might argemone oil and splintered glass. Dulcin, wrongly used for colouring sherbet, and coal-tar dyes used for reddening betel nut in *pan*, are poisonous with a cumulatively

adverse effect on the eater. Kesari dhal contains a toxin capable of causing lathyrism, which may result in permanent paralysis of the legs.

Legal Prohibition of Adulteration

Laws exist to prohibit fraudulent food practices in India. Tamil Nadu was one of the earliest States to legislate against food adulteration in the Madras Prevention of Food Adulteration Act of 1918. The Act provided for the inspection and control of food offered for sale. Food standards were set, the post of public analyst was established and procedures for enforcing the Act were stipulated. The Madras Prevention of Adulteration Rules of 1932 modified the Act of 1918, and empowered sanitary inspectors and health officers of local governing bodies to inspect food markets and to collect food samples for analysis (2).

Legislation of Madras State in prohibiting fraudulent food practices was a forerunner of the Prevention of Food Adulteration (PFA) Act of 1954 for All India. The Act provided for deterrent punishment of offenders, and prohibited the manufacture, import and sale of adulterated food. It envisaged the setting up of the Central Committee of Food Standards and the Central Food Laboratory, Calcutta, which were established in 1955. The former advises the Central and State Governments on administrative matters arising from the Act. The Central Food Laboratory carries out research on food standards and on methods of detecting food adulteration. It is advised by sub-committees on the standardization of foods and on amendments necessary to PFA Rules (3). The PFA Act of 1954 was amended in 1965, making the punitive measures somewhat stricter.

At present, Tamil Nadu has 290 local governing bodies and the Corporation of Madras to enforce the PFA Act in their localities. All sanitary inspectors are responsible for periodic collection of food samples for analysis. Analyses are made either in the Government Analysts' Laboratory at the King Institute, Guindy, or in the Public Analysts' Laboratory of the Madras Corporation. An analysts' laboratory has recently been started at Coimbatore on the lines of the King Institute.

Intensified Efforts Required

The number of food laboratories in Tamil Nadu is completely inadequate. Many more regional and district laboratories are required with better facilities than those existing in the established ones. A sufficient number of personnel should be trained as food inspectors and employed in every food market and local administrations of Tamil Nadu. At present the machinery for enforcing the PFA Act barely covers a third of the State. The machinery for the control of food production centres which do not seek voluntarily standards certification of their products, and eating houses in urban and rural areas needs to be strengthened considerably.

The present penalty for offenders against the PFA Act, of a fine and not less than five months' imprisonment, is too lenient for habitual offenders who may have caused disease or death to consumers. A repeated offence should be punished by withdrawal of the food trading licence for prolonged periods or for life, depending on the seriousness of the crime.

Legislation and punishment are not ideal ways of ridding society of evil practices. Each citizen should take an active part in their eradication. In the case of food adulteration, public apathy and ignorance hamper governmental agencies in work connected with health, hygiene, food and drugs. A well-informed and watchful public can aid the government in the detection and prevention of food malpractices and can provide ideas and incentives for the improvement of food handling and quality. Nutrition and health education in schools can produce awareness in the educated classes and can lead to rationalization of eating and disposal habits and can do credit to the maxim of the hygienic home. The education campaigns directed at the citizenry can likewise, if they succeed in breaking through apathy, only lead to consumer resistance. In a developing economy, returns from food processing industries are among the highest and a great factor in the stabilisation of demand for the surplus products of the G.M.F. and Green Revolution campaigns. Public health preferences should not act as a deterrent against small-scale and proprietorial kind of marginal enterprises where small cost increments can fatally magnify competitive differentials.

Communication techniques must take account of this. The maxims of public health should, therefore, be embodied and institutionalized in constructive training in food production and distribution trades and in deterrent legislation enforceable by local authority. Enforcement machinery and analysts' laboratory facilities are more important at the local authority level.

Most consumers can recognize obvious adulterants, such as sand and dirt in food, but the more ingenious types are difficult for the lay public to detect. The consumer must be kept informed of current food adulterants and constantly reminded to report offences through recognized local channels. Tamil Nadu requires a non-profit making, voluntary organization, such as the Consumer Guidance Society of Bombay, with branches in every district, town and block of the State. Members of the organization would be responsible consumers, for whom consumer education would be part of membership. Consumer education would include knowledge of additives permitted in foods for their enrichment, preservation and consumer appeal, and of the dangers and prevention of food-borne diseases and food poisoning. In a competitive multi-firm economy, they can provide a technical guidance service for consumers by which choice can be based on objective criteria as well as personal preferences.

With public vigilance and intensified governmental action, food adulteration could become a crime of the past in Tamil Nadu. Then efforts to improve food production and eating habits would become worthwhile and rewarding. By itself, legislation can only be a tardy means of upgrading standards of public behaviour.

The efforts of improved food production and consumption and the banishment of food adulteration can be of maximum benefit to the nation only when food-borne diseases, intestinal parasites and food poisoning are not allowed to debilitate the health of the public.

Communicable Diseases

Of more than 60 communicable diseases, at least 25 are associated with food and can be prevented. The causal micro-organisms reach the human host by direct or indirect transmission

from a sick person or a carrier, or through consumption of food or water contaminated by insects or animals or by eating food from diseased animals (4).

Transmission by humans can be prevented by isolation of patients with infections, through precautionary measures when treating the patients and after recovery, immunization, periodic examination of food-handlers in public eating places, and by strict personal cleanliness of all food-handlers and the general public.

Transmission of communicable diseases by water can be prevented by purification of water supplies and protection of water sources by proper sewage disposal. The latter includes adequate sanitary facilities in homes and public places, and education in their proper use. A proper beginning can only be made when the provisions against the commission of nuisance in public places are enforced.

The transmission of disease by insects and animals can be eliminated by control of breeding places, prevention of animal and insect entry into the premises of eating places and food distribution centres and the destruction of rodents and harmful insects which contaminate food supplies.

To prevent transmission of disease by food, conditions in which food is produced, transported and stored must be strictly supervised. The conditions include adequate food storage, equipment, services and personnel, animals involved and all the modes and stages of distribution. All food stuffs in public places should be regularly inspected and suspected items destroyed at once. Milk and dairy products should be pasteurized and all stages between pasteurization and consumption should be carefully controlled to prevent recontamination.

Parasites

The disease-causing micro-organisms associated with food are as harmful to health as intestinal parasites that lay eggs in human or animal faeces, and pass into human hosts as eggs or larvae depending on the species. Common parasites are round-

worms, tapeworms and flukes that take up residence within the unprotected body and set up conditions of varying severity, all of them debilitating to the host.

Basic prevention of intestinal parasites consists in sanitary disposal of excreta, elimination of soil pollution around dwelling places, and strict personal hygience. Protecting the feet and the skin from infestation by parasites, and adequate cooking of meat and fish, are also precautions not to be disregarded.

Bacterial Food Poisoning

Methods of preventing food-borne diseases and intestinal parasites are equally applicable to the prevention of bacterial food poisoning. This may be described as an acute attack of abdominal pain and diarrhoea, often accompanied by vomitting, developing within 2 to 36 hours of eating contaminated food. The major causes of bacterial food poisoning are staphylococcal toxin, and a miscellaneous group of bacterial infections and intoxins caused by the contamination of food by a number of different organisms (5).

The miscellaneous group of bacteria causing food intoxins and infection come mainly from insanitary sewage disposal and unhygienic habits of food-handlers. With proper sanitation and personal hygiene, food would not be exposed to contamination by bacteria.

Staphylococcal food poisoning occurs more rapidly than others caused by bacteria. Its duration is shorter and the symptoms may not be too severe. It is a common food poisoning usually derived from food-handlers. Harmful staphylococci may be transmitted to food in droplets from the nose or throat or by the hand from boils, cuts and other skin lesions of infected people. Though the organism is easily destroyed by heat, unfortunately, the toxin it produces is heat-stable. Unprotected food in a warm, moist kitchen is an ideal place for the organism to grow and produce toxin, which no amount of cooking can destroy. Foods most vulnerable to this kind of poison are cooked foods, such as processed meat, canned foods left in open containers, pastries containing cream or custard or meat, sauces and gravies, cooked curries and root crops eaten cold, and exposed " left-overs " for reheating.

Prevention of food poisoning depends upon the observance of sanitary conditions of food from its production to its consumption. Temperature, moisture and time are vital factors in food protection. Bacteria cannot grow without moisture and food. The most favourable temperature for bacterial growth ranges from 14°C to 40°C. Most bacteria are destroyed at higher temperatures, and lower ones inhibit bacterial activity. The length of time over which food is exposed to contamination is important since a single bacterium can produce over two million bacteria in a few hours of favourable conditions. The higher the bacterial count the more severe is the poisoning (4).

The essential factor of strict personal cleanliness in preventing adverse consequences from contaminated food must be stressed in all programmes of health, nutrition and consumer education. This is of vital importance in India where many people use their hands for eating, so the majority of the population are in that sense food-handlers.

Food Spoilage

Harmful micro-organisms causing disease and poisoning are particularly dangerous in that they mark food in no evident manner. Other micro-organisms and enzymes leave signs of their activities by obvious change in appearance, smell or taste. Some of the changes are beneficial and are used in food processes such as making curds, cheese and ready-to-eat meats. Other enzymatic and microbial activities are undesirable if unwanted and uncontrolled. Enzymes accelerate the setting in of rot in fruits and vegetables unless inhibited; micro-organisms putrefy meat, fish and eggs, sour milk, ferment inefficiently canned or bottled fruits and vegetables.

This type of food spoilage, which can be detected by smell, sight and taste, though less dangerous than food contamination undetected by the senses, is wasteful of food, money, time and effort, as spoilt food must be thrown away. It is chiefly perishable foods, having a relatively high moisture content, that are spoilt in indiscernible ways. Their care in storage should form part of the basic education of food-sellers, food inspectors and consumers alike.

Chemical Food Poisoning

Apart from the pitfalls of adulteration, spoilage and contamination, foods must be protected from chemicals used in various stages for preservation and as insecticide from their production to consumption.

Through careless storage and use, arsenic and other components of rat poisons have appeared in confectionery and other food stuffs. Arsenic, sprayed on fruits and vegetables as a pesticide, may leave a residue, poisonous when imbibed. The presence of arsenic, too, has been reported in paper, waxpaper, tin and aluminium foil used to wrap food (4). Sodium fluoride used against cockroaches and in insecticide sprays may contaminate fruits, vegetables and food in storage. The dry compound is dangerous, unless cautiously stored, as it could be mistakenly used for flour, baking powder or milk powder with disastrous consequences.

Other chemical hazards include zinc poisoning from acid fruits and their juices left in exposed galvanized or plated containers, and from rain-water collected in galvanized tanks ; copper poisoning from meat cooked or canned in copper containers and from copper dissolved in acid liquids and carbonated beverages ; lead poisoning from the metal dissolved by soft water and acid foods and drinks in contact with lead piping or plated and soldered cans and equipment. Antimony, extracted by foods cooked in poor quality enamelware and cadmium from cadmium-plated food containers, have also poisoned consumers (4).

Antibiotics, if used in excess of allowances for preserving poultry, or in accidental contact with stored foods, can cause considerable sickness, as can excessive amounts of sodium and potassium nitrates used in curing meat. Ethylene dioxide, hydrocyanic acid gas and methyl bromide, used to fumigate storerooms, can cause serious harm to people and animals unless used with due precaution.

The chain of events for consumer protection from chemical poisoning, starts with food and drug authorities setting standards for the use of permissible pesticides and fungicides in specified, safe amounts. Government machinery for enforcing the

standards and for controlling the use and storage of crop-protection chemicals should include agricultural supervisors and sanitary inspectors. Education of the public in these matters should be the responsibility of extension, health and consumer guidance personnel.

Endogenous Poisoning

In addition to chemical compounds and micro-organisms causing food poisoning, illness can result from eating foods containing natural compounds that are toxic unless neutralized, or from eating foods poisoned by fungi during harvest or storage.

Certain species of *fusarium*, when growing in grain before harvest, produce compounds harmful to man and animals and ergot on grains, especially rye, can cause ergotism which restricts blood circulation, if the infected cereal is eaten. A careful inspection of grain during harvest and dry conditions of storage are necessary to protect cereals from such field fungi.

Numerous storage fungi are likely to be present in the air and dust or grain-storage warehouses. If the grains are insufficiently dry and the storage temperature is too high, storage fungi will invade the grain to produce damage and decay, rendering the grains unusable for food or feed (6).

The moisture content of grains and groundnuts during harvest and storage exposes them to *Aspergillus—flavus*, which produces aflotoxins poisonous to man, birds and animals. Food infections carried by oilseeds and vegetable oils have caused health hazards in other countries. Preventive health care in India should concern itself with the identification of diseases caused by or transmitted through edible oils peculiar to this country.

Practically all seeds of leguminous plants contain toxins that interfere with digestion if eaten raw. Fortunately, the seeds are generally cooked as pulses before eating and the process destroys the anti-digestion toxins. Broad-beans (*Vica flavia*) contain another compound that may cause Favism, a severe hemolytic anaemia. Cooking makes the bean safe for the majority of people, but fresh, young broadbeans are tempting to eat in salads or when

being prepared for cooking. A number of people are allergic to raw broad-beans, but are not harmed by the cooked form. A few unfortunates are allergic to cooked and raw broad-beans, to the pollen of broad-bean flowers and to milk from cows that have grazed on or near broad-beans (7). Health authorities in parts of India, including the temperate zones of Tamil Nadu, where broad-beans are grown, should warn the public of dangers associated with this crop.

More dangerous to Indians than broad-beans is the Lathyrus Pea, (*Lathyrus sativus*), commonly known as kesari dhal and previously mentioned as an adulterant of masur dhal, which it resembles. Lathyrus peas contain a toxin that may cause lathyrism in its consumers, resulting in spastic paralysis of more severe cases. Normal cooking methods do not destroy the poisonous compound, though soaking the pea after harvest followed by sun-drying has lessened its toxicity. The pea grows in drought conditions impossible for other crops. Its danger as food is common knowledge, yet *kesari dhal* will be eaten in times of famine in preference to starvation. Agricultural experts urge the cultivation of peas and beans, other than the lathyrus pea, which, through improved technology, can withstand drought. Public Health measures in Tamil Nadu prohibit the sale of both kesari and masur *dhals*.

Several foods commonly eaten in Tamil Nadu contain poisons that are usually rendered harmless by local methods of food preparation. Here again, there is scope for research organized on the basis of patient case study which can be traced back to the disease-causing elements in food. These could be usefully organized under the aegis of municipal authorities in the large urban or metropolitan cities (which have special machinery for dealing with contaminants originating in imports) or under consumer associations. Much work done by the Indian Council of Agricultural Research on toxins in natural chemical products is available for further applied use.

Pests of Cereals and Pulses

Although cereals and pulses are staple foods of India, their protection during harvest and storage is far from sufficient. They are exposed to onslaught by rodents which invade warehouses

and feed on grains meant for human food or animal feed. They, and their excreta on foods, transmit disease and poison to unprotected consumers. In addition, certain insect pests cause considerable harm to grains, flour and other foods in storage.

The rice weevil, *Sitophilus calandra oryzae*, can breed in any cereal grain. Each egg of the weevil is laid in a hole bored in a grain and sealed with a gelatinous substance as protective covering. The female lays four to five eggs daily and over 200 in her life-time. The larvae hatch in a few days and feed on the grains as they tunnel their way out, leaving excreta in their wake. The weevil develops most rapidly when moisture in the grain is 12 to 14 per cent. Under favourable conditions of moisture and temperature, two or three generations of rice weevils can destroy an enormous amount of grain stored in heavily infested granaries (8).

The lesser grain weevil, *Rehizopertha dominica*, is probably a worse menace to stored grain than the rice weevil, for it lives longer, lays more eggs daily and can breed at higher temperatures and in drier conditions. Pea weevils, especially *Bruchus chinensis*, common in India, can destroy large quantities of legumes while growing and during storage. Many varieties of beetles choose stored meals and flour for breeding in preference to grains. The eggs they lay, being sticky, adhere to the flour and are hard to detect; their larvae are appropriately known as "meal worms". A beetle pest, common in India, is *Orzaephilus surinamenisis* that can crawl through tiny cracks and bore holes in stout cardboard in search of food. Its appetite is enormous; it depletes food and nutrients and spoils the taste and appearance (8).

To protect food and feed from pests, an adequate number of granaries and warehouses must be provided. The Central Warehousing Corporation has constructed 77 Central warehouses and State warehouses in 16 States, each with a capacity of a third of a million tons of food. The Food Corporation, a statutory body established in 1965, purchases and distributes staple food. In Tamil Nadu, the Food Corporation has a storage capacity for half a million tons of 80 different types of cereals. Plans for the future include increasing storage capacity to over 8 million tons, by the Warehousing and the Food Corporations and private

agencies (9). With a population of 555 millions in India, and 41 millions in Tamil Nadu, food storage capacity is already inadequate without the expected population increase.

Even with enough warehouses, each must be proofed against rodents, and they and their habitats must be destroyed. Stores must be shelved well above the ground and with room for the free flow of air. Heat treatment, or carefully controlled fumigation, is necessary for destroying insect pests. Good ventilation is indispensable for control of temperature and moisture. Proper supervision of harvesting and storage processes is necessary for safe food control. Above all, a knowledgeable and vigilant public must aid the government in the protection of food. Through the strategies for nutritional improvement, the consumer must be sufficiently well-fed so as to refuse food that is spoiled, has deteriorated in quality and is teeming with weevils—which is not the case in Tamil Nadu at present.

ANNEXURE I

INTEGRATED NUTRITION FROM NURSERY SCHOOL THROUGH SECONDARY SCHOOL

General Objectives

(1) To motivate children to want to eat for their best growth, health and activity.

(2) To develop good food habits.

(3) To know the use and preparation of locally produced foods.

(4) To learn good food hygiene and safe food practices.

NURSERY SCHOOL

Activities

(1) Conversations with children on foods they eat at their daily meals.

(2) Discussion with them on foods to eat that make a 'good' breakfast, lunch, snack or supper. Illustrate by any meals provided at school or if none can be provided, a class project is the provision of 'sample' meals at school, cooked with the co-operation of the parents.

(3) The children bring news to school of any 'new' food they have eaten at home and vice versa, bringing a sample, if possible.

(4) Children prepare real or imaginary foods with real utensils in a kitchen provided for them.

(5) Weights and heights are recorded periodically, and a sample chart is kept of each child's development. Discussions with parents and children on foods for growth.

(6) Children learn to wash hands and clean teeth before and after meals.

(7) Children bring fruits and vegetables to school to wash and peel before eating and learn why this is necessary.

(8) Children have a model shop where they "buy" foods daily.

(9) Children learn songs, games and rhymes related to food.

(10) Stories are told about well-fed and poorly-fed children and animals.

(11) Food posters and pictures decorate the nursery school walls. Children paint and colour pictures of foods.

(12) Parent/teacher discussions on the four basic food groups. Children's eating problems are discussed and solutions suggested by the group.

PRIMARY SCHOOL

All schools should be equipped with a non-spring balance and a measuring rod for taking weights and heights annually.

STANDARD I

Concepts

(1) Living things, plants, animals and people need food every day.

(2) To grow strong and healthy, children need food, rest, exercise and cleanliness every day.

(3) Foods are not alike; they differ in colour, shape, taste, texture and odour.

(4) Different foods can be grouped together; some make us "grow", some make us "go", some make us "glow". Each day choose some foods from each group so that we can "grow", "go" and "glow" every day.

Syllabus	**Teaching Aids and Activities**
Regional Language:	
Oral words:	Pictures of foods, utensils, etc. with matching words.
Reading known words:	Flash cards of words with pictures of foods.

Pot-book writing :	Including names of foods, utensils, etc.
Poetry, rhymes, songs :	Related to foods and to eating. Children make up food rhymes to recite in class.
General :	Illustrated books and stories about foods. Prepare simple dramas and dances related to food habits, food preparation and harvesting, washing and peeling of food articles before eating, hand-washing, tooth-cleaning.
Arithmetic :	Teaching arithmetic through eating and food interests.
Counting :	Learn to count by charts. Write the numbers after counting on slate, book and black board.
Easy addition and subtraction :	Learn by "shopping", paying and receiving change due.
Art & Craft :	Draw, colour and cut out "foods". Keep a food "scrap book".
History :	Tell stories of ancient India ; Life and food habits of nomads and hunters. The coming of the Aryans with cattle. Agrarian life, use illustrated picture-books, flip charts.
Geography :	Visit local parks, gardens and farms. Locate water supplies, observe path-ways, to and fro exits.
Nature Study :	Observe and learn plants and berries that can and cannot be eaten. Grow seeds in the classroom.

STANDARD II

Concepts

(1) Animals and plants are useful to man.

(2) Some animals give us food. Each kind of animal needs its own food and drink.

(3) Many plants give us food. Different parts of plants are used for food.

(4) We can plant in gardens, boxes and pots to grow our food.

(5) Foods we eat must be clean. Hands must be washed before and after touching food. Teeth must be cleaned after eating.

Syllabus	Teaching Aids and Activities
Regional Language :	Include poems and prose describing foods, eating, seed-sowing and harvesting. Use cut-outs and pictures for illustration. Children make up and recite their own poems on these subjects.
Reading :	Select passages that contain description of festivals and what foods are eaten then. Read and illustrate food needs of animals, birds and fish.
Dictation :	Include names of animals and their young, and the names of foods they eat.
Arithmetic :	Counting, adding and subtracting with two digits, using food charts and Khadigraph.
	Counting by 5's, 10's, 20's by children as they line up to wash hands.
	Notion of fractions ; using whole and part of food cut-outs.
	Units of length : metres and centimetres, illustrated by the children's own heights.
	Measure of capacity : litres, linked with measurement of milk and water.
	Calendar : with festivals and their foods as " red letter " days.
	Indian money : learned by " shopping " activities.
Art & Craft :	Colour pictures in outline of foods, farms and animals. Make clay models of vegetable, fruit, etc.

History :	Illustrated stories of the *Vedas*, *puranas*, and epics, with emphasis on agriculture and home life.
Geography :	Learn the map of India and the shape of the school and its grounds. List chief crops produced and animals reared in a region.
Nature Study :	Observe the various stages of plant cultivation in local gardens and parks. Bring vegetables to school. Observe how much dirt is removed from them when washed.

STANDARD III

Concepts

(1) Foods are eaten in natural and prepared forms. The different forms add interest and variety to daily meals.

(2) Machines and utensils are used in food preparation.

(3) Places where foods are prepared have different names, e.g., mill, bakery, dairy, poultry unit.

(4) Dry foods last longer than fresh foods. Foods must be carefully stored so that they may last longer.

(5) Clean, safe food must be prepared and eaten in clean, bright places, by clean, neat people.

STANDARDS IV & V

Concepts

(1) Foods are prepared in a variety of ways for our daily meals.

(2) Food preparation can change the appearance, colour, shape, taste and texture of food.

(3) Foods must be well chewed before being swallowed.

(4) Bits of food stick to our teeth if we do not clean them after eating.

(5) For food preparation, we use different kinds of utensils and equipment. These must always be kept clean.

(6) Different preparations are called by different names: soups, curries, *rotis*, etc.

(7) Fresh foods can be bought at markets, cooked foods at bakeries, stalls and eating places.

(8) The cleanliness and neatness of people, places and equipment in connection with food is very important.

(9) Foods are grouped into four basic groups. We must choose foods from each food group daily.

SYLLABUS

Subject	*Standard III*	*Standard IV*	*Standard V*
Regional Language			
Poetry & Prose :	As in Standard II, but at progressively advancing levels.		
Reading :	do.		
Grammar :	Nouns, verbs, singular and plural, tenses. All can be taught through foods and food preparation, etc. using Khadigraph, charts, flash cards.		
Writing composition :	Learn to write a menu, write about the school lunch.	Write on food likes and dislikes. Why we clean our teeth and wash our hands.	Describe each food in the four basic groups. Describe how the foods are prepared.
English :			
Vocabulary :	Learn those words particularly needed for understanding the concepts above.		
Poetry :	Learn riddles and rhymes about foods.		
Reading & writing :	As Standard II at progressively advancing levels.		
Grammar :	All can be taught through foods, etc., using Khadigraph cut-outs and words.		
Arithmetic :	Decimal system, weight, capacity taught by use of foods, multiplication and division by planning shopping and meals for the family, time of day, hour, etc. by promoting the habit of eating at fixed times.	As Standard III at more advanced levels. Teach concept of lakhs through population and imports and exports. Buying and selling land, produce, animals. Averages and percentage taught through the children's weights and heights. Areas by quantities needed for planting.	
Art & Craft :	Draw and colour foods and make cardboard food models. Make a model farm or kitchen.		

Subject	*Standard III*	*Standard IV*	*Standard V*
History:	Asoka and his influence on Hinduism and introduction of vegetarianism.	Moslem Rule, Akbar the great. Shah Jehan. The enormous Moghul contribution to foods, customs and culture.	European trades. East India Co. Vast exchange of food habits. Discovery of the New World-Slavery.
	Use flip charts and story book illustrations.		
Geography:	Site of school, with special reference to kitchen, dining room and in relation to markets, restaurants, mills, bakeries, etc. Arrange visits to these. Visit farms. Learn of food and fodder grown in regions. Irrigation and water supply. Learn about maps, physical features, climate, occupations, trade and trade routes.	Use of maps continued. Home districts, India—air, sea, road and rail transport. Population and demography, 5-year plan of agriculture. Make a map of the school campus.	Geography of India; climate, vegetation, agriculture, irrigation, fisheries, power resources, minerals. World trade routes.
Nature study, agriculture and health:	Observe the kinds of foods that animals need to eat. Visit flour mills and bakeries.	Visit places where poorly fed and well-fed animals can be observed. Visit kitchens to note cleanliness and neatness.	Learn how decaying matter is used for food production. Learn foods included in the four basic groups.

STANDARDS VI-IX

Concepts

(1) Foods are made up of nutrients. Each nutrient is different from the other.

(2) Each nutrient has a special job to do in the body. If the nutrient is missing from the diet, its job in the body is left undone.

(3) Foods that supply the specific nutrients for giving the body energy.

(4) Foods that contain proteins for building and repairing all parts of the body. Types of protein-high foods, animal, vegetable.

(5) Foods that supply minerals; iron for blood; calcium for bones and teeth.

(6) Vitamins needed to help the body get energy from food, to use nutrients for growth and repair, to protect the body from ill-health.

(7) Fruits and vegetables that supply vitamins and minerals.

(8) Meaning of what constitutes an adequate diet and how this can be obtained.

(9) Good and poor eating habits.

(10) The processes foods must undergo before our bodies can use the nutrients. Food preparation, digestion, absorption.

(11) Poor sanitary and hygienic habits lead to intestinal parasites and total waste of nutrients from food and nutritional education.

(12) Good food habits, personal hygiene, and good food preparation practices serve to prevent nutritional deficiencies.

Syllabus

Subjects should be continued according to the syllabus, with emphasis on food and nutrition wherever possible. Mathematical problems centred on foods; history of wars, conquests, famines and immigration as instrumental in changing food habits; social and economic development and its endowment of a country. Geography, with its climatic effects on agriculture; economics, trading and trade routes. Geography of hunger and of the well-fed.

Elementary Science:

STANDARD VI: Function of nutrients in foods, taught by using Khadigraph, charts and graphs.

STANDARD VII: The digestive system, with models and charts—food habits of animals, fish and birds.

STANDARD VIII: Natural "food factories", the cow, goat and buffalo as milkgivers. Birds as producers of eggs. Plants synergism with man; their processing the elements into food. Nitrogen cycle in soil. The earth-worm in soil formation. Microbiology: use in food manufacture, curds, cheese, etc.

STANDARD IX: Food poisoning and food-borne diseases. The effect of food preparation on nutrients in food.

SECONDARY EDUCATION—STANDARDS X & XI

Concepts

(1) Nutrition as a function in the life of all living creatures.

(2) Nutrition is necessary for maintaining all normal body systems.

(3) The science of chemistry is basic to nutrition.

(4) Nutrition influences health and disease.

(5) Chemical changes occur in foods and to alter their size, shape, colour, texture, taste, digestibility, palatability and nutrient contents.

Syllabus

Subjects taught as in primary education with nutritional emphasis when possible.

Science:

BOTANY: (1) Life and stages of growth of monocot, e.g., *ragi*, paddy, their nutrient content.

(2) Life and stages of growth of a dicot e.g., sunflower, legumes, their nutrient content.

(3) Soil: its formation, composition; its nutrient requirement; its contribution to plant and animal production.

ZOOLOGY: Natural history of animals, classification and habits, especially feeding habits.

BIOLOGY AND PHYSIOLOGY: The 9 systems of the body, human and animal, with emphasis on health and nutritional aspects.

CHEMISTRY: Factors that induce chemical change. Acids, bases and salts. Hardness of water. Changes that occur when foods are cooked.

A THREE-YEAR COURSE IN HOME SCIENCE FOR SECONDARY SCHOOL

Objectives

(1) To give future wives and mothers an understanding of efficient house-keeping and care of the family.

(2) To provide experience in skills needed for efficient house-keeping and family care.

Time: 3 hours a week for 3 years.

Subject	Allocation of Time (in hours)					
	I Year		II Year		III Year	
	Theory	Practical	Theory	Practical	Theory	Practical
Foods and Nutrition	14	28	14	28	14	28
Hygiene, First aid, Home Nursing	8	6	3	6	2	4
Home Management	5	10	4	8	4	8
Textiles, Clothing, Laundry	7	22	4	20	4	22
Child Welfare	2	6	4	2	4	6
Family Relations			4	2	4	2
Family Economics			3	6	4	2
Total:	36	72	36	72	36	72
	108		108		108	

OUTLINE OF FOOD AND NUTRITION

Objectives

(1) To gain a broader understanding of nutrients, their functions and sources.

(2) To comprehend the nutrient values of individual foods and of the basic food groups.

(3) To acquire skill in food preparation so as to cause the minimum of waste and to preserve the maximum of nutrients in cooked food.

(4) To develop good eating and food preparation habits.

(5) To learn ways of saving food values through good techniques of storage and preservation.

(6) To understand ways of overcoming food fads, fallacies and prejudices and of selecting the best of cultural food patterns.

(7) To develop the ability to plan and prepare adequate, attractive and palatable meals.

(8) To learn how to select, buy and use foods economically.

(9) To practice sanitary and hygienic food handling methods.

FIRST YEAR

(T = Theory; P = Practical)

Week		Classes
1.	T.	Utensils and equipment needed for food preparation.
	P.	Check and arrange lockers.
2.	T.	Food storage methods and reasons for them.
	P.	Store, and arrange food containers, with labels.
3.	T.	Weights and measures used in nutrition; use of recipes.
	P.	Practice using weights and measures; class weights and heights taken.
4.	T.	Foods and their nutrients.
	P.	Practice using recipes for cooking a simple dish.
5.	T.	Foods for energy; carbohydrates and fats.
	P.	Cook rice in various ways, evaluate the results.
6.	T.	Cereals, methods of cooking and nutrient contents.
	P.	Cook *chapatis, parathas, puris,* evaluate results.
7.	T.	Millets, their contribution to the diet and methods of preparation.
	P.	Prepare *ragi* porridge, *ragi* malt.
8.	T.	Roots and tubers, their nutrient content and methods of preparation.
	P.	Prepare roots and tubers in various ways.

9. T. The banana's contribution to the diet and ways of using it.
   P. Prepare banana milkshake, banana fritters, banana chips.
10. T. Proteins; functions in the body, classification, daily requirements, food sources.
   P. Make a list of quantities of specific foods to supply the daily requirements of protein for the class age group.
11. T. Pulses, their nutrient content and methods of cooking.
   P. Cookery of grams and *dhals.*
12. T. Complementary aspects of proteins from one food served with proteins from another.
   P. Cook *iddlis, dosai,* vegetable kedgree.
13. T. Eggs, their contribution to the diet and methods of preparation.
   P. Egg cookery.
14. T. Nuts and how to use them.
   P. Make nut cutlets, groundnut chutney, groundnut milk.

SECOND YEAR

Week **Classes**

1. T. The place of fish in the diet, classification. Nutrient contents. Effect of heat on their structure.
   P. Fish cookery.
2. T. Minerals; function in the body, food sources.
   P. List the quantities of foods to supply daily requirements of iron and calcium for the age group of the class.
3. T. Meat, types and classification of joints. Structure of meat, effect of heat on the structure and nutrient contents.
   P. Meat cookery.
4. T. Milk and its unique place in the diet. Types and uses of milk.
   P. Preparation of milk dishes.
5. T. Microbiology of milk and milk products. Milk-borne diseases. Use of bacteria in making curds and cheese.
   P. Making of curds and cheese.

6. T. Methods of using cheese and curds in food preparation.
   P. Prepare *channa* cheese and other cheese dishes.
7. T. Vitamins; fat-soluble vitamins, functions and sources.
   P. Preparation of green and yellow vegetables.
8. T. Water-soluble Vitamin C, functions in the body and food sources. Methods of fruit and vegetable preparation to conserve the vitamin. Recommended allowances.
   P. Make fruit and vegetable salads.
9. T. Water-soluble B Vitamins, thiamine, riboflavin, niacin, functions in the body, food sources, recommended allowances.
   P. Make fruit and vegetable salads.
10. T. Other Vitamins of the B-complex group, functions and food sources.
    P. Demonstrate losses of riboflavin in whey upon exposure to sun light. Losses of thiamine and niacin in milling. Discussion on preservation of vitamins in food preparation.
11. T. Planning nutritious daily meals. Cost studies. Time and motion studies.
    P. Plan a meal including methods and time for preparing each food.
12. T. Method of preparing snacks that contribute valuable nutrients to the daily diet.
    P. Preparation of nutritional snacks.
13. T. Methods of preparing beverages that add to the value of daily meals.
    P. Preparation of nutritious beverages.
14. T. The need for an adequate breakfast and constituents of one.
    P. Prepare nutritious breakfasts.

THIRD YEAR

Week **Classes**

1. T. Food fads and fallacies, their effect on the diet.
   P. Prepare a meal for a family of four.

2. T. Other factors that affect dietary habits.
   P. Prepare a picnic lunch.

3. T. Nutritional needs in pregnancy and lactation.
   P. Prepare a day's meal for a normal woman with additions for pregnancy and lactation.

4. T. Nutritional needs of the infant. Infant feeding.
   P. Prepare food for infants of various ages.

5. T. Nutritional care of the young child.
   P. Prepare a day's meal for a young child.

6. T. Theory and practice of School Feeding Programmes.
   P. Visit a midday meal at school. Report on the visit.

7. T. Nutritional needs in adolescence.
   P. Prepare a day's meal for an adolescent boy and girl.

8. T. The aging process and nutritional requirements.
   P. Prepare a meal for an old person.

9. T. Over weight and under weight, their danger and therapeutic diets for them.
   P. Prepare a reducing diet.

10. T. Constipation, prevention and diet therapy for it.
    P. Prepare diet to help cure constipation.

11. T. Types and causes of diarrhoea, nutritional and dietary aspects.
    P. Prepare a diet to alleviate diarrhoea.

12. T. Principles of diet therapy. Types of therapeutic diets.
    P. Prepare a liquid diet for a patient with fever.

13. T. Therapeutic diets for home-nursing. Convalescent diets.
    P. Prepare a convalescent diet.

14. T. "Let's have a party". Planning and preparing for a party.
    P. Give an end of school party.

ANNEXURE II

CURRICULUM IN PRINCIPLES OF FOOD AND NUTRITION

(Basic Course for All College Students Majoring in Humanities)

[Total hours : 32. Lectures, (L) : 16, Practicals or Demonstrations, (PD) : 16.]

L. 1. *Introduction :* The meaning of nutrition. Description of nutrients in foods and their general functions. Signs of good and poor nutrition. The effects of daily meals on health.

L. 2. *Sugars, Starches & Celluloses :* Occurrence in nature. Functions in plants and animals. Chief food sources. Effect of heat on carbohydrates.

L. 3. *Fats :* How plants make oils and animals generate fats. Dietary sources, uses and abuses in food preparation ; ebullition, frying and decomposition points.

L. 4. *Proteins :* Occurrence in nature. Building blocks of proteins, essential and non-essential. Quality of dietary proteins, animal, plant and mixed. Functions of proteins in the body. Daily requirements. Meeting the daily requirements.

PD. (1) Methods of cooking rice and wheat. (2) Demonstration of ebullition, frying, and decomposition points. (3) Cooking potato and banana chips. (4) Egg cookery.

L. 5. *Digestion of Food, Absorption of Nutrients :* Organs of digestion and absorption. Definition of enzymes and hormones. Processes of digestion and absorption.

L. 6. *Blood* : Functions of blood in the body. Life of a red blood cell. Daily requirements and food sources of iron; factors affecting absorption of iron. Mention of other trace minerals.

L. 7. *Bones and Teeth :* The composition of bones and teeth. Food sources of calcium and phosphorus. factors affecting their absorption and utilization in bone formation. Sources of Vitamin D. Mention of sodium, chloride and potassium.

PD. (5) Methods of using milk in food preparation. (6) Preparation of curds and cottage cheese. (7) Preparation of *ragi* malt and groundnut milk.

L. 8. *Vitamins:* Definition and classification. Occurrence of carotene and Vitamin A in nature. Functions of Vitamin A. Recommended daily allowances. Good food sources of Vitamin A and carotene. Mention of Vitamins E and K.

L. 9. *Thiamine, Riboflavin and Niacin:* Diseases associated with these deficiencies. Functions in the body. Recommended daily allowances. Good food sources. Losses in food preparation. Mention of other B-complex vitamins.

L. 10. *Vitamin C:* Functions in the body. Description of deficiency leading to Scurvy. Recommended daily allowances. Good food sources. Factors affecting the Vitamin C content during harvest, storage and food preparation.

PD. (8) Preparation of salads. (9) Preparation of carrots, pumpkin and leafy vegetables. (10) Sprouting green gram.

L. 11. *Factors Affecting Food Production, Distribution and Consumption:* Effects of climate, geography, season, economy, trading, transport, education and politics on food production, distribution and consumption.

L. 12. *Food Beliefs in India:* Effects of religion, society, culture and beliefs on food habits and health.

L. 13. *Food Hygiene:* Description of micro-organisms. Beneficial micro-organisms in food processes. Food-borne diseases and infections. Methods of hygienic food handling and storage.

L. 14. *Planning Daily Meals:* Use of food charts and guides. Food exchange lists. Economical marketing and food preparation.

L. 15. *Diets for Women:* Daily foods for a "normal" woman. Extras to include in times of pregnancy and lactation.

L. 16. *Feeding Infants and Children:* Nutritional needs of infants. Time to introduce new foods in baby's diet, amount, type and texture of foods. Family meals by twelve months. Additions required by young children, school children and adolescents.

PD. (11-13) Plan and prepare a day's food for an average woman with additions for nursing mothers. (14) Prepare infant foods for 3, 6, 9 and 12 months old infants. (15) Plan daily meals for children and adolescents. (16) Plan family meals.

ANNEXURE III

CURRICULUM IN THE SCIENCE OF NUTRITION FOR COLLEGE STUDENTS IN SCIENCES

[Total hours : 32 ; Lectures, (L) : 20 hours ; Practicals or Demonstrations, (PD) : 12 hours]

L. 1. *Nutrient in foods:* Nutrient composition of foods. General functions in providing energy and materials for growth and repair of the body and for regulating body processes.

L. 2. *Composition of the body:* Body fluid compartments and their measurements.

L. 3. *Carbohydrates:* Occurrence in nature, classification, chemistry, functions in the body, chief food sources.

L. 4. *Lipids:* Classification, chemistry and characteristics of fats, food sources and dietary uses. Phospho-lipids and cholesterol functions in the body.

L. 5. *Proteins:* Unique quality of proteins, chemistry, composition and synthesis. Essential and non-essential amino-acids. Quality of dietary proteins. Calculating digestibility and biological values. Protein requirements. Effects of Protein undernutrition.

PD. (1) Iodine test for starches, sweetness test for sucrose *vs.* glucose. (2) Saponification of fat compared with non-saponification of mineral oils. (3) Action of cold and

boiling water on egg; stages of egg and meat coagulation; action of weak acid and beating on egg white.

L. 6. *Energy:* Sources and types of energy; units of measurement; measuring energy needs; measurement of calories in food. Human requirements. Effects of excess and insufficient dietary calories on the body.

L. 7. *Water and Electrolytes:* Functions of water in the body; water balance. Functions and dietary sources of sodium, chloride and potassium. Effects of water and electrolyte imbalances on the body.

L. 8. *Digestion of Foods:* Organs and processes of digestion. Factors governing appetite and satiety. Effect of heat in food digestibility.

L. 9. *Absorption and Assimilation of Nutrients:* Processes of absorption; factors affecting the processes. Fate of absorbed nutrients.

PD. (4) Determination of moisture in, say, pulses. (5) Action of salivary amylase on starch. (6) Action of proteolytic enzymes on (say), milk.

L. 10. *Minerals and Vitamins:* General introduction. Macro- and micro-minerals. Definition, classification and general functions of vitamins.

L. 11. *Iron and Micro-Minerals:* Functions in the body. Dietary sources. Factors affecting absorption of iron. Recommended daily allowances. Iron-deficiency anaemia.

L. 12. *Calcium, Phosphorus and Vitamin D:* Functions in bone and teeth formation and maintenance. Effect of Vitamin D on the absorption and utilization of minerals. Other factors affecting their absorption. Function of minerals in blood. Effect of excesses and insufficiencies on the body.

L. 13. *Vitamin A, E and K*: Occurrence in nature. Conversion of carotene to Vitamin A. Functions in the body. Food sources, daily requirements. Effects of excess and insufficiency on the body. Synthesis and

functions of Vitamin K. Use in child birth. Antagonists to Vitamin K, their use in ischaemic heart disease. Dietary functions of Vitamin E. Food use ; sources.

PD. (7) Determination of ash in, say, pulses. (8) Determination of alkalinity or acidity of water-soluble ash. (9) If equipment is available : make a red blood cell count. (10) Determine the packed cell and plasma volume of blood.

L. 14. *Ascorbic Acid :* History of Scurvy, foods which prevented it. Functions in the body. Recommended daily allowances. Food sources ; losses in food preparation. Effects of Vitamin C deficiency on the body.

L. 15 and 16. *The B-Complex Vitamins:* Description and general functions in the body. Recommended or suggested daily allowances. Food source. Losses in food preparation. Effects of deficiencies on the body.

PD. (11) Test presence of ascorbic acid in, say, orange juice before and after exposure to air and heat. (12) Demonstrate presence of riboflavin in whey, and its disappearance on exposure to sunlight.

L. 17. *Table of Nutrients, Basic Food Guides :* Comparison of recommended daily dietary allowances in India, USA, UK, Canada and FAO/WHO. Their uses. Composition of food tables ; different kinds for different purposes, basic food guides. Food exchange lists and their uses.

L. 18. *Normal and Therapeutic Diets :* Planning normal diets. Philosophy of diet therapy. Therapeutic changes to normal diets.

L. 19. *Nutrition for Growth :* Nutritional needs and how to meet them in pregnancy, lactation, infancy and through childhood.

L. 20. *Assessing the Nutritional Status of a Community :* Clinical examinations ; anthropometry ; biochemical, biophysical and physical assessment ; dietary survey. Indirect methods ; vital statistics.

ANNEXURE IV

CURRICULUM IN NUTRITIONAL EDUCATION FOR COLLEGES OF TEACHER EDUCATION

(32 Hours. Use visual aids throughout the course; term paper required.)

1. *Introduction:* Nutrition as fundamental to life. Nutrition integrated in the educational system. Nutrient composition of foods and their general functions.
2. *Man's Environment:* Similarity of the sea and blood composition, minerals in the sea and in the soil. Uses of trace elements in plants and animals.
3. *Integument, Cells and Tissues:* Protoplasm, cell structure, division and permeability, types of tissues, integument, functions, structure, pigmentation and absorption through the skin. Nutrition of integument, cells and tissues.
4. *The Skeletal System:* Its functions and component parts, nutrients needed for bone and tooth formation. Daily requirements of the nutrients. Food sources of calcium and phosphorus. Sources of Vitamin D. Diseases of the bone due to nutritional deficiencies.
5. *Energy:* Sources and trapping of energy by plants. Types and units of energy. Measurements of energy requirements and calories in foods. Human requirements of energy. Effects of caloric malnutrition on the body.
6. *Plant Factories:* Plants make sugars, starches and cellulose for man and animals. Edible portions of plants. Food sources of carbohydrates. Their utilization by the body.
7. *Oils and Fats:* How and why oils occur in plants and fat in animals. Characteristics and kinds of oils and fats. Uses in the body and in food preparation.
8. *Soil and Nutrition:* Bacteria and earthworms aid in soil fertility. The nitrogen cycle and plant proteins. Fodder of food-producing animals.
9. *Proteins:* Their building blocks and functions in the body. Proteins of plants and animals, mixed proteins of foods.

Daily requirements. Principal food sources. Disease caused by protein insufficiencies.

10. *The Digestive System:* Organs and processes of digestion. Factors affecting appetite. Digestion of foods; absorption and assimilation of nutrients. Factors affecting absorption.

11. *The Muscular System:* Structure of muscles. How they function. Their utilization of nutrients.

12. *The Circulatory System:* Organs and functions of the system. Life of red blood cells. Daily needs of the body for iron food sources. Factors affecting absorption.

13. *History of Vitamins:* Definition and classification of vitamins. Diseases associated with vitamin deficiencies lead to their discovery. Vitamin A as it occurs in nature. Functions in the body. Daily needs and food sources.

14. *Water-soluble Vitamins:* Thiamine, riboflavin, niacin and other B-Complex vitamins. General functions, daily needs, food sources. Losses in food processing and preparation.

15. *Vitamin C:* Functions in the body. Daily needs. Food sources. Factors affecting Vitamin C content in foods; season, variety, harvesting, storage, and food preparation.

16. *Body Signs and Nutritional Status:* Outward signs of good and poor nutrition. Relationship of weight for height and age to nutrition. How weights and heights are recorded accurately. Record of class weights and heights.

17. *Milk:* The unique, first food for man and animals. Composition of milk. Comparison of human milk with others. Milk-borne diseases. Pasteurisation and processing of milk. Uses of milk and its products. Suggested amounts for daily consumption.

18. *Meat and Poultry:* Hanging meat. Types and joints of meat and poultry. Quality and marketing prices. Structure of muscle meat and offal. Nutrient content. Methods of cooking. Meat-borne diseases. Care in storage and use. Meat processing and meat extracts. Suggested amounts for daily consumption by non-vegetarians.

19. *Fish & Eggs:* Types and sources of fish and eggs. Structure and nutrient contents. Methods of cooking. Fish and

egg-borne diseases. Care in marketing and storage. Processing of fish and eggs. Suggested amounts for daily consumption.

20. *Pulses and Nuts:* Types and nutrient contents. Harvesting and storage. Methods of preparation. Use as milk substitutes. Suggested amounts for daily consumption.

21. *Green and Yellow Vegetables, Fruit:* Classification. Chief contribution of nutrients to the diet. Methods of preparation to avoid nutrient losses. Suggested amounts for daily consumption.

22. *Starchy Foods:* Varieties of cereals and millets. Structure. Harvesting. Storage. Milling and processing. Nutrient composition. Methods of preparation. Suggested amounts for daily consumption.

23. *Miscellaneous:* Accessory foods for calories and meal palatability. General rules of food hygiene. Teeth and their care.

24. *Teaching Nutrition in Schools:* Food groups. Exchange list. Teaching the concept of the three "gs"—"go", "grow" and "glow" foods; grains, grams and greens. Types of teaching aids to make and use. Class to prepare lessons and aids for demonstration teaching.

25. *Teaching Nutrition in Literature and Language:* Use names of foods, farmyard animals and food utensils for teaching vocabulary, spelling, parts of speech, composition. Teach rhymes and riddles about food. Emphasize foods and their production in drama and literature, e.g., Foods in the Bible. Effects of religion on food habits.

26. *Teaching Nutrition in Arithmetic and Mathematics:* Counting-cards of foods, addition, subtraction, multiplication and division in shopping and catering. Percentages and averages with class weights and heights; weights and measures of food. Time of day and dates of meals and festivals. Monetary systems and marketing. Area of fields for quantities of seeds.

27. *Teaching Nutrition in History:* Indian history: hunters and cave dwellers and their food habits. Coming of the Aryans

with their cattle, agrarian influence. Buddha and his vegetarianism. Asoka and his influence. Mongol rule and exchange of food habits. Akbar, the great. International exchange of ideas; caravan routes, crusaders. Marco Polo. Discovery of the New World. Traders and missionaries. Wars, famines and migrations. Rural reconstruction. Indian Constitution. Cooperatives and voluntary bodies.

28. *Teaching Nutrition in Geography:* Climate and rainfall. Effects of crops. Maps of chief crops and animals reared by regions. Irrigation and water-supply, effects on foods and nutrition. Trade winds, trade routes, industries. Sea, rail, road and air transport. Population and demography. Five-year plans for agriculture and nutrition.

29. *Teaching Nutrition in Science:* Nature study of plants and their edible portions; stages of plant cultivation, growing seeds in the classroom. Measurement of dirt and refuse removed from vegetables before cooking. Farm stock and their fodder. Signs of good and poor nutrition in local animals. Visit mills and bakeries. Teaching the "3-gs" and functions of nutrients with graphs and charts of skeletal, circulatory, muscular, respiratory and digestive systems; organs, their functions and relationships to nutrition. Natural food-producing factories: farm animals, birds, fish, plants. Elementary chemistry; minerals, acids, bases and salts, their place in nutrition. Hardness of water. Effects of heat on starches, fats, proteins.

30. *Teaching Nutrition in Arts and Crafts:* Colour pictures of foods and farm animals. Make posters and charts of foods. Embroider aprons with fruits and vegetables. Woodwork: cupboards for storage, dining tables. Pottery, cups, plates and bowls.

31 and 32. Class completes visual aids and each one gives a demonstration lesson of a school syllabus subject, using her aids. Evaluation of lesson and aids.

ANNEXURE V

IN-SERVICE TEACHER'S TRAINING COURSE FOR NUTRITION EDUCATION IN SCHOOLS

(6-day course)

First Day

9.30—10.30 *Introduction to the Course:* Purposes and organization. Contents of the course.

10.30—11.30 *Carbohydrates and Fats:* Occurrence in nature, classification and characteristics. Functions in the body. Chief food sources.

11.30—12.30 *Proteins:* Occurrence in nature; basic structures. Functions in the body. Quality of animal, plant and mixed proteins; recommended allowances. Chief food sources. Effects of protein deficiency on the body.

12.30—1.30 Lunch.

1.30—2.30 *Minerals:* Occurrence in nature. Functions in building and maintaining bones, teeth and blood.

2.30—4.30 *Vitamins:* Definition. Brief history of discovery. Classification. General functions in the body. Recommended allowance. Food sources. Effects of vitamin deficiencies on the body.

Second Day

9.30—10.30 *Factors affecting Food Habits:* Food beliefs in India.

10.30—11.30 *Food Hygiene:* Storage and handling. Beneficial and malevolent food bacteria.

11.30—12.30 *Teeth*: Structure, formation and maintenance; dental hygiene.

12.30—1.30 Lunch.

1.30—2.30 *Digestion and Absorption:* Digestion of food. Absorption and assimilation of nutrients.

2.30—3.30 *Food Economy*: Economic food purchasing and preparation. Minimizing nutrient losses in processing, storage and preparation.

3.30—4.30 *Weight and Measurement:* Weight and measurement of food. Weights, heights and outward signs of good and poor nutrition.

Third Day

9.30—10.30 *Basic Food Groups:* Exchange list. Composition of foods. Tables. Nutrient contribution of the food groups to the diet. Suggested daily amounts from each group.

10.30—11.30 *Diet Planning:* Planning diets for the family. Extras needed for expectant and nursing mothers.

11.30—12.30 *Diets for Young Children:* Feeding infants and young children. Their growth patterns and nutritional requirements.

12.30—1.30 Lunch.

1.30—2.30 *Diets for School Children:* School children: growth, development and nutritional needs. The school lunch and ANP in nutritional education.

2.30—3.30 *Audio Visual Aids:* Types, uses and equipment. How to make and use film strips and slides. Demonstration and practice in using projectors.

3.30—4.30 *Visual Aids:* Types and how to use them. Demonstration by teaching, spelling and counting.

Fourth Day

9.30—10.30 *Geography and History:* Demonstration of teaching nutrition in geography and history.

10.30—11.30 *Literature and Language:* Demonstration of teaching nutrition in literature and language.

11.30—12.30 *Science:* Demonstration of teaching nutrition in school science.

12.30— 1.30 Lunch.

1.30— 4.30 Teachers plan their demonstration lessons.

Fifth Day

All day: Teachers make visual aids for their demonstration lessons.

Sixth Day

All day : Teachers in turn give demonstration lessons. Evaluation by the group of the lessons, visual aids and of the course.

ANNEXURE VI

PRACTICAL NUTRITION

(96 Hour Course for Block and Mini Health Centre Nutrition —Workers 32 Hours Theory and 64 Hours Practical)

1. *Introduction :* Purpose and organization of the course. How to learn and teach practical nutrition. Effects of diet on health. Signs of good and poor health.
2. *Measurements :* The importance of accurate measurements. How to take and record weight, height and length. How to weigh and measure food. Care of measuring apparatus. Precautions in weighing.

3—4. *Practice* in taking and recording weight, height and length. Using weights and measures in marketing and in food preparation.

5. *Basic Food Groups :* Concept and contents of basic food groups. How much of each group to include in daily diets. Cost versus nutritional contribution of foods to health.
6. *Foods for Energy :* Cereals, roots, tubers and bananas, fats and oils. Their contribution to the diet ; methods and uses in food preparation.

7—8. *Cooking Energy Foods :* Preparation of *iddli, dosai, uppuma, roti* and *parathas.*

9—10. *Cooking Energy Foods (contd.) :* Hay box cooking (absorption method) of rice. Roasting or baking potatoes. Making banana chips.

11. *Foods for Growth and Repair :* Muscle meat and poultry. Types and joints of meat and poultry. Liver, kidney and heart, meat extracts. Contribution to the diet. Methods of cooking.

12. *Foods for Growth and Repair :* Fish : types, contribution to the diet. Methods of preservation and cooking.

Eggs, contribution to the diet. Methods and uses in food preparation.

13—16. *Preparation* of meat, poultry, fish in curries. Frying fish. Egg cooking : boiling, frying, scrambling, poaching, as omelettes and pancakes.

17. *Foods for Growth and Repair :* Pulses and nuts. Classification, contribution to the diet. Methods and uses in food preparation. Groundnut milk as a substitute for cow's milk.

18—21. *Preparation of Pulses and Nuts :* Sprouting green gram, frying Bengal gram ; gram and dhal curries ; groundnut milk and chutney.

22. *Milk and Milk Products :* Unique food for growth and repair. Uses in sickness and convalescence. Contribution to the diet. Methods and uses in food preparation.

23—26. *Preparation of Milk :* Making cocoa, milk soups, banana (and other fruit) milk shakes. Preparation of curds and cottage cheese. Uses in fruit and vegetable salads.

27. *Vegetables :* Classification and parts eaten. Contribution to the diet and the digestive system. Methods of food preparation.

28—29. *Preparation of Vegetables :* Green and leafy vegetables, cooking and use in salads, stuffed *parathas* and stuffed *dosai*. Carrots grated, cut in strips, boiled as soup. Use in salads. Stuffed pumpkin. Stuffed tomato, tomato juice, tomato salad. Preparation of fresh beans and peas and pureed vegetables. Chutney making.

30. *Fruit :* Classification, preparation, preservation, contribution to the diet and digestion.

31—34. *Preparation of Fruit* : Raw, stewed, pureed, as salad. Preservation of fruits in season. Chutney making. Making jam, jelly, fruit cheese and fruit juices.

35. *Effects of Cooking and Eating on Food :* How starchy foods, meat, fish, eggs, milk, pulses, vegetables and fruit are altered

in cooking, during eating and in the body.
Body's need for roughage and water.

36. *Food Hygiene:* Food poisoning and food-borne diseases. Factors to observe when buying food. Proper storage of food. Sanitary handling of food utensils. Personal hygiene of food-handlers.

37. *Food Adulteration:* Types of foods likely to be adulterated. How foods are adulterated. Indian food laws. Consumer's role in preventing food adulteration.

38. *Planning Diets:* Food and fuel budgeting. Planning meals with utensils available. Choice of foods in season. How to prepare and serve planned meals.

39—40. *Practice in Planning Diets* for a family of six, on a low income, for a day and a week.

41. *Kitchen Craft:* How to make and use a smokeless *chula* and haybox. Kitchen arrangement and management. Evaporation as a cooling system.

42. *Diets for Women:* Daily food requirements of a normal woman. Why and how to alter the diet in pregnancy and lactation.

43—44. *Preparation of Daily Meals for a Woman* and an expectant and nursing mother.

45—46. *Feeding the Infant and Young Child:* Golden rules in infant feeding; when to start supplementary feeding. How to prepare milk formula. Types, amounts and preparation of food for the infant and young child.

47—48. *Preparation of Food for Infants and Young Children:* Potato, ripe banana, fruit juice, carrot, green leafy vegetable, cereal, egg, pulses, rusk and milk formula or milk drink.

49. *Feeding Programmes* for infants, young children and mothers at *Kuzhanthaikal Kappagams* and *Mahalir Manrams.* Family and Child Welfare Scheme. Demonstration feeding project, Special nutrition (Modern Bread) scheme.

50. *Feeding the Nursery School Child:* Food requirements and physical needs of the nursery school child. Experiences in nutritional education at the nursery school.

51—52. *Visit* a *Kuzhanthaikal Kappagam* and or a nursery school.

52—53. *Prepare* a meal for nursery school children.

54. *Assessing* nutrition programmes and nutritional status of the community. Methods used. How to obtain data and keep records.

55. *Educating mothers* in child feeding in Mini-Health and other centres, *Mahalir Manrams* and *Kuzhanthaikal Kappagams*. Visual aids and teaching methods to use. How to interview mothers. Questions to ask, records to keep, using the interview for nutritional education.

56. *Educating Mothers* on their diets before and during pregnancy and lactation. Visual aids and teaching methods to use in Health Centres, *Mahalir Manrams* and *Kuzhanthaikal Kappagams*. Interviewing women on their own food attitudes and habits, using the interview for nutritional education.

57—58. *Visit a Mahalir Manram* and a Health Centre.

59. *Nutritional Education and International Aid:* CARE UNICEF, FAO, WHO and UNESCO. The ANP. The Tamil Nadu Nutrition Project.

60. *Kitchen Gardening:* The place of home, school and community gardens in nutrition education. Choice of vegetables and fruits to grow. The rotation of crops. Fertilizers, manure, pests and pesticides.

61—62. *Visit* a Kitchen Garden and Orchard.

63. *Feeding the Primary School Child:* How to meet food requirements of a primary school child. School lunches. Planning home meals in relation to school meals.

64—67. *Visit* a School Midday Meal Scheme in a town and a village. Visit an ANP programme.

68. *Poultry Keeping:* How to keep poultry, the house, feeds, breeds of birds, the deep-litter system. Poultry diseases and how to avoid them. Making poultry pay.

69—70. *Visit a Poultry Unit.*

71. *Nutrition Education of School Children :* Integrated nutrition education in the school syllabus. Visual aids and teaching methods to use.

72—73. *Preparation of Meals for a Primary School Child.*

74. *Feeding the Adolescent :* Growth spurt in adolescence. Need for extra food of good quality. How to meet adolescent needs for food. Additions required for pregnant and lactating adolescent girls.

75. *Nutritional Education of the Adolescent :* How to appeal to the adolescents through peer groups and youth clubs. Good diets for boys for their success in sports and careers. Appeal to adolescent girls for good looks as future wives. Appeal to maternal instincts as future mothers.
Home Science teaching, visual aids and teaching methods.

76. *Food and Nutritional Education for the "Bread Winner" :* Dietary needs of men, and how to meet them. Knowledge of nutrition useful to food producers. Knowledge of nutritional needs of each family member; marketing for the family. Men make the best cooks. Nutrition education for school masters.

77—78. *Prepare* meals for an adolescent boy and a man.

79—80. *Prepare* meals for adolescent girls and with extra nutrition for adolescent in pregnancy and lactation.

81. *Home Nursing :* Care of the sick. Diets in colds and fevers. Serving attractive food for the invalid.

82. *Prepare a tray* of soft foods and milk beverages for a sick or convalescent patient.

83. *Diets in Constipation and Diarrhoea :* Causes of constipation. Diet high in fibres and fluid to prevent constipation. Diet in (casual) diarrhoea; feeding the baby suffering from summer diarrhoea.

84—85. *Prepare Diets* for adults suffering from constipation and diarrnoea.

86—91. *Visual Aids :* Students prepare visual aids for themselves for nutrition education in *Kuzhanthaikal Kappagams, Mahalir Manrams,* Youth Clubs, Farmers Clubs and Schools.

92—96. *Demonstration Nutrition Education* by each student, using the visual aids she has made.

ANNEXURE VII

CURRICULUM IN SCIENCE OF NUTRITION FOR MEDICAL STUDENTS

(Total hours : 32 ; Lectures : 20 hours ; Practicals or Demonstrations : 12 hours)

Lectures

1. *Introduction to the Course :* Nutrient composition of foods. General functions in providing energy and materials for growth and repair of the body and for regulating body processes.
2. *Composition of the Body :* Body fluid compartments and their measurements.
3. *Carbohydrates :* Occurrence in nature, classification, chemistry ; functions in the body ; chief food sources.
4. *Lipids :* Classifications, chemistry and characteristics of fats ; food sources and dietary uses. Phospho-lipids and cholesterol functions in the body. Ketone bodies and ketoses.
5. *Proteins and Enzymes :* Definition. Unique quality of proteins, chemistry, composition and synthesis. Essential and non-essential amino acids. Quality of dietary proteins. Calculating digestibility and biological values. Protein requirements. Effects of protein undernutrition. Enzymes and their functions.
6. *Energy :* Source and types of energy ; units of measurement, measuring energy needs, measurement of calories in food. Human requirements. Effects of excess and insufficient dietary calories on the body.
7. *Water and Electrolytes :* Functions of water in the body ; water-balance. Functions and dietary sources of sodium, chloride and potassium. Effects of water and electrolyte imbalances on the body.

8. *Micro-minerals:* Functions in the body. Dietary sources. Recommended allowances of iron and iodine. Effects of micro-mineral malnutrition on the body. Organs and processes of making blood.

9. *Macro-minerals and Vitamin D:* Functions in the body. Food sources of calcium, phosphorus and magnesium. Sources of Vitamin D. Recommended allowances. Effects of excesses and deficiencies on the body.

10. *Vitamins A, E and K:* Occurrence in nature. Conversion of carotene to Vitamin A. Functions in the body. Food sources, daily requirements. Effects of excess and insufficiency on the body. Synthesis and functions of Vitamin K. Use in child birth. Antagonists to Vitamin K, their use in ischaemic heart disease. Dietary functions of Vitamin E. Food sources.

11. *Ascorbic Acid:* Functions in the body. Synthesis. Recommended allowances. Food sources, and factors affecting them. Effects of ascorbic acid deficiency on the body. Methods of estimating ascorbic acid nutritional status of an individual.

12 and 13. *The B-Complex Vitamins:* Description and general functions in the body. Recommended or suggested daily allowances. Food source. Losses in food preparation. Effects of deficiencies on the body. Methods of determining the B-complex vitamin status of an individual.

14. *Digestion, Absorption and Elimination of Nutrients:* Organs and processes of digestion, absorption and elimination of the body. Factors affecting the processes.

15. *Effects of Non-Nutritional Factors on Diet:* Factors affecting food production, distribution, consumption: climate, geography, trading, transport, storage, political, economic, social, cultural and religious.

16. *Food Hygiene:* Food-borne diseases. Sanitary food storage. Hygiene of food handling and preparation. Teeth: structure and cutting. Effects of nutrition and diet on teeth. Dental hygiene.

17. *Tables of Nutrients, Basic Food Guides:* Comparison of recommended daily allowances of India, USA, UK, Canada and FAO/WHO. Their uses. Composition of food tables; different kinds for different purposes. Basic food guides. Food exchange lists and their uses.

18. *Normal and Therapeutic Diets:* Planning normal diets. Philosophy of diet therapy. Therapeutic changes to normal diets.

19. *Nutrition for Growth:* Nutritional needs and how to meet them in pregnancy, lactation, infancy and through childhood.

20. *Assessing the Nutritional Status of a Community:* Clinical examinations; anthropometry; bio-chemical, bio-physical and physical assessment; dietary survey. Indirect methods; vital statistics, ecological information.

Practicals or Demonstrations

1. Effect of heat on starch demonstrated by the iodine test.
2. Reducing properties of sugar demonstrated with alkaline solution of metals.
3. Saponification of fats. Non-saponification of mineral oils.
4. Demonstration of thermal, chemical and mechanical coagulation of protein.
5. Determination of water in food.
6. Determination of food ash, and pH of water-soluble ash.
7. Demonstration of action of salivary amylase on starch.
8. Demonstration of proteolytic action of digestive enzymes on protein.
9. Make a red blood cell count.
10. Determination of haemoglobin and plasma protein by copper sulphate specific gravity method.
11. Determination of haematocrit.
12. Determination of ascorbic acid in blood and urine by the dye method.

ANNEXURE VIII

CURRICULUM IN THE SCIENCE OF NUTRITION FOR STUDENTS OF AGRICULTURE AND ANIMAL HUSBANDRY

(Total hours: 32; Lectures: 20 hours; Practicals or Demonstrations: 12 hours)

Lectures

1. *Introduction to the Course:* Nutrient composition of foods, general functions of nutrients.
2. *Energy:* Source and types of energy; units of measurement. Direct and indirect methods of measuring energy needs in man and animals. Caloric needs of human and farm animals. Measurement of calories in food stuffs; O_2 consumption. CO_2 production of plant tissues.
3. *Carbohydrates:* Definition. Occurrence in nature. Classification and chemistry. Functions in the organism. Chief food sources.
4. *Lipids:* Definition. Classification. Chemistry and characteristics of fats. Food sources and dietary uses. Functions of phospho-lipids and cholesterol in the organism. Ketone bodies and Ketoses.
5. *Proteins and Enzymes:* Definition. Chemistry, composition and synthesis of proteins. Functions in the organism. Essential and non-essential amino acids. Quality of proteins. Digestibility and biological values. Protein requirements. Effects of protein malnutrition. Functions of enzymes.
6. *Water and Electrolytes:* Functions of water in the organism. Water-balance. Functions and dietary sources of sodium, chloride and potassium. Effects of water and electrolyte imbalances on the organism.
7. *Iron and Micro-minerals:* Micro-minerals in soil. Dietary sources. Functions in the organism. Dietary allowances. Effects of micro-mineral malnutrition in plants, animals and man.

8. *Macro-minerals and Vitamin D:* Functions in the organism. Sources of macro-minerals and Vitamin D. Daily allowances. Effects of macro-mineral and Vitamin D excesses and deficiencies on the organism.

9. *Vitamins A, E and K:* Occurrence in nature. Functions of Vitamin A in the organism. Food sources and daily requirements of Vitamin A. Effects of Vitamin A malnutrition on the organism. Synthesis, functions and antagonists of Vitamin K. Food sources. Effects of malnutrition on the organism. Functions of Vitamin E in the diet, in food and in animals. Food sources. Effects of malnutrition on animals and birds.

10. *Ascorbic Acid:* Functions in the organism. Synthesis of ascorbic acid. Daily allowances. Food sources. Factors affecting ascorbic acid content of food. Effects of ascorbic acid deficiency in man and guinea pigs.

11. and 12. *B-Complex Vitamins:* Description and general functions in the organism of the B-complex vitamins, choline and inositol. Daily allowances. Food sources. Factors affecting the food sources. Effect of deficiencies on the organism.

13. *Digestion of Foods, Absorption of Nutrients:* Organs and processes of the digestive tract. Factors affecting the processes.

14. *End Products of Metabolism:* Excretion of nitrogen by man and animals. Nitrogen cycle in nature. Excretion of lipids, vitamins, electrolytes and minerals. Products of carbohydrate metabolism.

15. *Experimental Animals*: Nutritional needs of experimental animals and birds. Effects of malnutrition on these organisms. Uses in clinical diagnosis and nutrient assays of food.

16. *Microbiology of Foods:* Classification of food micro-organisms. Use of micro-organisms in food processes. Micro-organisms in food malevolent to man and animals. Hygiene and sanitation in food handling and storage.

17. *Non-Nutritional Factors affecting Food :* Effects of climate, geography, soil, seasons and education on food production and harvesting. Effects of trade, transport, storage facilities, economics and politics on food distribution.

18. *Food Beliefs in India :* Effects of religion, society, tradition, culture and beliefs on food habits and health. Distribution and consumption of food within the family and community.

19. *Planning Daily Meals* : Recommended daily allowances of nutrients. Food composition tables. Use of food charts, guides and exchange lists. Economical marketing and food preparation.

20. *Nutrition Programmes :* Types of rural and urban nutritional programmes. Crop and small animal raising in schools and communities. Poultry keeping. Contribution of nutritional activities to the nutritional status of the population. Aid of national and international agencies in nutrition programmes.

Practicals or Demonstrations

1. Iodine test of starches. Chemical tests of mono-and di-saccharides.
2. Saponification of fats. Non-saponification of mineral oils, formation of emulsions and suspensions.
3. Formation of gels. Thermal, chemical and mechanical coagulation of protein.
4. Determination of water in foods.
5. Action of salivary enzymes on starches.
6. Action of proteolytic enzymes on proteins.
7. Determination of ash in food, and the pH of water-soluble ash.
8. Obtain riboflavin from milk in whey. Observe its disappearance in light.
9. Determination of ascorbic acid in orange juice, before and after exposure to air.

10. Determination of ascorbic acid in potatoes, before and after peeling and cooking.

11. Demonstration of micro-biological action of yeast, moulds. and

12. Bacteria on foods, e.g., jam, bread and milk.

ANNEXURE IX

CURRICULUM IN SCIENCE OF NUTRITION FOR STUDENTS OF FOOD ENGINEERING

(Total hours: 32; Lectures: 20; Practicals or Demonstrations: 12 hours)

Lectures

1. *Introduction to the Course:* Nutrient composition of foods. General functions of nutrients.
2. *Development of Food Chemistry:* History of food chemistry. Variability and uniformity in bio-chemical research. Methods of sampling. Moisture in foods.
3. *Carbohydrates*: Definition, occurrence in nature, classification and chemistry. Functions in the body. Chief food sources. Identification by chemical reactions: colour, fermentation, optical activity.
4. *Lipids:* Definition. Occurrence in food. Physical and chemical properties of edible fats and oils. Uses in food preparation and in the diet. Chief food sources.
5. *Proteins and Enzymes:* Definition, chemistry, composition and synthesis. Functions in the body. Amino acid quality of proteins. Digestibility and biological values of proteins. Protein requirements. Effects of protein malnutrition on the body. Functions of enzymes.
6. *Water and Electrolytes:* Functions and water-balance of the body. Functions and dietary sources of sodium, chloride and potassium. Effects of water and electrolyte imbalances on the body.
7. *Micro-minerals:* Functions of iron and micro-minerals in the body. Food sources. Dietary allowances. Effects of micro-mineral malnutrition on the body.

8. *Macro-minerals and Vitamin D:* Function in the body; sources, recommended daily allowances. Effects of excess and deficiencies on the body.

9. *Vitamins A, E and K:* Functions in the body of Vitamins A and K. Functions of Vitamin E in food. Food sources. Recommended daily allowances of Vitamin A. Effects of dietary excess or deficiencies on the body.

10. *Ascorbic Acid:* Functions in the body. Effects of dietary deficiencies on the body. Food sources. Factors affecting the food sources. Recommended allowances.

11. *B-Complex Vitamins:* Description and functions in the body. Food sources. Daily allowances. Losses in food handling and preparation. Effect of dietary deficiencies on the body.

12. *Digestion, Absorption and Excretion of Nutrients:* Organs and processes of the gastro-intestinal tract and of elimination of waste-products. Factors affecting the processes.

13. *The Flavour and Aroma of Foods:* Sensation of flavour; influence of chemical constitution and other factors on taste, odour, texture, and blends. Control of flavour and aroma in processed foods; flavouring agents, measurement of flavour.

14. *Flesh Foods:* Structure of animals, poultry, fish and eggs; muscle and connective tissues. Postmortem changes. Colour of meat. Composition of flesh foods, contribution to the diet. Changes which occur in cooking.

15. *Milk and Milk Products:* Formation and composition of milk. Milk processing and types of milk produced. Checks for purity. Butter, chemical composition and additives. Cheese: composition and types. Processes in cheese-making. Contribution to the diet of milk and its products.

16. *Pulses and Nuts:* Classification, structure, chemical composition. Effects of heat on the composition. Methods of use. Contribution to the diet.

17. *Cereals and Their Uses:* Classification, structure of grains, chemical composition. Effects of harvesting, milling and processing on grains. Changes of carbohydrates on cooking. Browning reaction. Contribution to the diet.

18. *Vegetables and Fruits:* Classification of fruits and vegetables. Their structure and texture. Pigments and flavonoids in fruits and vegetables. Contribution to the diet. The Browning reaction. Pectic substances and fibres; uses in the diet. Changes on cooking and processing in pectic substances, cellulose, starch. Intercellular air. Production of volatile acids and sulphur compounds, post-harvest changes.

19. *Food Hygiene and Sanitation:* Food-borne diseases. Food infections and infestations. Food processing. Sanitary storage of food. Hygiene in food handling.

20. *Planning Meals:* Food beliefs. Economic marketing, storage and preparation of foods. Recommended allowances of nutrients. Composition of food tables. Use of food charts, guides and exchange lists. Planning food for the family.

Practicals or Demonstrations

1. Demonstrate the effect of cooking on starches by the iodine test.
2. Quantitative determination of sugars by their ability to reduce alkaline solutions of metals.
3. Demonstrate relative solubility of sugar and starch. Gelatinization of starch.
4. Saponification of fats. Demonstration of rendering.
5. Demonstrate thermal, chemical and mechanical coagulation of protein.
6. Determination of water in foods.
7. Action of salivary amylase on starches.
8. Action of proteolytic enzymes on proteins.

9. Determination of ash in food, and pH of water-soluble ash.
10. Demonstrate micro-biological action of milk in curd-making.
11. Demonstrate presence of riboflavin in whey and its loss on exposure to light.
12. Determination of ascorbic acid in a food and its loss on exposure to air and heat.

ANNEXURE X

MIDDAY MEAL MENU PATTERN FOR PRE-SCHOOL CHILDREN 3 TO 6 YEARS OF AGE

The cost* and quantity of food for pre-school midday meals are shown in Table A below, per child each day.

TABLE A—**Cost and Quantity of Food per Child Daily**

Day and Menu	Food	Price per kg. Rs.	Amount in grams	Cost per portion Rs.	Total Cost Rs.
Monday, Menu 1.	Rice, parboiled	1·25	80	0·100	
	Bengal gram *dhal*	1·35	20	0·027	
Lime rice	Amaranth, tender	0·20	50	0·010	
Keerai Kootu	Tomato	0·60	20	0·012	
Sliced Tomato	Lime juice	10 Paise—a few drops		0·003	
	Seasoning	—	pinch	0·003	
	Groundnut oil	3·50	10	0·035	
				0·190	0·190
Tuesday, Menu 2.	Maize flour	0·65	80	0·052	
	Green gram	2·10	20	0·042	
Maize-Vegetable	Amaranth	0·20	50	0·010	
Uppuma	Brinjal	0·20	80	0·016	
Sprouted *Mung*	Jaggery	1·80	12	0·021	
	Oil	3·50	5	0·018	
	Seasoning	—	pinch	0·003	
				0·162	0·162

* Excluding overhead charges which may not exceed 2 Paise per child per day.

Day & Menu	Food	Price per kg. Rs.	Amount in grams	Cost per portion Rs.	Total cost Rs.
Wednesday, Menu 3.	*Cholam*	0·65	40	0·026	
	Rice	1·25	40	0·050	
	Black gram *dhal*	2·45	20	0·049	
Cholam Iddli	Bengal gram *dhal*	1·35	5	0·007	
Curry leaf chutney	Curry leaves	0·20	25	0·005	
Mango	Mango	0·20	50	0·010	
	Oil	3·50	5	0·018	
	Seasoning	—	—	0·003	
				0·168	0·168
Thursday, Menu 4.	*Ragi*	6·65	60	0·039	
	Bengal gram *dhal*	1·35	20	0·027	
Ragi Pittu	Vine Spinach	0·20	25	0·005	
Keerai Kootu	Potato	0·80	100	0·080	
Grated Carrot	Carrot	0·20	50	0·010	
	Jaggery	1·80	8	0·014	
	Oil	3·50	5	0·018	
	Seasoning	—	pinch	0·003	
				0·196	0·196
Friday, Menu 5.	Rice	1·25	80	0·100	
	Bengal gram *dhal*	1·35	10	0·014	
Keerai Dhal	Red gram *dhal*	2·00	10	0·020	
Kozhakattai	Amaranth	0·20	50	0·010	
Sliced Papaya	Papaya	0·20	50	0·010	
	Oil	3·50	10	0·035	
	Seasoning	—	pinch	0·003	
				0·192	0·192
Saturday, menu 6.	Wheat *ravai*	1·25	80	0·100	
	Bengal gram *dhal*	1·35	20	0·027	
	Amaranth	0·20	50	0·010	
Wheat-Vegetable	Carrot	0·60	10	0·006	
Pongal	Oil	3·50	10	0·035	
Grated carrot	Seasoning	—	—	0·003	
				0·181	0·181
				Grand Total	1·089
				Average Cost	0·181

Nutrient Content of Menus Compared to One-Third of the Recommended Daily Allowances for a Three to Six Year Old Child

Nutrients	One-Third RDA	Menus Numbered					
		One	Two	Three	Four	Five	Six
Calories	475	474	475	477	477	476	475
Protein, g.	7·5	13·0	17·9	15·7	11·2	13·4	12·9
Calcium, mg.	150	230	158	262	258	227	237
Iron, mg.	5·8	16·8	16·5	8·0	11·9	16·6	18·6
Carotene, I.U.	390	2874	2935	2919	1504	3119	2975
Thiamine, mg.	0·25	0·33	0·49	0·41	0·44	0·34	0·66
Riboflavin, mg.	0·26	0·31	0·41	0·26	0·29	0·43	0·32
Niacin, mg.	3·2	4·8	3·2	5·3	3·5	4·8	4·9
Ascorbic acid, mg.	15	57	60	15	31	77	50

ANNEXURE XI

RESULTS OF STUDIES ON THE MIDDAY MEALS SCHEME IN SRI AVINASHILINGAM BASIC SCHOOL

The results of the School Midday Meals Scheme are presented in the following order:

1. Changes in the nutritional status of children as revealed by :
   (a) Height.
   (b) Weight.
   (c) Haemoglobin level of the blood.
   (d) Red Blood Cell count.
2. Changes in dietary habits.
3. Sociability.
4. Attendance in the school.
5. Mental alertness.
6. Nutritional knowledge gained by the children.
7. Parents' evaluation of the school lunch.

1. *Changes in the Nutritional Status of Children*

The mean height, weight, haemoglobin and RBC of 60 children taken fortnightly during a period of five months in one study are presented in Table A.

TABLE A—**Changes in the Nutritional Status of Children participating and not participating in Sri Avinashilingam Basic School Midday Meals**

(Number of children in each group—30; Experimental period—5 months)

	Mean Height (cm)		Mean Weight (kg)		Mean Haemoglobin (g/100 ml.)		Mean RBC Count (million/c.c.)	
	S.L.	N.S.L.	S.L.	N.S.L.	S.L.	N.S.L.	S.L.	N.S.L.
Initial	104·5	104·0	15·9	15·9	9·4	10·0	3·8	3·9
Final	106·4	105·4	17·5	16·8	11·7	11·2	4·3	4·0
Increase	1·9	1·4	1·6	0·9	2·3	1·2	0·5	0·1
	0·12		7·87*		0·9		6·0*	

*Significant at one per cent level
S.L. = School lunch
N.S.L. = Non-School Lunch

2. *Changes in Dietary Habits*

In another study, the impact of children's participation in the school lunch, on their food likes, dislikes and quantities consumed at home was elicited through administration of a questionnaire to their parents. Table B presents the food likes and dislikes of the children before and after participation in the school lunch as revealed by the parents.

TABLE B—**Parents' Evaluation of the Food Likes and Dislikes of 30 Children Before and After Participation in the School Midday Meals**

Food	Before		After	
	Number Liking	Number Disliking	Number Liking	Number Disliking
Rice/Cereals	24	6	30	0
Greens	12	18	30	0
Vegetables	16	14	30	0
Milk	21	9	30	0

While a considerable number of children did not like greens, vegetables and milk before participation in the school lunch, all had started liking them after the participation.

Table C gives the changes in the quantity of the foods consumed in the homes by children who were participating in the school lunch. The foods selected were those served in the school meal.

TABLE C—**Changes in Home Food Consumption of 30 Pupils participating in School Midday Meals**

Food	Number of children		
	Consuming amount	Consuming More	Consuming Less
Cereals	22	2	6
Dhal	26	4	0
Vegetables (Greens)	6	24	0
Milk	18	12	0

It is striking to note that six children started consuming less of cereals, while 24 had increased their consumption of greens and 12 of milk. Thus definite changes in the dietary habits of children were evident due to their participation in school lunch.

3. *Sociability*

The social development of pupils participating in the school lunch was assessed through the observations of the children at play and gardening activities by class teachers every week during a period of six months in another study. The results are presented in Table D.

TABLE D—**Scores for Play and Gardening of Children in the School Lunch and Non-School Lunch Groups**

(Number of children—16 per group ; Period—6 months)

	Scores			
	Play		Gardening	
	S.L.	N.S.L.	S.L.	N.S.L.
Initial	41	39	38	40
Final	45	38	46	40
Difference	+4	−1	+8	nil

S.L. = School Lunch
N.S.L. = Non-School Lunch
\+ = Changes in desirable direction
− = Changes in undesirable direction

Children participating in the school lunch showed desirable trends in sociability as compared to those not participating in the school lunch.

Table E presents the sociability of children in terms of their conversational ability during lunch as appraised by their parents.

TABLE E—**Sociability of Children in the Lunch Group as assessed by Parents**

(Number of children—30 ; Period—5 months)

Nature of Conversation	Before Joining the School Lunch	After Joining the School Lunch
Never talked at lunch time	19	1
Talked to a selected few	5	2
Felt shy to talk	3	2
Talked freely	3	25

That the participation in school lunch had helped children to become communicative is clearly evident.

4. *Attendance in the School*

That the attendance in school was influenced by participation in the school midday meal programme is shown in Table F.

TABLE F—**Attendance of the School Lunch and Non-School Lunch Groups**

(Number of children in each group—30; Experimental Period—5 months)

	Number of days	
	First half	Second half
School lunch	59	68
Non-School lunch	68	59

The percentage of attendance of the school lunch group improved from the first half to the second half of the experimental period. There was an equivalent decrease in attendance of the non-school lunch group during the second half of the period.

5. *Mental Alertness*

Sixteen pupils in the school lunch and a corresponding group not participating in the lunch were required to write a proverb, after being given three minutes to memorise it. Scores were assigned for the time taken to write, and also for the correctness. The teachers maintained records of the performance of the pupils in class tests. Both these were used to assess the mental alertness of the pupils. These results are presented in Table G.

TABLE G—**Marks Awarded to Pupils in the School Lunch and Non-School Lunch Groups for Mental Performance**

(No. of children in each group—16; Period—6 months)

Percentage of marks	NUMBER OF PUPILS					
	Memory Test			Class performance		
	S.L.	N.S.L.	x^2	S.L.	N.S.L.	x^2
Below 35	—	1		—	—	
36—50	—	3		—	—	
51—75	—	6	17·7**	2	12	13·0*
76—100	16	6		12	4	

** Significant at 0·05 level
* Significant at 0·01 level

S.L. = School Lunch
N.S.L. = Non-School Lunch

A percentage of 76 was obtained by 16 school lunch pupils and six of the non-school lunch group. In class tests also, the number of children performing creditably was higher in the school lunch group. These differences are statistically significant.

6. *Nutritional Knowledge Gained by the Children*

In a study with children participating in the school lunch programme at three different schools in Coimbatore district, nutrition education was found as an integral part of the programme only at one school (Sri Avinashilingam Basic School). The nutritional knowledge gained by the children is presented in Table H.

TABLE H—**Nutritional Knowledge of Children participating in Three Different School Lunch Programmes**

(20 in each group ; Period—5 months)

Question	Answers	Number answering in each group		
		I*	II	III
Why do we eat food ?	1. Food makes us			
	Healthy	20	2	4
	Strong and big	20	2	2
	Beautiful	10	—	—
	2. Food supplies us energy to study well	18	—	—
What are the foods you like most ? Why ?	3. Rice, Chappathi			
	Because we feel hungry	6	10	12
	Greens give us vitamins	18	—	—
	Milk :			
	Strengthens our body	12	—	—
	Milk ; Greens :			
	To get good red blood	4	—	—
What are the foods we need daily ?	4. Milk	17	2	4
	Greens	20	1	1
	Sprouted green gram	20	—	3
	Tomatoes	18	—	—

* With Nutrition Education

It is clear from Table H that when nutrition education is an integral part of the lunch programme, there is a definite influence on the nutritional knowledge of children participating in it.

7. *Parents' Evaluation of School Lunch*

Another study was made on the impact of the school midday meals programme in changing the food habits of one hundred families. The results indicated that

(1) Parents of school lunch children who received nutrition education were more conscious of the school lunch objectives than those of the non-school lunch group.

(2) Parents of the school lunch group knew more about the school lunch preparations, than those of the non-school lunch group.

(3) Parents of the school lunch group considered leafy vegetables and millets were also important for the growing child.

(4) Consumption of leafy vegetables, and millets like *ragi* and *cholam* and wheat was higher among the school lunch group than among the non-school lunch group.

(5) Parents considered that the school lunch programme had a significant influence on changing the dietary habits of children.

(6) Many children in the school lunch asked their mothers for the types of foods served in the school lunch.

ANNEXURE XII

DAILY FOOD FOR EXPECTANT AND NURSING MOTHERS

The approximate cost and quantities of daily foods for moderately active expectant and nursing mothers are tabulated below.

Cost and Quantities of Daily Foods for Moderately Active Mothers

Food	Unit price per litre/ kg.	Expectant Mother		Nursing Mother	
		Amount in grams	Cost per portion	Amount in grams	Cost per portion
	Rs.		Rs.		Rs.
Cow's milk	1·05	120	0·126	120	0·126
Pulses, mixed (average price)	1·90	45	0·086	60	0·114
Fruit in season	0·20	100	0·020	100	0·020
Dark leafy vegetables	0·20	100	0·020	130	0·026
Other vegetables	0·60	70	0·042	80	0·048
Rice, parboiled	1·25	140	0·177	160	0·200
Ragi flour	0·65	140	0·090	160	0·104
Wheat *ravai*, flour, whole	1·25	120	0·150	130	0·163
Cholam or maize *ravai*, flour	0·65	120	0·078	140	0·091
Jaggery	1·80	25	0·045	42	0·077
Groundnut oil	3·50	15	0·052	20	0·070
Seasoning, spice, coconut	—	—	0·024	—	0·031
Total	...	...	0·910		1·070

The dietary costs are limited by the estimate of 79 Paise as the minimum necessary to purchase foods supplying 2200 calories daily. A higher purchasing ceiling would make diets more varied and palatable as more milk, pulses, fruit, vegetable, jaggery, oil and spices could be included and the quantities of cereals considerably reduced.

Calories and nutrients of the diets were computed, tabulated and compared with the Indian Recommended Daily Dietary Allowances ([13]) as shown below :

Nutrient Contents of Diets for Moderately Active Mothers Compared with the Recommended Daily Dietary Allowances

Nutrient	Expectant Mother		Nursing Mother	
	RA	Diet	RA	Diet
Calories	2500	2500	2900	2900
Protein, g.	55	62·3	65	72·8
Calcium, mg.	1000	1302	1000	1527
Iron, mg.	40	60·5	30	85·2
Carotene, I.U.	3000	7965	4600	9638
Thiamine, mg.	1·3	2·8	1·5	3·2
Riboflavin, mg.	1·4	1·4	1·6	1·7
Niacin, mg.	17	20·2	20	22·9
Ascorbic acid, mg.	50	124	80	155

The making up of a mother's diet is illustrated below in a two-day menu pattern. Meals are practically interchangeable.

Menu

Day	*Breakfast*	*Lunch*	*Supper*	*Tiffin*
1.	*Cholam uppuma* Fruit	Savoury steamed *Ragi Adai*	*Dhal* Currie Rice Grated Carrot	Wheat *Mallitha* Milk
2.	*Ragi Puttu* Milk	Rice and *Dhal Kitcheri* Amaranth	Wheat *Pongal*	Maize Bread Sliced Tomato Fruit

The cost and quantities of foods for the menus are tabulated below. The slight variation in the cost of pulses is reciprocated in the seasoning costs.

Two-day Meal Pattern for Mothers

Meal and Food	DAY 1				Meal and Food	DAY 2			
	EXPECTANT MOTHER		NURSING MOTHER			EXPECTANT MOTHER		NURSING MOTHER	
	Amount in grams	Cost in Paise	Amount in grams	Cost in Paise		Amount in grams	Cost in Paise	Amount in grams	Cost in Paise
Breakfast									
Cholam ravai	120	7·8	140	9·1	*Breakfast*				
Bengal gram *dhal*	15	2·0	20	2·7	Ragi flour	140	9·0	160	10·4
Onion	15	0·9	18	1·1	Jaggery	25	4·5	42	7·7
Green chilli	5	0·3	7	0·4	Coconut	—	0·5	—	0·7
Oil	5	1·8	7	2·5	Milk	120	12·6	120	12·6
Seasoning	—	0·9	—	1·0					
Fruit	100	2·0	100	2·0					
Total	...	15·7		18·8	Total	...	26·6		31·4
Lunch					*Lunc*				
Ragi flour	140	9·0	160	10·4	Rice	140	17·7	160	20·0
Onion	15	0·9	18	1·1	Bengal gram				
Green chilli	5	0·3	7	0·4	*dhal*	30	4·8	40	6·4
Coriander	5	0·3	7	0·4	Onion	15	0·9	18	1·1
Drumstick leaves	30	0·6	40	0·8	Amaranth	100	2·0	130	2·6
Oil	5	1·8	7	2·5	Oil	5	1·8	6	2·1
Seasoning	—	0·9	—	1·0	Seasoning	—	1·1	—	1·4
Total	...	13·8		16·6	Total	...	28·3		33·6

Meal and Food	DAY 1				Meal and Food	DAY 2			
	Expectant Mother		Nursing Mother			Expectant Mother		Nursing Mother	
	Amount in grams	Cost in Paise	Amount in grams	Cost in Paise		Amount in grams	Cost in Paise	Amount in grams	Cost in Paise
Supper					*Supper*				
Rice	140	17·7	160	20·0	Wheat ravai	120	15·0	130	16·3
Red gram *dhal*	30	6·0	40	8·0	Green gram	15	2·9	20	3·8
Onion	15	0·9	18	1·1	Onion	15	0·9	18	1·1
Spinach	70	1·4	90	1·8	Green chilli	3	0·3	4	0·4
Carrot	10	0·6	15	0·9	Curry leaves	2		3	
Oil	5	1·8	6	2·1	Oil	5	1·8	7	2·5
Seasoning	—	1·0	—	1·1	Seasoning	—	1·1	—	1·4
Total	...	29·4		35·0	Total	...	22·0		25·5
Tiffin					*Tiffin*				
Wheat flour	120	15·0	130	16·3	Maize flour	120	7·8	140	9·1
Jaggery	25	4·5	42	7·7	Green chilli	5	0·3	7	0·4
Milk	120	12·6	120	12·6	Tomato	30	1·8	30	1·8
					Oil	5	1·8	7	2·5
					Seasoning	—	0·4	—	0·7
					Fruit	100	2·0	100	2·0
Total	...	32·1		36·6	Total		14·1		16·5
*Day's Total	...	91·0		107·0	Day's Total		91·0		107·0

* The costs of meals and menus worked out are subject to variations owing to periodic changes in prices of the food articles used.

ANNEXURE XIII

DAILY FOOD FOR ADOLESCENT GIRLS AND BOYS

The cost and quantities of daily food for adolescent girls and boys are tabulated below :

Cost and Quantities of Daily Foods for Adolescent Girls and Boys

Food	Unit price per litre/kg.	GIRL 13 to 18 years old		BOY 13 to 18 years old	
	Rs.	Amount in grams	Cost per portion Rs.	Amount in grams	Cost per portion Rs.
Cow's milk	1·05	120	0·126	120	0·126
Pulses, mixed (average price)	1·90	45	0·086	60	0·114
Fruit in season	0·20	100	0·020	100	0·020
Dark leafy vegetables	0·20	60	0·012	120	0·024
Other vegetables	0·60	60	0·036	80	0·048
Rice, parboiled	1·25	100	0·125	120	0·150
Wheat *ravai*, flour	1·25	100	0·125	120	0·150
Cholam or maize *ravai*	0·65	130	0·085	160	0·104
Ragi flour	0·65	130	0·085	160	0·104
Jaggery	1·80	18	0·032	24	0·043
Groundnut oil	3·50	12	0·042	18	0·063
Seasoning, spice, coconut	—	—	0·016	—	0·024
Total	...	...	0·790		0·970

The cost of diets for adolescent girls and boys is limited by the estimate of 79 Paise for purchasing food to supply 2200 calories daily. A higher purchasing ceiling would make the diets more varied and palatable as the quantity of cereals could be considerably reduced and replaced by more milk, pulses, fruit, vegetables, jaggery and oil.

Calories and nutrients of the diets have been computed, tabulated and compared with the Indian Recommended Daily Dietary Allowances of Nutrients ([13]), as shown below :

Nurient Content of Adolescent Diets Compared with the Recommended Daily Allowances

Nutrient	GIRL 13 to 18 years old		BOY 13 to 18 years old	
	RA	Diet	RA	Diet
Calories	2200	2200	2750	2750
Protein, g.	50	57·5	58	72·1
Calcium, mg.	600	907	600	1222
Iron, mg.	35	46·7	25	69·7
Carotene, I.U.	3000	5784	3000	9163
Thiamine, mg.	1·1	2·5	1·4	3·0
Riboflavin, mg.	1·2	1·2	1·6	1·7
Niacin, mg.	14	17·8	19	21·4
Ascorbic acid, mg.	30 to 50	91	30 to 50	91

Examples of how to use the foods listed are given below in menus for two days. The meals of the day are interchangeable.

Two-Day Menu for Adolescent Girls and Boys

MENU

Day	*Breakfast*	*Lunch*	*Supper*	*Tiffin*
1.	*Ragi Puttu* Milk	Wheat *Pongal* Amaranth Grated Carrot Salad	*Cholam Uppuma* Fruit	*Iddli* and Sauce
2.	Wheat *Kozhakattai* Milk	*Dhal* Currie Rice Sliced Tomato Salad	Savoury *Ragi Adai* Fruit	Maize *Chapatis* Vegetable *Kootu*

Cost and Quantities of Foods for Adolescent Menus

Meal and Food	DAY 1				Meal and Food	DAY 2			
	GIRL		BOY			GIRL		BOY	
	Amount in grams	Cost in Paise	Amount in grams	Cost in Paise		Amount in grams	Cost in Paise	Amount in grams	Cost in Paise
Breakfast					*Breakfast*				
Ragi flour	130	8·4	160	10·4	Wheat flour	80	10·0	90	12·3
Jaggery	18	3·2	24	4·3	Jaggery	18	3·2	24	4·3
Grated coconut	—	0·5	—	0·7	Grated coconut	—	0·5	—	0·7
Milk	120	12·6	120	12·6	Milk	120	12·6	120	12·6
Total	...	24·7		28·0	Total	...	26·3		29·9
Lunch					*Lunch*				
Wheat *ravai*	100	12·5	120	15·0	Rice	100	12·5	120	15·0
Bengal gram *dhal*	25	3·5	35	4·7	Red gram *dhal*	25	5·0	30	6·0
Onion	15	0·9	20	1·2	Onion	10	0·6	15	0·9
Carrot	15	0·9	15	0·9	Oil	4	1·4	6	2·1
Amaranth	60	1·2	120	2·4	Seasoning	—	0·7	—	0·8
Oil	5	1·8	7	2·5	Tomato	20	1·2	20	1·2
Seasoning	—	0·6	—	1·0					
Total	...	21·4		27·7	Total	...	21·4		26·0

Meal and Food	DAY 1				Meal and Food	DAY 2			
	GIRL		BOY			GIRL		BOY	
	Amount in grams	Cost in Paise	Amount in grams	Cost in Paise		Amount in grams	Cost in Paise	Amount in grams	Cost in Paise
Supper					*Supper*				
Cholam ravai	130	8·5	160	10·4	*Ragi* flour	130	8·5	160	10·4
Onion	15	0·9	20	1·2	Onion	10	0·6	15	0·9
Green chilli	5	0·3	8	0·5	*Green chilli*	5	0·3	8	0·5
Seasoning	—	0·6	—	1·0	Coriander	5	0·3	8	0·5
Fruit	100	2·0	100	2·0	Drumstick leaves	30	0·6	60	1·2
Oil	5	1·8	7	2·5	Oil	4	1·4	6	2·1
					Seasoning	—	0·7	—	0·8
					Fruit	100	2·0	100	2·0
Total	...	14·1		17·6			14·4		18·4
Tiffin					*Tiffin*				
Rice	100	12·5	120	15·0	Maize flour	130	8·5	160	10·4
Black gram *dhal*	20	4·9	25	6·1	Wheat flour	20	2·5	30	4·1
Curry leaves	—	0·3	—	0·5	Bengal gram *dhal*	20	2·7	25	0·4
Tamarind pulp	—		—		Spinach	30	0·6	60	1·2
Onion	5	0·3	7	0·4	Onion	10	0·6	14	0·8
Oil	2	0·7	4	1·4	Oil	4	1·4	6	2·1
Seasoning	—	0·1	—	0·2	Seasoning	—	0·6	—	0·7
Total	...	18·8		23·6			16·9		22·7
Day's Total	...	79·0		97·0	Day's Total		79·0		97·0

If colleges and industry wish to provide midday meals for adolescent girls and boys, the cost per meal will be approximately 26 and 32 Paise respectively to ensure that each meal provides one-third of the recommended daily dietary allowances of nutrients. In addition, the cost of fuel, labour and overhead expenses must be calculated.

ANNEXURE XIV

BUDGET ESTIMATE FOR THE DEPARTMENT OF NUTRITION

(Recurring)

	Details	State Directorate	Districts	Total
1.	Salary	10,00,000·00	34,40,000·00	44,40,000·00
2.	Travelling Allowance	25,000·00	3,00,000·00	3,25,000·00
3.	Rent	36,000·00	31,200·00	67,200·00
4.	Stationery	15,000·00	13,000·00	28,000·00
5.	Contingencies	25,000·00	39,000·00	64,000·00
6.	Petrol and Vehicle Maintenance	15,000·00	1,35,000·00	1,50,000·00
	Total	11,16,000·00	39,58,200·00	50,74,200·00
	Total (Non-recurring)	3,54,500·00	11,64,000·00	15,18,500·00
	Progressive Total	14,70,500·00	51,22,200·00	65,92,700 00

	Rs. in lakhs		Rs. in Crores
Total Expenditure for 12 years	50·74×12	=	6·089
Non-recurring expenditure (as per details given below)		=	0·152
	Total	=	6·241

Abstract Estimate for the Proposed Nutrition Directorate

(*Non-Recurring*)

	Details	State Directorate	Districts	Total
1.	Printing press & accessories	97,000·00		97,000·00
2.	Cinema unit with Van	46,000·00		46,000·00
3.	Exhibition unit with Van	50,000·00		50,000·00
4.	Audio-visual accessories—Tape recorder, amplifier, etc.	3,000·00		3,000·00
5.	Equipments for artist-*cum*-photographer	20,000·00		20,000·00
6.	Calculating machines	10,000·00		10,000·00
7.	Typewriter & duplicators (13+6 for the Directorate and 13+13 for districts)	28,500·00	39,000·00	67,500·00
8.	Initial expenses for food-processing	50,000·00		50,000·00
9.	Cost of vehicles—2 for the Directorate, 6 for the regional officers, 13 for the district officers and 26 for mobile units	50,000·00	11,25,000·00	11,75,000·00
	Total	3,54,500·00	11,64,000·00	15,18,500·00

REFERENCES

1. Berg, Alen D. *Malnutrition and National Development,* Council of Foreign Relations Inc., 1967.
2. Cravioto, J., E.R. Delicardie, C. Pinero, M. Lindero, M. Arroyo and E. Alcade. *Mental Development and Malnutrition,* Proceedings of the Nutrition Society of India, 10, 1971.
3. *Nutrition and Working Efficiency. Freedom from Hunger Campaign—Basic Study 5,* Food and Agricultural Organisation, Rome, 1966.
4. Venkataswamy, G. *Malnutritional Blindness in India,* J. of Ind. Med. Assn., 47, 1966.
5. McLaren, D.S., *Malnutrition and the Eye,* Academic Press, London, 1963.
6. Cook, R. *The Financial Cost of Malnutrition in the Commonwealth Caribbean,* J. of Trop. Ped., 14, 1968.
7. Boerma, A.H. *Key-note address to the First Asian Congress of Nutrition,* Hyderabad, Nutrition News Letter 9, 1971.
8. Gopalan, C. *III Worldwide Experience. Special Problems and Preventative Programmes (1) India,* J. of Trop. Ped. 14, 1968.
9. Raju, B.V. Unpublished communications, 1972.
10. Scrimshaw, N.S., C.E. Taylor and J.E. Gordan. *Interactions of Nutrition and Infection,* World Health Organisation, Geneva, 1968.
11. Dandekar, V.M. *Poverty in India,* Economic and Political Weekly, Bombay, 1971.
12. Gopalan, C., S.C. Balasubramanian, B.V. Rama Sastri, and K. Visweswara Rao. *Diet Atlas of India,* Nat. Inst. of Nutrition, ICMR, Hyderabad, 1969.
13. Gopalan, C., B.V. Rama Sastri and S. C. Balasubramanian, *Nutritive Value of Indian Foods,* Nat. Inst. of Nutrition, ICMR, Hyderabad, 1971.

14. *Food Habits in Madras State,* Census of India, Vol. II, 1964.

15. Dept. of Statistics. National Sample Survey, 24th Round, 1971.

16. Devadas, Rajammal P., Rohini Sambamurthy, Mercy Vasantha Kumari Devadoss, R. Mira Bai and A. Radharukmani. *A Dietary and Nutritional Survey of a Small Village Community in South India,* Ind. J. of Nutr. & Diet. I, 1964.

17. *Production Figures,* Based on the Final Forecast from the Dept. of Statistics.

18. Gopalan, C., and K. Vijaya Raghavan. *Nutrition Atlas of India,* Nat. Inst. of Nutrition, ICMR, Hyderabad, 1969.

19. Ghosh, S., S.K. Bhargava and V. Bhargava. *Growth Patterns of Babies in Delhi Area in the First Year of Life,* Proceedings of the Nutr. Soc. of India, 10, 1971.

20. Gopalan, C. *Nutrition and Development,* Nat. Inst. of Nutrition, ICMR, Hyderabad, 6, 1972.

21. Bogert, L. Jean, George M. Briggs and Doris Howe Calloway. *Nutrition and Physical Fitness,* W.B. Saunders Co., Philadelphia, 1966.

22. Jelliffe, D.B. *The Assessment of the Nutritional Status of the Community,* World Health Organisation, Geneva, 1966.

23. Stearnes, Genevieve, *Nutritional Status of the Mother Prior to Conception,* Nutrition in Pregnancy, Symposium IV. Council on Foods and Nutrition. Am. Med. Assn., Chicago, 1958.

24. *Maternal Nutrition and Course of Pregnancy,* National Academy of Sciences, Washington, D.C., 1970.

25. Coimbatore District Secondary Schools Medical Aid Committee—Coimbatore—Second Annual Report—1970-71.

26. Government of Tamil Nadu—Finance Dept., Economic Appraisal—Tamil Nadu—1971-72.

27. Avinashilingam, T.S., Seminar on Nutritional Feeding in the Fourth Plan, Sri Avinashilingam Home Science College, 1970.

28. Devadas, Rajammal P. and A. Radharukmani. *The Growth and Nutritional Status of School Children*, Ind. J. of Nutr. & Diet. 1, 1964.

29. Sundaravadivelu, N.D., *Midday Meals Scheme—Growth of a Massive Movement*, Yojana 14, 1969.

30. Davidson, Sir S. and R. Passmore *Human Nutrition and Dietetics*, E and S. Livingstone Ltd., Edinburgh and London, 1968.

31. Robinson, Corinne. *Fundamentals of Normal Nutrition*, The MacMillan Co., New York, 1968.

32. *Food. The Year Book of Agriculture 1959*, U.S. Dept. of Agri., Washington, D.C., 1959.

33. Ritchie, Jean A.S. *Learning Better Nutrition*, Food and Agricultural Organisation, Rome, 1967.

34. Macy, Icie G. *Metabolic and Biochemical Changes in Normal Pregnancy*, Nutrition in Pregnancy, Symposium IV Council on Foods and Nutrition, Am. Med. Assoc., Chicago, 1968.

35. *Recommended Dietary Allowances*, National Academy of Science, Washington, D.C., 1963.

36. *Health and Nutrition*, Monthly commentary, 5, 1968.

37. Barnes, R.H. *Effect of Malnutrition on Mental Development*, Am. J. of Home Ec., 611, 1969.

38. Hotzel, D. *Working Efficiency and Its Dependence on Nutritional Status*, Berlin-Gressan Seminar, Spring 1966.

39. *Report of the Latin American Seminar on the Planning and Evaluation of Applied Nutrition Programs*, PAHO/WHO, Washington, D.C., 1967.

40. Low, D.I.D. *Evaluating Nutrition Education Programmes on Two Islands in the Caribbean*. Ph. D. Thesis, U. of Calif., 1970.

41. Gandhi, Indira. *Towards Growth with Social Justice*, Budget Message, 1970.

42. Subramaniam, C. *Strategy Statement on Action to Avert the Protein Crisis in the Developing Countries*, Dept. of Econ. and Soc. Affairs, United Nations, New York, 1971.

43. Boerma, A.H. *Address to the Second World Food Congress*. The Hague, 1970.

44. Jagannathan, Maithily. *Up in Arms for the Consumers*, The Hindu, Sunday, April 11, 1971.

45. Rao, Mohan, District Health Office, Coimbatore, unpublished communication.

46. *India, A Reference Annual* 1971-72, Ministry of Information and Broadcasting, New Delhi, 1972.

47. Collins, C. P. *Food Hygiene Ashore and Afloat*; Pitman Medical Publishing Co. Ltd. London, 1952.

48. Hobbs, Betty, C. *Food Poisoning and Food Hygiene*, Edward Arnold and Co., London, 1952.

49. Irving, G. W. and S. R. Hoover. *Food Quality—Effects of Production, Practices and Processing*, Amer. Assn. for the Advancement of Science, Washington, D. C., 1965.

50. Aykroyd, W. P. and J. Doughty. *Legumes in Human Nutrition*, FAO, Rome, 1964.

51. Nicholls, L. *Tropical Nutrition and Dietetics*, Bailliere, Tindall and Cox, London, 1945.

52. *Times of India Directory* and *Who's Who*, 1971.

LIST OF TABLES

Tables		Page
1.	Daily allowances of nutrients for Indians	... 11
2.	Mean per capita daily consumption of calories and proteins in the different states of the Indian Union	... 12
3.	Per capita mean daily food consumption in Tamil Nadu	... 12
4.	Food consumption pattern in Tamil Nadu —1961	... 13
5.	Percentage distribution of population according to monthly per capita expenditure classes in 1969-70 in Tamil Nadu	... 14
6.	Calorie and nutrient intake of selected groups in Coimbatore District	... 15
7.	Population projections and distributions in Tamil Nadu (Age Groups)	... 16
8.	Protein-calorie requirements for population of Tamil Nadu according to the ICMR recommendations (1968)	... 17
9.	Production in Tamil Nadu of cereals and pulses and calories and protein available from their edible portion 1970-1971	... 17
10.	Mean length, height and weight of children in Coimbatore District and percentage attainment of standard weight for length/height, age and sex	... 19
11.	Morbidity pattern among children below ten years of age in Tamil Nadu	... 21
12.	Morbidity in selected rural areas of Tamil Nadu	... 22

Tables Page

13. INCIDENCE OF MALNUTRITION AMONG CHILDREN ... 23

14. PERCENTAGE OF PUPILS SUFFERING FROM VARIOUS DEFECTS/DISEASES IN SELECTED SECONDARY SCHOOLS IN COIMBATORE DISTRICT DURING 1970—71 ... 24

15. PERCENTAGE PREVALENCE OF NUTRITIONAL DEFICIENCY SIGNS IN TAMIL NADU ... 25

16. MAIN CAUSES OF MORTALITY AMONG PRE-SCHOOL AGE-GROUP IN MADRAS ... 26

17. TOTAL NUMBER OF CHILDREN WITH MALNUTRITION TREATED IN MADRAS INSTITUTE OF CHILD HEALTH DURING 1971 ... 27

18. ON-GOING FEEDING PROGRAMMES IN TAMIL NADU ... 31

19. CALORIC AND PROTEIN DEFICITS AND NEEDS OF SELECTED VULNERABLE GROUPS IN TAMIL NADU ... 37

20. COST, QUANTITY AND NUTRITIVE VALUE OF FOODSTUFFS USED PER CHILD PER MEAL ... 50

21. WEEKLY MENU IN SRI AVINASHILINGAM BASIC SCHOOL MIDDAY MEALS ... 51

INDEX

A

Abilities, subnormal, 1
Additives, 86, 87
Adolescent, 11, 51, 53
Adulteration, 86
Adults, 11, 53
  Refer Nutrition Programmes
Adequacy, nutritional, 37
Agencies, 57
  Refer Nutrition Programmes
Allowances, recommended daily, 11, 12
Analysts' laboratories, 87
Annexures, 97—155
Anthropometry, 27
Applied Nutrition Programme (ANP)
  Refer Nutrition Programmes
Approach to combating malnutrition, 6, 10
Aspects, hygienic, economic, educational, 36, 37
Atlas, Diet, of ICMR 10

B

Balawadies, 8
  Refer Kuzhanthaikal Kappagams
Balasevikas, 48
Baldwin-Wood tables, 18
Beliefs, 3
Blindness, 2
  Refer Deficiency

C

CARE, 28, 30, 32, 50
Calories, 2, 10, 12—15, 16, 17
Capacity, 1, 2, 97
Centres, rehabilitation, 8
Cereals, 15, 19, 22
Children, 3, 5, 6, 7, 15, 18, 19, 21, 22 23, 27, 28, 29, 31, 39, 43, 49
Child, pre-school, 6, 7, 12, 28, 37, 44, 65
Coimbatore, 15, 19, 22
Collaboration, 78—80
College
  Christian Medical, Vellore, 67
  Madurai Medical, 70
  Sri Avinashilingam Home Science, 14, 37, 67
  Women's Christian, 69
Consumption, daily per capita, of Calories and Proteins, 9, 10, 11, 12, 27
Consumer Guidance Society, 89
Contamination, 86, 91, 92
Creches, 8, 42, 63, 65
Curricula, 9, 34, 35
Customs, 2, 3

D

Data bank, 76, 77
Deficiency, 2, 15, 24, 25, 27, 46
Dependents, 4, 33
Demonstration feeding programme, 28, 48, 49
Disease, 2, 15, 24, 25, 27, 46
Distribution, 1, 7, 9, 56, 96
Domestique, 4

E

Education, 7, 8
  Department of 56
  Nutrition, 33, 34, 35, 36, 50
Energy, 1
Environment, 1
Expenditure, 1, 14, 64—66
Evaluation, 34, 38, 57, 60, 80

F

Family, 4, 5, 55,
Fatalism, 1

Feeding programmes, 29—33, 57
Refer Nutrition Programmes
Foods, 1, 2, 6, 9, 13, 50, 72, 86, 96, 97
Food patterns, 12, 73
Food poisoning, 91—93, 94

G

Goals, 7, 8, 9, 81
Groups, 1, 15, 20, 36, 37, 43, 45, 81
Growth, 1, 2, 9, 40, 43, 44, 51, 52

H

Habits, 1, 3, 4, 5, 13, 41, 55, 72
Health Centres, (PHC), 20, 23, 30, 31, 65
Health Education
Refer Education
Hospitals, 2

I

I.C.M.R., 9, 106
Ignorance, 4
Immunisation, 6
Infants, 4, 5, 11, 12, 19, 40
Refer Nutrition Programmes
Infections, 3, 5, 21, 22, 91
Infestations, 3, 5, 32, 95, 96
Intake, 1, 3, 15
Institute of Child health, 20, 26, 27, 68

K

Kuzhanthaikal Kappagams, 8, 28, 29, 31, 32, 37, 44, 62—66

M

Mahalir Manrams, 80
Malnutrition, 1, 2, 3, 5, 6, 10, 20, 27, 28, 48
Midday Meals Scheme, 29, 32, 33, 49, 51, 57
Morbidity, 2, 10, 20, 21, 22, 27
Mortality, 3, 10, 25—27
Mothers, expectant and nursing, 17
Refer Groups, Nutrition Programmes

N

National Sample Survey, 14
Nutrients, 2, 10, 70
Nutrition, *Ibid.*
Department of, 8, 58, 59, 60, 81
Plan, 62—66, 76
Programmes, 28, 29, 30, 31, 34, 43, 45, 48, 51, 53, 57, 58, 65, 74, 78—80
Research, 66—75
Strategies, 76
Systems approach, 70
Status, 70, 71

O

Objectives, 80
Organisational Structure
Refer Department of Nutrition

P

Parameters, 4, 10, 19, 81, 82
Parasites, 90
Panchayats, 32
Pests, 32, 86, 95
Poisoning 93, 94, 95
Refer Food
Policy, 7, 89
Population, 1, 3, 7, 9, 10, 11, 14—27
Poverty line, 7, 8, 42, 48, 56
Pre-schools, 25, 26, 29, 44
Prevention of
Food Adulteration Act, 87
Prices, 9, 56
Primary schools, 49
Productivity, 2
Pro forma, 83, 84, 85
Programmes, 35, 36
Refer Nutrition
Projects, 9, 67—75
Proteins, 2, 10, 11, 12, 15, 16, 17, 18, 44
Pulses, 17
Purchasing power, 3, 4

R

References, 156—159

Rehabilitation, 48
Requirements, 1, 9, 55
Revolution, Green, 18
Rural Institute,
Gandhigram, 66

S

Sanitation, 6
Services, 1, 58
Stamina, 1
Strata, 4
Statistics, 12—15, 20—27
Surveys, 23, 25

T

Tables, list of, 160 161
Tamil Nadu, 3, 7, 9, 12, 13, 17, 29, 35, 36, 39, 50, 80, 87

V

Vitamins
Refer Deficiencies

W

Water-supply, 6, 32
Weight, 18
Refer Parameters
Workers, 9, 61, 80
Woodbury tables, 18

N. I. N. LIBRARY MADRAS.