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Subject: TRENDS IN MALNUTRITION AND ASSOCIATED SOCIO ECONOMIC FACTORS - A STUDY OF SRI LANKA

Prepared By: Dr. G. Thenabadu

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i. INTRODUCTION:-

Malnutrition^{1/} is a global problem. It is the world's third commonest cause of disablement after road accidents and work related injuries, and is deeply rooted in the socio-economic status of each country.^{2/} In developing countries of the third world, undernutrition is a significant problem, with over 50% of its children affected. In the developed countries, especially in the West, overnutrition, resulting in obesity is causing great concern, and a recent Food and Drug administration study has shown that approximately 70% of Americans are malnourished.^{3/}

Sri Lanka, a developing country with a per capita Gross National Product of US \$ 254^{4/} and a population of 14.8 million, is no exception when compared to the rest of the poor developing countries of the third world. Although Sri Lanka could boast of a high literacy rate of 80%, low crude death rate of 6.1% and a high life expectancy of 68 years, malnutrition is still widely prevalent in the island.

The main problem in Sri Lanka appears to be chronic undernutrition which affects approximately one third of the pre-school population.^{5/} This condition increases with age, and is estimated to be around 46.2% among 5-6 year olds. The incidence and prevalence of undernutrition varies among urban to rural/estate areas, and this is discussed under sections pertaining to current

1/ Malnutrition - defined as unbalanced nutrition by the Random House Dictionary of the English Language.

2/ Graham, Peter - "The malnourished walk on the edge of an abyss." Daily Mirror, 10/30/81.

3/ This is mainly due to overconsumption of "Junk Foods" contributing large amounts of calories, but poor in other nutrients. (Nergis Dalal - "Eating comes naturally.") Daily Mirror, 11/30/81.

4/ Central Bank Report - 1980

5/ "Nutritional Status in Sri Lanka, its determinants and proposed corrective measures" - Cabinet paper presented by His Excellency the President in July 1980. Food & Nutrition Policy Planning Division.

nutritional problems and surveys. The technical and health aspects of malnutrition are discussed in the section X., Consequences of Malnutrition and Section XI. 2, Association between Malnutrition and Disease.

Purpose:-

This report has been written for several reasons. Very often, researchers and consultants have remarked on the lack of adequate nutritional data on Sri Lankan populations. Whatever data which is available, too, is often scattered in various libraries and institutes, and this is often inaccessible to the general reader. Thus, the purpose of this report is to provide:

1. Technical information on different aspects of malnutrition - its etiology, consequences and associated factors.
2. General background information including brief descriptions of food habits, customs, beliefs, and types of food consumed - especially for readers who are visitors to Sri Lanka.
3. A broader perspective of the problem of malnutrition. To consider malnutrition not as an isolated entity but in association with socio-economic factors operating in Sri Lanka.

III. EXECUTIVE SUMMARY:-

Malnutrition, almost by definition, represents a complex interaction of social, economic and cultural factors, and is prevalent throughout the world. The overall purpose of this report is to present available information on malnutrition and to discuss the associated socio economic factors operating in Sri Lanka.

As mentioned in the report, malnutrition is a complex problem, and should not be viewed as an isolated health concept. The association and influence of the economy, social services and culture have to be considered and these aspects are briefly discussed in the sections on malnutrition and its association between poverty, disease and fertility. In Sri Lanka, with a per capita GNP of US \$ 254, and a total fertility rate of 3.8 (1977), poverty and fertility wield an important influence on malnutrition.

When compared with developing countries of the East such as India, Bangladesh and Pakistan where acute starvation is still present, Sri Lanka's problem is of a more insidious nature. There is a high prevalence of chronic under-nutrition in Sri Lanka which varies from 34 - 46% among the pre-school and primary school populations. The consequences of chronic malnutrition are grave, and the results may appear in adult life, leading to apathy, debility and disease. The incidence of acute undernutrition is fairly low, apparently 6 - 19% among pre school age groups, while nutritional anaemia affects approximately 50 - 70% of pregnant and lactating women.

The infant mortality rate (IMR) is an indirect indicator of the severity of malnutrition, and the national average is around 37 per 1,000 live births.

This compares favourably with Middle South Asian countries, but is high when compared with European countries with IMR rates around 8 - 18 per 1,000 live

births. Even within the country, districts such as Nuwara Eliya have IMR of 75 per 1,000 live births (1978). This is mainly due to the plantation populations living in these areas who had been neglected during colonial rule and existing health conditions. In the past, the IMR in this district was as high as 140 per 1,000 live births and the MMR was 16.5 per 1,000 live births (1945). The significant decline in the mortality rates is due to better health care, food supplementation and welfare programs provided by the State and voluntary organizations. However, the sanitation, educational levels and economy of most estate populations has yet to be improved and new projects utilizing foreign aid have been formulated with government approval to improve the physical quality of life. The populations living in urban slums, too, show signs of malnutrition and these populations are the breeding grounds of disease and crime. Women, infants, and children in slum communities are the groups most vulnerable to malnutrition, and nutrition programs should be targeted to these groups.

The culture, food habits and beliefs of the population play an important role in nutrition especially in the family unit. Even if plenty of food is available, cultural factors alone may prevent people from utilizing the food. Very often high protein foods are eliminated from the diet as "heavy" and intensive nutrition education is needed to overcome these fears. In others, although the household income is increased, this is not used to purchase foods for the children, but is spent on electrical items, lavish clothes and alcohol. The general consumption patterns discussed in the report reveal the high expenditure on alcohol and smoking. Analysis of food, too, show the prominent role of rice and bread in supplying calories and proteins and the use of coconut in various forms in the diet. The contribution of coconut oil in providing saturated fatty acids is also discussed. The various customs pertaining to feeding still operate in some rural areas, and the elderly

villagers are good resources for information of this nature. In programs providing nutrition education, the cultural beliefs and customs of the population should be studied, and modern nutrition education should not be contradictory to traditional beliefs. Whenever possible, modern scientific knowledge should be blended with traditional beliefs, in order to be more acceptable to the indigenous population.

The section on growth patterns discusses the rapid spurts of growth which occur during foetal life, infancy and pre-pubertal periods. During these phases, the nutritional intake should be increased to cope up with growth of body cells. The recommended dietary allowances (RDA) for Sri Lankans have been assessed according to WHO standards and more research is needed to assess the extent to which increased nutritional intake is required during pregnancy, lactation and puberty, especially in Asians.

The report briefly reviews the supplementary feeding programs, as many reports have already been written on this subject. The food stamp scheme although included in the section on supplementary feeding is basically geared to improve household incomes of low income families. By providing food stamps, which are utilized to purchase food items, the nutrition of the family is improved and household expenditure on basic food items is reduced. The long term supplementary food programs operating in Sri Lanka are the School feeding and Thripasha distribution programs which began in 1956 and 1972 respectively.

These programs are designed and implemented by CARE - a non profit voluntary United States organization with branches all over the world. A Thripasha factory was built in 1977, to cope with the increasing demand for Thripasha and to gradually phase down PL 480 Title II commodities till a weaning food completely utilizing locally available grains is produced. The school feeding and Thripasha programs are to be evaluated in early 1982 to assess the nutritional

impact of these programs. A third project has been initiated in 1977 by CARE/UNICEF to encourage growth of soya beans and use of soya based foods. The report also deals with trends in malnutrition and evidence of these changes are reflected by results of surveys carried out in the past. In the 1930s and 1940s, severe vitamin deficiency symptoms and high mortality rates due to malnutrition were seen. This became worse during the IIInd World War, as the people became totally dependent on food rations. In the early 1970s severe forms of protein calorie malnutrition such as Kwashiokor and Marasmus were seen frequently, and resulted in high mortality rates especially among 0 - 5 year age groups. In 1975, acute malnutrition was seen to decrease while chronic malnutrition prevailed among the population and this problem still exists, despite many welfare programs.

The policies and programs of the Food and Nutrition Policy Planning Unit and the role of USAID in providing food aid is briefly discussed to provide a more complete understanding of the government's role in promoting nutrition.

In conclusion, I would like to state that reducing chronic malnutrition is a complex task, unlike treatment of isolated vitamin or mineral deficiencies. In the treatment of isolated nutrient deficiencies, supplementary feeding programs are of value and experience throughout the world has shown a dramatic response to such programs. In preventing chronic malnutrition, the mere distribution of food is not likely to make a positive impact unless integrated with health, education, and family planning programs. As the etiology of malnutrition is multifaceted, the approach to reducing malnutrition should be integrated to reduce poverty, ill health, fertility and illiteracy. Furthermore, nutrition promotion and prevention of malnutrition should be given a prominent place in development programs and the concept of "Prevention is always better than the cure" should be widely disseminated.

III. GENERAL BACKGROUND INFORMATION ON SRI LANKA:-

Sri Lanka is an island with a total area of 25,332 square miles (approximately the size of the State of West Virginia, U.S.A.) and is a predominantly agricultural country. A population of 14,850,001^{1/} persons is scattered throughout this area with a large concentration along the South West coast of the island. Colombo is the capital city and has an internationally known port, which was a major trading center as far back as the 15th century.

1. Population:-

The population of Sri Lanka has an urban^{2/} distribution of 21.5% (3,194,879), rural distribution of 72.2% (10,721,671) and estate distribution of 6.3% (933,451).^{3/} The Estate Sector consists of all estates which are 20 or more acres in extent and have 10 or more resident labourers upon them. The estates are mainly in the upcountry central area of the island where tea, rubber, coffee and cocoa are grown. A few coconut and rubber estates are scattered in the South West Coastal regions. The age distribution of the population shows a relatively young population with approximately 35% below 14 years of age.

2. People of Sri Lanka

The earliest inhabitants were the Veddhas, who have Australoid traits and are the true natives of Sri Lanka. A few of them are still present in relatively isolated communities within thick jungle. The present population is often described as multi-ethnic, consisting of Sinhalese, Tamils,^{4/} Moors, and Burghers. The Burghers are people of mixed European

^{1/} Estimated mid-year population, Census 1981.

^{2/} Urban area is defined as areas which are covered by all Municipal, Urban and Town Councils.

^{3/} Census of Population and Housing - 1981.

^{4/} Tamils are divided into Sri Lanka Tamils and Indian Tamils related to country of origin. However some Tamils of Indian origin who have obtained Sri Lanka citizenship may report themselves as Sri Lanka Tamils. (Department of Census and Statistics, Census of Population and Housing, Sri Lanka, 1981.)

and Sri Lankan descent. This distinction among ethnic groups appears somewhat arbitrary as all the communities have been living together confined in the island for the last fourteen centuries. There has been a great deal of intermarriage and internal migration, apart from sporadic foreign invasions which has led to mixing of genes. The general appearance of the people of different communities is quite similar with varying hues of complexion ranging from very fair to dark brown. Studies done by Physiologists on different communities have concluded that racial mixing has occurred to varying degrees, and anthropometric characters are affected by environment and economic status.^{5/} However, certain anthropometric characteristics such as height and arm muscle development are due to racial differences. The Burghers are the tallest and the Sinhalese are the shortest. The Burghers also have a faster rate of growth than the other racial types from age of 10 years till puberty.

3. Distribution of Ethnic Groups:-

The majority of the people are Sinhalese comprising 74%. The Sri Lanka Tamils comprise 12.6%, Indian Tamils 5.6% and Sri Lanka Moors 7.1% and others 0.7%. The Sinhalese live mainly in the South West and Central areas and are concentrated in districts such as Kurunegala and Gampaha. The Sri Lanka Tamils are scattered throughout the island with 49.2% in Jaffna district, with other concentrations in Colombo, Batticaloa, Mullaitivu, Trincomalee, and Nuwara Eliya. The Indian Tamil populations are found mainly in estates and central areas such as Badulla, Nuwara Eliya, Kandy and Ratnapura, while the Burghers prefer living in Colombo.

4. Religion:-

The majority of the population are Buddhists (69.3%), and the rest comprise of Hindus (15.5%), Muslims (7.6%), Roman Catholics (6.8%),

^{5/} Cullumbine, 1949 (6).

Christians (0.7%), and others (0.1%). Foods partaken by the different religious groups are somewhat different due to religious beliefs. The Buddhists generally dislike eating flesh of slaughtered animals, due to the religious belief that it is sinful to kill or harm animals. Full moon Poya days are declared holidays by the State and on these days slaughtering of animals and sale of beef is forbidden. The Hindus consider the cow as a sacred animal, and abstain from eating beef, but partake of mutton and chicken. Some Hindu families abstain from eating animal flesh for two days of the week, i.e., Tuesdays and Fridays. Among the Muslims, pork and crab are considered unclean according to religious beliefs and are not eaten.

5. The temperature varies between 31.1°C in Colombo to 12.0°C in Nuwara Eliya. In Colombo the temperature varies according to the months of the year; in April/May it is very warm (31°C) and in November/December it is cooler (23°C). The humidity is also high (approximately 70%), especially during April/May, in the South West Regions of Sri Lanka.

The island is divided into three zones - wet, dry and intermediate zones. The warm climate and high humidity have affected the physical activity of the people, and physical activity is voluntarily decreased by many. Over-activity in this climate is uncomfortable and causes sweating. In a comparative study of healthy British subjects living in Colombo, Sri Lanka, and in the United Kingdom, it was found that these people consumed less calories per day in Sri Lanka.^{6/} Thus, the populations living in warmer climates of Sri Lanka such as Jaffna, Polonnaruwa and Hambantota, may need smaller amounts of calories per day. The currently recommended intakes may be adequate for populations living at 25°C , but may be inadequate for

^{6/} Cullumbine - "A study of Diets consumed by European subjects in Ceylon."

colder climates. The high prevalence of undernutrition in areas such as Nuwara Eliya, Kandy and Badulla, may be due partly to the cold climate.

6. Crop Cultivation:-

Paddy cultivation is the main occupation of the peasant in Sri Lanka, and from ancient times, irrigation and food production were considered of great importance. After the decline of the Sinhalese Kingdom in the 12th Century, irrigation and cultivation of crops deteriorated. Foreign domination by Portuguese, Dutch and British; epidemics of Malaria and the Second World War, caused setbacks in food production. From 1931^{7/} onwards, after the country gained a certain measure of independence, irrigation activity gathered momentum. The largest irrigation project - the Mahaweli Development scheme was initiated in 1970. This project aims at diverting the longest river in Sri Lanka (334,74 kilometres) to the Dry Zone. Presently, paddy is cultivated on an area of 0.66 million hectares, and 1.2 million hectares account for cultivation of tea, rubber, and coconut. Cultivation of alternate crops is done on a land area of 0.36 million hectares.^{8/} Sri Lanka is presently on the threshold of self sufficiency in rice production. However, severe weather changes in the form of droughts and floods have not been too kind to farmers, and these have caused setbacks towards achieving high yields. In the plantation sector, coconut production has been poor.^{9/} This has been attributed to increasing senility of trees, high costs of fertilizer, and pests such as coconut caterpillar and black beetle.

^{7/} Year of Universal Franchise.

^{8/} Department of Census and Statistics - Sri Lanka Economic Atlas - 1981.

^{9/} Extracts from Finance Minister's Budget speech for 1981 - November 13, 1981.

Since the advent of the Second World War, Sri Lanka has been heavily dependent on food imports to feed its rapidly increasing population. Wheat flour and wheat are imported in large quantities from U.S.A. Pulses and onions are imported from South Asian countries. Thus, Sri Lanka has yet to be self sufficient in food production.

7. Economy:-

Economic growth has improved from a pre 1977 average of 1.5% per capita to 5% per capita in 1980.^{10/} The government has encouraged international assistance in the form of loans and grants on various development projects. The three key development projects are the Mahaweli river diversion scheme, the Greater Colombo urban renewal program, and the Greater Colombo Economic Commission (GCEC) free trade zone.

The most important sector of the Sri Lankan Economy is based on agriculture and this provides employment for 50% of the 6 million strong work force. This also provides 25% of GNP and 70% of export earnings. The per capita GNP is approximately 254 US \$, and presently Sri Lanka is placed among the poorer developing countries of the world.

^{10/} Wijesekera, Malin and Slough, David - "Sri Lanka's future depends on foreign aid" - Asian Business, September 1981.

IV. HEALTH SERVICES:-

Sri Lanka has a well developed infrastructure of Western and Ayurveda health services which extends its networks all over the island. A total of 932 institutions and 43,389 beds are found in different categories of state hospitals, while a large number of private hospitals and clinics cater to the health needs of the population as well. The island is divided into 22 Health Districts for purposes of administration, and each district is supervised by a Superintendent of Health and his staff. The overall administration of the State Health Service is conducted by the Ministry of Health which is comprised of a Minister, Deputy Minister, Secretary, Director and his staff.

Accessibility to health institutions appears to be satisfactory, according to a WHO Health Manpower study in 1975, and a government western type health institution can be reached within 3 miles from any home in Sri Lanka. However, in emergencies, seriously ill patients are handicapped due to lack of adequate transport. Most of the ambulances are old, and due to high cost of fuel, a limited number of vehicles are available to transport patients from homes. There is no well developed mobile emergency health service, although some developing countries have this type of service.

In Sri Lanka, there is a marked distinction between the preventive and curative types of service, and of the 932 institutions, only 105 provide preventive health care. These community health institutions are in the charge of medical officers of health (M.O.H.) who work with a staff of public health inspectors, nurses and family health workers (formerly designated midwives). Most of the para-medical workers are of older age groups, and there is a great dearth of public health nurses. Most of the young nurses opt to pursue a career in general nursing rather than preventive health, since most curative health facilities are based in large towns and the work load is less. A

prominant role is given to curative health care by the government and large hospitals are being built in Kotte. Many health professionals prefer to specialize in curative health since the results of treatment are usually rapid and dramatic, while channelled private practice provides a more lucrative income than working in the public health field. A few dedicated individuals specialise in preventive health, but the majority are posted to remote areas where they devote their time mainly in administrative work. Most of the preventive health work is done by the family health workers and attempts are being made by the Ministry of Health to integrate preventive and curative health care by training FHW in treating minor ailments. The concept of primary health care has also been introduced into the training of para medical workers at the National Institute of Health Sciences at Kalutara.

The traditional health care system (Ayurveda, Siddha and Unani) has been given a prominent place, by establishment of the Ministry of Ayurveda, and a network of institutions similar to western care institutions has been developed. Very little integration of the Ayurveda and Western services has taken place, and both systems have developed on separate, but parallel lines.

The estate sector is cared for by a State health plantation scheme. This was established only when the state took over the plantations, and prior to that, the estate populations were neglected. Most plantation owners developed the plantations but did little to improve the socio-economic status of its employees. This led to a deterioration in the health status of the plantation populations. The state provides all Sri Lankans (including non citizens) with free health services and this is a unique feature of the health system. Although Sri Lanka has a well established health system, the health indicators are not very satisfactory, as morbidity and mortality statistics show a predominance of preventable diseases. About 40% of the causes of hospitalization are due to diseases such as Typhoid,

Dysentery, Gastroenteritis and Helminthiasis (worms). Briefly, the main problems are:-

1. High incidence of communicable diseases
2. Poor environmental sanitation
3. High level of malnutrition
4. The need for socio-economic development^{1/}

In 1980, statistics available from government hospitals show that some of the leading causes of deaths were attributed to slow foetal growth, foetal malnutrition and immaturity. (Refer Table 1 - Leading causes of deaths in government hospitals, 1980, page 60).

^{1/} Source - Ministry of Health, Sri Lanka.

V. FOOD HABITS

Rice is the staple food regardless of economic level, ethnic group or religious belief. Rice is generally eaten during the mid-day meal with side dishes consisting of vegetables or fish or pulses in different combinations. Meals are generally eaten three times a day according to the three positions of the sun - sunrise, noon and sunset. In between, people partake of light snacks and black tea. According to N.D. Wijesekera,^{1/} in Sri Lanka, one could be almost certain of the economic class of a person by studying the food which is consumed daily. Generally the nutritive value (more animal protein) and "richness"^{2/} of food depend on the wealth of the family.

In some rice producing areas such as Anuradhapura and Hambantota, rice is consumed three times a day. In poor rural homes, yams substitute for rice and are eaten with coconuts and onions. The morning and dinnertime meals are prepared with rice flour and many kinds of foods^{3/} are made with rice flour which is roasted and mixed with coconut.

The food habits in the rural and urban areas are somewhat different and some foods which are available in urban areas are not available or are too costly in rural areas and vice versa.

Rural Areas:-

Bread made of wheat flour is generally considered inferior to rice and bread is consumed only if rice is not available. More yams, fresh vegetables and green leaves are consumed in rural areas, while fish is rarely eaten.^{4/} The pace of life is slow, and after a heavy mid-day meal, a nap (siesta) of two hours is taken. Tea is drunk often with plenty of sugar. The people are very hospitable

^{1/} Wijesekera, N.D. - The people of Ceylon (1965) M.D. Gunasena & Co. Ltd.

^{2/} Denotes the high cost of the food - regardless of nutritive value.

^{3/} Pittu, Roti, Stringhoppers, Hoppers, Thosai, Cookies, Kavum, etc.

^{4/} Note that fish consumption is higher in certain fishing villages along the coast.

and offer visitors tea or king coconut water. Since the villager has no access to cakes, pastries and chocolates, the cup of tea with plenty of sugar provides a fair amount of calories. During festive seasons, the Sinhalese and Hindus prepare sweetmeats with rice flour and honey. Dinner is generally eaten before sunset, as the villages have no electricity and households retire to bed early. Most Sinhalese Buddhist families do not keep poultry farms, or breed cattle, except for milking. Milk drinking is not popular among the Sinhalese Buddhists and milk is generally sold to traders in towns or curd is prepared. Among the Hindus and Christians, milk drinking is more popular.

Urban Areas:-

The pace of life is faster, and in families where both parents are employed, the trend is to eat pre-cooked foods. Thus, bread is popular, and ready made foods such as stringhoppers, hoppers, roti, are bought from eating houses, snack bars, etc. However, in most families, the mid-day meal consists of rice, and the women generally cook the mid-day meal early in the morning. This is carried to the places of work or sent through "food-carriers." Yams, and cereals such as green gram, ragi, millet and sorghum are not freely available and are costly. These have to be cooked prior to eating and are not popular as the methods of preparing these foods are time consuming as well. In both urban and rural areas, food is highly spiced and chillie powder is used lavishly in foods.

Chweing of Betal and Tobacco

This habit is seen in both urban and rural areas - mainly among older people. The ingredients of a chew of betal are arecanuts, betal leaves, and lime tinged with tumeric. The mixture is chewed for long periods and red coloured juice is spat out at frequent intervals. Betal chewing has been associated with oral cancer, which is high among the Sri Lankans.

Alcoholic Beverages:-

Toddy is a beverage obtained from fermenting the juice of flowers of Kitul,

Coconut, or Palmyrah. When Toddy is distilled, Arrack is produced. Toddy is liberally consumed in rural areas. Food consumption surveys have found that expenditure on alcohol consumption is high.

Observances regarding precedence in dining:-

In many Sri Lankan homes, the men are first fed. The man, being the bread winner is given first preference, and he consumes a major share including protein rich food. The women next feed the children, and eat the leftovers. In most households, special foods for children are seldom prepared. Special cooking for the young child means extra work, and mothers are incapable of handling this due to the burden of repeated pregnancies and apathy.^{5/} The men rarely help in cooking or washing up, as it is considered the women's duty to do all the work. Especially in the villages, it is considered the wife's duty to prepare the food. The husband shows himself at mealtimes even though he himself may have done nothing to help obtain the food.^{6/} In early Sinhalese literature, it is said that a faithful or devoted wife is supposed to go hungry rather than eat before her husband partakes of his meal. Due to these cultural practices, most hardworking housewives are malnourished and anaemic. However, the housewife who is an income earner as well as an illustrious housewife, is a treasure indeed.

Food Taboos and Beliefs:-

These taboos are mostly observed among rural folk and uneducated urban folk. A certain amount of superstition and ignorance is woven around these beliefs and are specially observed during childbirth, pregnancy, puberty and marriage. Some of these taboos are:-

1. Women are expected not to eat foods such as pineapple, pork, fried foods, when pregnant or during menstruation.

^{5/} Soysa, Priyani M.D. - "Young child clinics in Ceylon"

^{6/} Wijesekera, N.D. - Ibid ref (1) page 75

2. Meat and fish should not be consumed at the same time.
3. The flesh of animals and fish whose names end in "ran" are taboo e.g., Uran, (Pig), Pokurissan, (Lobster) etc.
4. Consumption of a large amount of "heaty" foods such as pineapple, crabs, dry fish, are harmful.
5. Consumption of a large amount of "cooling" foods such as curd, kingcoconut, cucumber may cause a chill.
6. Combination of cooling foods and head bath may cause a chill.
7. Allergic reaction of skin - Urticaria, Wheals, Itching, are due to consumption of all heaty foods.
8. A child should not be given milk when he starts eating rice.
9. Foods fried in oil should not be consumed when walking alone on a road.
10. All tinned foods are "good" regardless of the date of expiry or what they contain.
11. Yams such as Bathala (sweet potato), manioc, breadfruit, are considered inferior as they are often consumed by poorer folk.
12. Ordinary food packed in attractive containers are thought to contain highly nutritive foods. For example, common table salt is sold under a brand name, while artificial dyes and colouring are mixed and sold as fresh fruit drinks.

The classification of foods such as "heaty," "cooling," "neutral" are based on individual preferences. There does not appear to be a definite view on what foods are cooling or heaty. Many traditional practitioners (Ayurveda, Siddha, Unani) advocate the concept of eating balanced diets with a combination of heaty and cooling foods.

Some traditional practitioners go to the extent of classifying foods as "wind causing," "bile causing" and phlegm causing." However, these observations should not be dismissed as ignorant superstitions as they have been made after observing the effects of different foods on humans, and date back to early medical history. Scientific medical research has to test the validity of these hypotheses made by traditional practitioners, so that their discoveries could be widely disseminated.

VI. CUSTOMS PERTAINING TO FEEDING

There are many customs associated with feeding and some of the better known ones are given below:

1. In the traditional cultural background, weaning is undertaken at an auspicious moment sometime after the ninth month.
2. The new born baby is bathed in a clay vessel and is given mother's milk mixed with gold, called "Ran-kiri-katagama"- which means the oral application of a bit of human milk in which gold has been mixed. This is done almost immediately after birth and is believed to give strength and beauty.
3. Feeding on demand is the general practice in villages. Sometimes when it is difficult to wean a baby from suckling after 2-3 years of age, there is application of bitter substances (Kaduru, Bitter gourd, Bitter opium) on the nipples.^{1/}
4. "Indul-kata-gema" - the first feeding at which all kinds of foods are placed before the infant and the child is allowed to choose the food. This is a festive occasion and traditional sweetmeats are prepared.

Women's Role in Nutrition of the Family

Women are the backbone of society and have an important role in maintaining the proper nutrition of their families. Unfortunately, most women think in terms of quantity and have no proper knowledge of nutritive values of food.

Indulgent mothers often overfeed their children with excessive amounts of carbohydrates in the form of sweets and chocolates. Most rural mothers are not aware of the importance of feeding children with fresh cow's milk and vegetable proteins. Even among urban mothers, nutrition education is minimal. Thus, the education of mothers is important, as children, especially the very young are dependent on the mother for their nutrition, during the crucial formative years of physical and mental growth.

^{1/} "Family and crisis of life" -- (page 93) Ibid Ref. (1) Section IV.

Studies have shown that maternal nutrition is important too as it affects milk composition and volume. The pattern of fatty acids in breast milk varies with diet, and protein, water soluble vitamins and Vitamin A are decreased in poorly nourished mothers. Undernourished mothers are unable to feed babies for more than three to four months rather than six months, which is the norm with well nourished mothers.^{2/}

Maternal nutrition reflects on the birth weight of the baby as well, and the average Birth weight in Sri Lanka is 6½ pounds or 2.9 kilos.

In Sri Lanka, there is no strict line of division between male and female labour. Women are occupied in agriculture and harvesting of fields. They work long hours as labourers and scavengers. In addition to all this they have to go through childbirth, rear children and look after the homes.

^{2/} Jelliffe & Jelliffe - Proceedings of the workshop on Breast feeding and Supplementary Foods - November 1979.

VII. CURRENT NUTRITIONAL PROBLEMS

1. Acute and Chronic Undernutrition

Chronic undernutrition^{1/} (stunting) continues to be a major problem in Sri Lanka.^{2/} Chronic undernutrition affects about one third of the pre school population, and increases with age, reaching a high incidence (46.2%) in the 60 to 72 months age group.^{3/}

Pre School Ages:- (less than 5 yrs.) There is a considerable variation in the degree of chronic undernutrition among districts and age groups. On the national average, chronic undernutrition affects 34.7% of pre school children. In a survey of eight districts by the F&NPPD, chronic undernutrition was found to be as high as 49.2% among Estate pre schoolers in Nuwara Eliya. In the rural areas, the prevalence was less, with 34.6% being affected.

Acute undernutrition^{4/} too is a problem, among 13 - 24 month age groups. More children in rural areas are affected than in estates. Puttalam district has a rate of 10.2%, while in the Mahaweli area it is around 19.6%.^{5/} On the average, acute undernutrition affects 6.1% of pre schoolers.

Primary School Age Groups:- (between 5 - 12 yrs.) Chronic undernutrition affects approximately 50% of school children in the country. This is significantly higher in the Estate sector, than in rural and urban areas. Chronic undernutrition is higher among older age groups (11 yrs.) and in districts such

^{1/} Chronic undernutrition is defined in anthropometric terms as persons whose height for age is less than 90% of reference medium provided the child's weight is not less than 80% of reference median, weight for age.t.

^{2/} F&NPPD/MPI - (July 1981) "Feasibility study on a pilot project for soya fortification of wheat flour."

^{3/} Cabinet paper presented by His Excellency the President (July 1980) on "Nutritional Status in Sri Lanka."

^{4/} Acute undernutrition: Persons whose weight for height is less than 80% of the reference medium and whose height is not less than 90% of the reference median (height for age).

^{5/} Ministry of Plan Implementation/F&NPPD "Nutritional Status Survey in the Mahaweli H Area" - December 1980.

as Kandy, Nuwara Eliya, Moneragala, Bandarawela, Galle, Kegalle and Ratnapura.

Acute undernutrition is around 3.41%, and is highest at age groups 5 - 6 year and 10 - 11 year olds. This is higher in rural and urban areas than estates,^{6/} and districtwise is high in Nikeweratiya and Polonnaruwa.^{6/}

Concurrent acute and chronic undernutrition which is a very severe form of malnutrition is very low - around 1%.

2. Nutritional Anaemia:-

Nutritional anaemia in Sri Lanka is mainly due to Iron deficiency although in rare instances Folic acid and Vitamin B₁₂ deficiency have been the cause. MRI and WHO studies have estimated that 50 - 70% of pregnant and lactating women are anaemic, based on Haemoglobin surveys carried out from 1968 to 1973. Iron deficiency is also seen among young children due to Hook worm infestation, which increases the severity of anaemia. Poor intake of iron as well as large amounts of phytates and phosphates in a cereal based diet may contribute to iron deficiency anaemia. High amounts of phytates and phosphates cause poor absorption of iron in the body. In pregnancy, the Iron requirements increase, and Table 2 (pg 61) (a & b) gives an estimate of anaemic mothers who have participated in the 'Thriposha supplementary feeding program'.^{7/} There appears to be a correlation between Haemoglobin concentration and work output. Studies of tea pluckers by FAO in Sri Lanka have shown that with decreasing levels of Haemoglobin, work output tends to be reduced.

3. Vitamin A Deficiency

Vitamin A deficiency is no longer a major problem in Sri Lanka although isolated cases are seen in rural areas.

4. Endemic Goitre

This is seen in populations living along the south west coastal belt and in

^{6/} CARE/Sri Lanka - "Sri Lanka Primary School Nutrition Survey" - October 1981. The reference used is NCHS.

^{7/} University of Colombo (1979) - Status of women -- Sri Lanka.

central regions of the island. Studies done in the two villages named Sirikandura and Omatta in the south, by Schuttelaar and Walsum, found a high prevalence of goitre in these villages. De Mel and Fernando, found large numbers of women suffering from goitre in a village called Weerakoongama in the central region of the island. The high prevalence of Goitre is attributed to low content of Iodine in the soil, resulting in vegetables and fruits with low Iodine content, and high consumption of substances containing goitrogens - which are found in vegetables like cabbage.

5. Dental Caries:-

According to recent medical and press reports, dental caries is an increasing problem especially among school children, young pre schoolers and young adults. Dental caries affect mainly urban groups, while gum disease (Gingivitis) affects rural children and elderly people. Some causes leading to dental caries is the neglect of primary teeth and consumption of excess amounts of carbohydrates in the form of sticky sweets and chocolates. The frequency of intake, and length of time the sugar stays in the oral cavity is an important factor. Dental caries appear less of a problem among people living in the North of the Island due to high content of Calcium in the soil and Fluorine in the water. Some mottling of enamel is seen due to fluorosis.

6. Obesity:-

Obesity seems to be a problem among upper and middle income groups. Both sexes are affected. According to the observations of one general practitioner, approximately 80% of patients from these income groups who were examined were affected by obesity as well as its complications. The high incidence of Ischaemic Heart disease, mature onset Diabetes, Cholecystitis (Gall stones) gives an indication of this problem. The sedentary life styles of the people, lack of exercise, over consumption of carbohydrates, saturated fats and alcohol, contribute to this problem. According to recent statistics, heart disease is a major killer in Sri Lanka, and is rivalled only by a high accident rate.

8/ De Mel, B.V. and Fernando, M.W., "Tradition, Modernity and Value movement: A study of dietary changes in a Sri Lanka Village" - Marga Vol. 6, No. 1, 1980.

VIII. NUTRITION SURVEYS AND STUDIES

Many surveys on the nutritional status of selected populations have been carried out in Sri Lanka. One of the earliest surveys among persons was recorded in 1932 by L. Nicholls, a Director of the Bacteriology Institute (presently Medical Research Institute). He found a high incidence of Vitamin deficiencies such as Phrynoderma,^{1/} Sore mouth, Keratomalacia, Neuritis and Intractable Diarrhoea. Mortality was also high. He also studied the average birth weights of babies of different social classes and found that the lower social class produced babies averaging six pounds and higher social classes had babies averaging seven pounds birth weight. In 1936, about 65% of the poorer economic groups were found to be blind as a result of Vitamin A deficiency.^{2/}

in 1941, Nicholls and Nimalasuriya^{3/} conducted rural dietary surveys and analysed types of dietary deficiencies resulting in ill health, stunted growth and lowered resistance to disease. They concluded that approximately 50% of the rural population examined was affected by dietary deficiency diseases. In 1949, studies done by Collumbine, Bibile and Wickramanayake discussed causes for differences in physical fitness noted between subjects in three main environmental zones of Sri Lanka and considered the influence of economic levels on dietary habits. Even in 1951, Collumbine observed clinical undernutrition among people of different economic levels and ethnic groups.

In 1958,^{4/} Gunasekera studied the dietary deficiencies and the influence of the economic factor on the nutritional adequacy of diets, and compared the

1/ Phrynoderma or follicular hyperkeratosis - a condition characterised by dry skin due to Vitamin A deficiency.

2/ Nicholls, L. - Indian Medical Gazette, 68, 681, 1933.

3/ Nicholls, L., Nimalasuriya, A. (1941) - Ceylon J. Science (D) 1941.

4/ Gunasekera, D.B. (1958) - Nutrition surveys of some rural areas in Ceylon Ceylon J. Science (D) 1958 9(3): 107-123.

diets of villagers with those of upper income groups in Colombo. A study of heights and weights of 6,388 school children of 6 - 18 year age group from a population in the Western Province was studied by Gunasekera and Mahadeva in 1957.^{5/}

In 1977, de Mel surveyed 7,000 children and selected 5,600 from a well to do population to determine a Sri Lankan Structure of Reference.^{6/}

In 1973, a survey done by Anderson, measured the left mid-arm circumference and height of primary school children aged 6 - 12 years. Of approximately 1,122,773 children surveyed, 41% were found to be malnourished. A study done by the Paediatric Unit at Colombo Hospital in 1973, reported that Marasmus (a form of gross chronic, calorie deficiency, where the child looks like a shrivelled monkey) was the second highest cause of deaths in the hospital. Since 1978/79, the admission rates for Marasmus and Kwashiorkor have dropped to a few cases per month.

In a 1975 Colombo Hospital study, weight, chest and hand measurements were taken of 350 pre-school and primary school children. These studies showed that 2nd and 3rd degree PCM (Protein Calorie Malnutrition) were seen in 32% of pre-school and in 66.6% of primary school children. This led researchers to observe a progressive fall in the nutritional status in 5 - 10 year age group.

In 1975/76, the well known CDC (Center for Disease Control) survey^{7/} was done and 13,450 rural and estate pre-school children aged 6 - 71 months were surveyed using anthropometric indicators as well as biochemical methods (Hb%).

The combined prevalence of second and third degree malnutrition was found to be 38.9% in villages and 63.8% in estates. In this study, 30 villages were selected

^{5/} Gunasekera, D.B. & Mahadeva, K. (1957) Heights and Weights of Ceylonese Children. The Ceylon Medical Journal - Vol: 4: 81.

^{6/} De Mel, B.V. (1971) Anthropometric data of Sri Lankan well to do children (unpublished).

^{7/} Sri Lanka Nutrition Status Survey, Center for Disease Control/CARE/USAID/Ministry of Health, 1976.

with each Superintendent of Health Services (SHS) area, using census data. This survey also included a small group of 438 children aged 48 - 71 months from private schools within the Colombo district. This showed that this group of children from the higher socio-economic groups had growth parameters approaching the NAS reference group medians for both height for age and weight for age. (Refer Table 3, page 63). These figures justify the use of NAS reference standards for comparison of younger populations, since there appear to be no specific reference studies done for Sri Lankan populations, although pilot studies have been attempted by individuals.

In 1978, a survey was carried out in the Matara and Hambantota districts by the Medical Research Institute. This survey showed that the prevalence of chronic undernutrition between 6 - 72 month old children was around 23%, and acute undernutrition was approximately 5.5%. These figures have to be interpreted with some caution since the geographical areas sampled are somewhat different from earlier surveys.

The Food and Nutrition Policy Planning Division has initiated an island wide survey from 1980. It has covered about six districts so far. Results obtained from these six districts have shown that certain districts such as Nuwara Eliya show large numbers of children, both pre-school and school going are affected by chronic and acute undernutrition. Few cases of Kwashiorkor or Marasmus have been detected. In the Nuwara Eliya district, approximately 34.6 to 49.2% of pre-school children in the estate and rural areas are found to be more chronically undernourished. Primary school children (5 - 12 years old) are more affected by chronic undernutrition, the figures being around 58% in both rural and estate areas.

Acute undernutrition, seems to be fairly high among children between 13 - 24 months. In the Vavuniya and Nuwara Eliya districts, acute undernutrition was about 17% at the age of 6 - 12 months.

In surveys carried out in the Mahaweli Area, where development work is carried out and new settlers are being introduced, there appears to be a high rate of acute undernutrition among children of pre-school ages (approximately 19.6%). It is hoped that this high incidence of acute undernutrition would improve with better nutrition education and improved socio-economic conditions. A nutrition educator has been recently appointed to this area.

In conclusion, it must be admitted that many attempts have been made by individuals, groups and organizations to obtain data on the nutritional deficiency status and problems among the Sri Lankan population from as early as 1930s. However, most of these studies have used small samples and although of great importance as individual studies, cannot be scientifically compared since methods used in criteria for subject inclusion, age determination, measurement methodology, and reference population used - differ from one survey to another. As mentioned by the F&NPPD, the data relating to the 1977/1980 surveys have to be viewed as estimates or baseline studies till similar estimations are made at some future point in time, using the same methodology.

IX. FOOD CONSUMPTION PATTERNS

Food consumption estimates give the amount of food consumed by an individual or household unit during a certain point in time. Since consumption patterns vary from day to day, seasons, festivals,^{1/} etc., the timing of the survey is important. The data obtained may be compared with recommended intakes, but these comparisons although useful in determining the general trends, cannot in themselves justify statements that malnutrition is present. Such conclusions should be supported by clinical or biochemical evidence. Thus, it is preferable that clinical nutritional surveys be carried out together with dietary surveys in order to obtain a more accurate picture.

Food consumption data is usually obtained by comparing data from Food Balance Sheets. The total calories available per capita, have been prepared by the Department of Census and Statistics by study of Food Balance Sheets. The total calories available for per capita consumption in 1980 appear to be 2,169 K cal. Rice contribution is approximately 44% of total calories.^{2/}

Food consumption surveys by the Central Bank of Ceylon, in 1953, 1963 and 1973, give valuable information, and the Socio-Economic Survey of 1969/1970 gives quantities of food consumed for a variety of 110 food items.

Food consumption patterns show the dominance of starchy foods including sugar in the average Sri Lankan diet. These foodstuffs supply about $\frac{1}{3}$ ths of the total calories, and rice alone accounts for 50%.

The dominance of rice in the diet is seen in all income groups. Rice provides a large amount of carbohydrates, and over one third of the protein (62%) consumed is derived from rice. However, rice is not a complete meal by itself as it has low amounts of vital amino acids, such as Lysine and Methionine,

^{1/} Sri Lanka has festivals throughout the year, and during these times food and alcohol are consumed in large quantities.

^{2/} Source: Food Balance Sheets - Department of Census and Statistics.

vitamins and minerals needed for effective growth. Studies done on people consuming only rice have shown the appearance of nutritional deficiencies, and stunted growth. Overconsumption of rice which is rich in carbohydrates has also resulted in obesity and malnutrition. This highlights the fact that food should be consumed in moderate amounts, and a balance of nutrients is necessary for optimal growth.

While rice is the staple food, other starchy foods such as wheat flour in the form of bread, tubers and roots such as manioc and sweet potato are consumed. (Refer Table 4, page 64).

Proteins in the diet of an average Sri Lankan come mainly from rice, as mentioned earlier. In the higher income groups, animal proteins contribute a higher percentage. Animal proteins are of high biological value, and if taken in small quantities are adequate. Due to the prohibitive prices of animal proteins - such as meat, fish, eggs, the low income groups are forced to consume vegetable proteins. Proteins of plant origin usually from soya, wheat flour, rice and Dambala are of poor biological quality^{3/} and have a low chemical score (Refer Tables 5 and 6). These foods have to be combined in correct proportions with other foods and eaten in large quantities to obtain the optimum benefits. The essential amino acids which are indispensable for human adults and the possible combinations of foods which could meet these requirements are given in Table 7. Fortunately, in Sri Lanka, rice is often combined with other supplementary foods such as dhal (legumes) coconut and vegetables. Legumes contain about 20 - 38% of protein and have a high content of Lysine (an amino acid which is lacking in rice and bread). The foods are generally mixed together with the fingers and eaten at one meal. If the food is mixed in proper quantities and is

^{3/} The Biological value of a protein relates to the ability of a particular protein to support growth when it solely provides the protein requirement. It is a measure of the availability of digested products and the adequacy of the essential amino acids.

of the correct nutritive value, it is adequate to meet the daily needs.

Coconut in the form of coconut milk, and grated coconut and coconut oil supply approximately 16.5% of the total calories in diet. Most Sri Lankans get 15% of their caloric requirements from the fat which mainly comes from coconut oil. In areas such as the North, where Gingelly oil is available, this oil provides a rich source of energy. Coconut oil, however, is rich in saturated fatty acids, and unsaturated fatty acids such as Linolenic and Linoleic acid are found in insignificant quantities. This high concentration of saturated fats in the average Sri Lankan diet, may have a bearing on the high incidence of Atherosclerotic Heart Disease, which is a major killer in Sri Lanka.

Food consumption surveys have shown that milk consumption is poor. Milk supplies only 3.5% of total calories in diet.^{4/} Even people who have dairy cows prefer to sell the milk rather than feed it to their children. Most Sri Lankan mothers give their children inadequate amounts of milk for drinking, by dissolving a small quantity of milk in tea or coffee. An analysis of food stamp expenditure, too, has shown that food stamps given for milk, have been utilized to obtain rice or sugar. The present government has recognized the value of milk in the diet and is now opening milk feeding centers throughout the island. Milk foods, especially "Lakspray" have been price controlled. "Vitamilk" an infant milk food, is subsidized, and in some Municipality Health Clinics is distributed free to mothers and infants.

Vegetables and fruits are widely consumed and provide vitamins, minerals and water. Green leafy vegetables provide the necessary roughage in the diet, as well as ascorbic acid (Vitamin C), Nicotianamide and Riboflavin (Vitamin B). Although the protein content of leaves is very low (8.0 gram/oz.) these proteins have a good biological value, with a higher lysine content than cereals.

^{4/} De Mel, B.V.; Jogaratnam, T. - "Population growth, nutrition and food supplies in Sri Lanka." Marga, 1977, Vol. 4, No. 3.

X. ETIOLOGY OF MALNUTRITION:-

Causes of malnutrition are many. One or all of these factors may contribute to malnutrition within a community.

1. Infections and Disease:- (Including emotional illness) Severe acute infections such as Typhoid fever, Diphtheria, Tuberculosis, Measles and Pneumonia cause a negative nitrogen balance, and if protein intake is insufficient during convalescence, would lead to malnutrition. This is caused by a stress reaction by which Amino Acids are mobilized to the Liver for gluconeogenesis and the residual nitrogenous products are excreted as urea. The urinary Nitrogen loss in infections is sometimes equivalent to over 2 kilograms of muscle in a few days.^{1/} In Sri Lanka, an analysis of 50 cases of Kwashiorkor treated at Lady Ridgeway Hospital in 1977-1978 indicated that 60% had suffered from an attack of measles immediately prior to onset of malnutrition.^{2/} The incidence of gastrointestinal infections and parasitic infestations such as Hookworm, Roundworm and Malaria contribute to chronic undernutrition in Sri Lanka.
2. Poverty:- Foods such as animal protein which is of high biological value, and milk foods are too expensive for low income groups and substitutes of poor nutritive value may be consumed. Very low income groups may even find it difficult to obtain carbohydrate requirements for energy purposes.
3. Lack of knowledge and misconceptions:- Food taboos, cultural habits, lack of knowledge of feeding infants and young children, times of weaning, nutrient values of foods, lead to malnutrition.
4. Lack of availability of food:- Production of food, defective food distribution and marketing systems, harsh environmental factors.
5. Other unknown factors:- Research may find other factors such as nuclear radiation, chemicals, mutations, etc.

^{1/} Scrimshaw, N.A. - "Malnutrition and Infection."

^{2/} Soysa, P. - "Trends in Paediatrics" - An unpublished paper presented at the Annual Conference of the Sri Lanka Paediatric Association, 1978.

XI. CONSEQUENCES OF MALNUTRITION:-

The consequences are well known, and are many. Acute and severe malnutrition is very apparent as Kwashiorkor/Marasmus. But chronic malnutrition leads to more severe problems which are manifested in an insidious manner.

Some consequences of malnutrition are:

1. Increased frequency and severity of illness. An analysis of those frequently falling ill will show an element of malnutrition.
2. High infant mortality rates. In Sri Lanka high infant mortality rates are seen to be correlated to incidence of stunting, in SHS (Superintendent of Health Services) areas.^{1/}
3. High stillbirth rate. In developing countries the stillbirth rate is 4% compared to 1% in developed countries.
4. Stunting (chronic undernutrition) wasting (acute undernutrition) and obesity (overnutrition).
5. Vitamin and Mineral deficiencies leading to Scurvy, Beri Beri, Pellagra, Blindness, Rickets and Goitre.
6. Impairment of mental development, learning and behaviour. Malnutrition is known to affect growth of brain. Brain growth occurs mainly during the first three years of age. The brain of a three year old child is usually 80% of its adult weight. In contrast, the total body weight of the child normally reaches 80% of adult weight after puberty.^{2/}
7. Physiological changes - apathy, sullenness, irritability and lack of general interest is seen. In some Vitamin deficiencies such as Pellagra, dementia (madness) occurs.

^{1/} Nutritional status of Sri Lanka - Cabinet paper prescribed by His Excellency the President - July 1980.

^{2/} Latham, M.C., "Food for thought - The relationship between malnutrition and intellectual development." 1981.

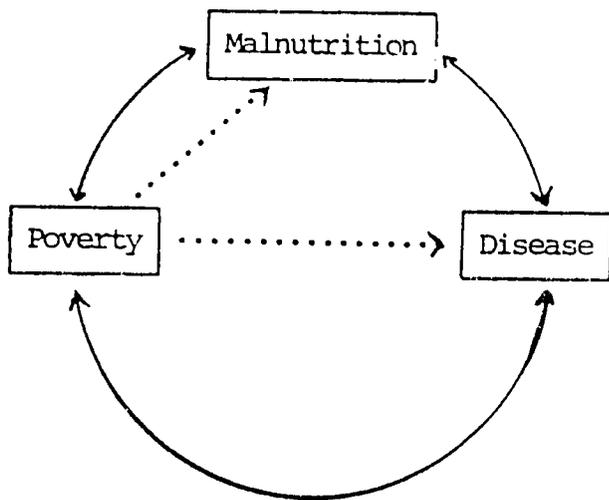
8. Overnutrition leads to obesity. Nutritional obesity is often associated with a high incidence of Diabetes, Atherosclerosis, Osteoarthritis, Galle Stones, Gout, Hypertension and decreases life expectancy.
9. Even in adult life the manifestations of malnutrition, especially chronic undernutrition are seen as inability to contribute fully to development programs due to poor physique and weak intellectual capacity. Apathy, lack of interest in work, frequent attacks of diarrhoeal and respiratory diseases, are frequent manifestations of adult malnutrition. This causes great economic burdens on the health services and economy of the country, as free drugs, full pay sick leave, etc. have to be accounted for.
10. Among adult women, especially among pregnant mothers, nutrition is important. Women who had been malnourished in childhood, are of short stature, with a contracted pelvis. In some cases of vitamin D deficiency a condition called "Rickets" pelvis occurs. These women have prolonged labour and difficulties in childbirth. Height is important in women as taller women have heavier babies. An undernourished mother also becomes more anaemic in pregnancy and is liable to have post partum complications such as Haemorrhage. She produces low birth weight, anaemic babies and is not able to sustain prolonged breast feeding. Maternal malnutrition is also seen to be associated with a high Maternal Mortality and Infant Mortality.

These examples show that the consequences of malnutrition manifest during all states of the life cycle. However, the most vulnerable period subjected to malnutrition is during early foetal life, infancy and childhood. These are the periods during which optimum nutrition should be given, and supplementary feeding should be directed to these target groups.

XII. RELATIONSHIP BETWEEN POVERTY, DISEASE, FERTILITY AND MALNUTRITION

Poverty, Malnutrition and Disease:-

It has been estimated that nearly a billion people throughout the world are trapped in a vicious cycle of poverty, malnutrition and disease.



In order to break this vicious cycle, it is necessary to attack poverty and bring about social development. Disease could be controlled by preventive health care and prompt medical treatment, and malnutrition could be avoided to a great extent by supplementary feeding and nutrition education. But in order to wipe out this vicious cycle, the main under-

lying factor - poverty, should be eliminated.

1. Association between Malnutrition and Poverty:-

Poverty is broadly defined as a condition wherein the flow of consumable resources available to a household falls short of a minimum that is deemed necessary for its members to meet their essential needs, so as to maintain their productive capacity and enjoy a minimum of well being.^{1/}

This definition encompasses terms such as "minimum," "essential needs," "ability to maintain productive capacity and well being" (Health?). This leads to a question as to what essential needs are. The essential needs are generally considered to be food, shelter, clothing, education, health and basic water and sanitation.

Absolute poverty has been defined as the inability to enjoy a diet that provides a minimum recommended level of nutrition in terms of bare calories

^{1/} Kurukulasuriya, G.I.O.M., "Poverty in Sri Lanka": Marga Vol. 5 No. 4 (1980).

and proteins. This inability would obviously lead to undernutrition. Very often it is difficult to establish a definite level of income, per capita or otherwise, by which poverty could be measured. A measurement of relative poverty could be obtained by examination of patterns of consumption at different levels of income. Research studies^{2/} done by classifying people according to economic status such as Low, Intermediate and High income groups, have shown that the average caloric value of the diet and average amount of each chemical constituent eaten per day, differed with economic status. Among the low income groups, there is a deficiency in total calories, proteins and vitamins - especially the B vitamin groups and some minerals.

Surveys done in 1969/70^{3/} and 1973^{4/} confirm the fact that income levels are important determinants of dietary adequacy. Reports published by the Food and Nutrition Policy Planning Division, show that approximately 7.26 million persons had declared incomes below Rs. 300/= per month and were receiving food stamps in 1980/81. In order to recheck this figure, several evaluations were done, and recent figures indicate that approximately six million persons now qualify for food stamps.^{5/} Most people in Sri Lanka are wary of declaring incomes, and the lower income groups deliberately declare lower household incomes due to fear of being eliminated from food welfare programs. In some instances, they are genuinely unable to declare their average income as it fluctuates daily or with harvests, especially in the case of farmers. The higher income groups evade declaring their incomes to avoid taxation, and thus it is very difficult to obtain reliable estimates of incomes. According to statistics furnished by the Consumer Finance Surveys, 5.8% of households in

^{2/} Bibile, S.W.; Wickremanayake, T.; Cullumbine, H. - "A study of the diets of various Ceylonese Communities."

^{3/} 1969/1970 Socio-economic Survey.

^{4/} 1973 - Consumer Finance Survey.

^{5/} Sun, 7th December 1981 "2 million not entitled to food stamps."

the sample were earning Rs. 101 - Rs. 200, and 27% of households earned between Rs. 201 - Rs. 400. If Rs. 400 per month is taken as a poverty line, approximately 32% of households appear to be below the poverty line.

Theoretical measures of income such as income elasticity and Gini concentration ratio, indicate expenditure on food, especially in poor developing countries such as Sri Lanka. The proportion of income spent on food generally declines with increases in income till a static level is reached. At low levels of income, the main consideration is satisfaction of hunger, and a proportionately large amount is spent on food. A study of the informal sector^{6/} of Colombo city, by the Marga Institute in 1978, analysed the eating habits of the lowest income groups in the informal sector. The household expenditure on food was very high, and the balance went into clothing, transport, alcohol and housing. The households could not afford more than one proper meal per day, and suffered from malnutrition. Housing was of shanty or tenement type and was found in Modera, Panchikawatte and Dematagoda areas.

List of areas of poor income households in Colombo:-

Modera	Borella North
Panchikawatte	Kirillapone
Dematagoda	Bloemendhal
Wanatomulla	Mahawatte

Another study done at the Lady Ridgeway Hospital, the Childrens Hospital in Colombo, revealed that 56% of 186 mothers of children attending the nutritional outpatients clinic had incomes below Rs. 300. All these studies confirm the finding that poverty causes undernutrition and undernutrition causes more poverty by recurrent bouts of disease.

6/ Informal sector -

2. Association between Malnutrition and Disease:-

A child who is undernourished is very susceptible to infections. The severity of the disease is also increased in a malnourished individual. This leads to a high mortality and high morbidity rate among a malnourished population.

These effects are due to:

1. Decreased immunologic response. Protein deficiency depresses cell mediated immune response to an antigenic stimulus, therefore cellular immunity is decreased. Deficiency of Vitamins A, B, and C have been shown to decrease antibody production in animal experiments.
2. Phagocytic activity of white blood cells is decreased in children with severe caloric deficiency such as Kwashiokor. The white blood cells are those cells which actively fight with bacteria and engulf them.
3. Nutritional deficiency may affect the integrity of epithelial surfaces, thus facilitating the entry of infectious agents into the body.
4. Wound healing and collagen formation is defective in Vitamin C deficiency states.
5. A higher frequency of Respiratory disease and complications such as otitis media are seen especially during the weaning period, in malnourished children.
6. In a mildly undernourished child, systemic and enteric infections are of major significance in precipitating acute nutrition-related diseases such as Kwashiokor and Keratomalacia.^{7/}

There is some evidence that even some neonatal mortality may be associated with intrauterine infections in the foetus in poorly nourished mothers.^{8/}

3. Association between Malnutrition and Fertility

There is a well documented association between large families and malnutrition. The most severe cases of malnutrition are usually children from large families.

^{7/} Scrimshaw, N.S. - "Malnutrition and Infection" - World Nutrition: A U.S. view page 117.

^{8/} Ibid, Ref. 7.

Among these families the younger children, especially pre-school age groups and infants, are more affected. Thus, these age groups are the most vulnerable since they are very dependent on the mothers for nourishment. Due to frequent pregnancies, the mother is unable to devote time and energy on feeding the young, and malnutrition results. The mother's nutritional status is also affected when the numbers of children are increased and there is poor spacing among births. The mother becomes more anaemic and malnourished with each succeeding pregnancy and is exposed to birth complications. High stillbirth rates have been reported among malnourished mothers as well.

Studies in India have shown that pregnant mothers with 4 or more children suffer from more severe forms of anaemia than mothers with less children. Malnourished mothers are unable to continue breast feeding regularly for long periods. Thus, the babies born to them become more malnourished due to lack of breast milk. A decline in the practice of breast feeding leads to a loss of contraceptive protection,^{9/} especially among deprived socio-economic groups who have poor access to other forms of contraception. Thus, more pregnancies occur and the vicious cycle of more malnutrition and high fertility continues, till the cycle abruptly ceases with maternal death.

^{9/} Frequent breast feeding on demand is known to have contraceptive properties by delaying ovulation due to high Prolactin levels in the blood.

II. GROWTH PATTERNS:-

It has been observed that most Sri Lankan children are small and underweight. This could be attributed to low birth weight and chronic undernutrition from infancy. Low birth weight is due to many causes and includes poor nutrition of pregnant mothers as a factor.^{1/} A study of 837 full term births shows that increasing the Haemoglobin content and maternal weights increases the birth weight of the baby. The mean birth weight of Sri Lankan babies is estimated to be 2.703 ± 0.415 kg.^{2/}

The small size of the Sri Lankan child is often thought solely to be due to genetic factors. That this is not so, is shown by studies done on well cared for affluent groups of children, who have almost reached the average heights and weights of children in U.S.A. or Europe. The findings of studies done by de Mel, Cullumbine, and the CDC survey confirm this observation. Thus, the small size of the child, and subsequently the adult, may be due to an adaptation to an environment where food supply has been irregular and scarce for the past few decades. This has been observed even in countries such as Japan from 1939 to 1948, where retarded growth occurred in teenagers, resulting in shorter stature at the end of the war than before.^{3/}

Growth refers to quantitative increase in size and is measured as growth in length (height) and growth in volume (weight). Internal organs such as the heart and brain also show growth, but at different periods of time. Growth and development occur continuously from the time of conception to death, but at different rates. There are two cycles of rapid growth which occur from:

1/ Cullumbine, H. "Some factors which influence Birthweight" (1950).

2/ Dissanayake, S.; De Silva, L.U.K.; Wickramanayake, T.W. - Relationship between birth weight and maternal weight - Ceylon Medical Journal, September 1978.

3/ Mitchell, H.S., "Journal of American Dietetics: A; 44: 165 (1964)

- a) conception through infancy
- b) prepubertal to adolescence

During the first trimester (1st three months of pregnancy) growth of vital organs of foetus occur, and this is a very vulnerable foetal period. If the mother is exposed to infections, radiation, trauma, drugs or nutritional deficiencies, malformation, congenital defects or death of foetus may occur.

In the second trimester (4th - 6th month of pregnancy) growth in length occurs rapidly with a very high rate in the fifth month. Malnutrition may stunt growth in length if it operates during this period, resulting in shorter babies.

In the third trimester (7th - 9th month) rapid growth in weight occurs, and unfavourable nutrition during the third trimester will result in lighter babies.

Once birth occurs, the rate of growth in weight and height decreases, and growth occurs at a fairly moderate pace. By the end of the 1st year, the birth length should generally increase by 50% and the weight should be triple the birth weight. The next rapid spurt of growth occurs in the pre-pubertal period for girls around 11 - 14 years and boys around 14 years. Here, there is a rapid increase in height with as much as 9 - 11 centimetres per year. Increased protein intake increases height gain. Growth in height generally ceases after puberty but growth in weight occurs throughout life.

Brain growth however, occurs very rapidly just before birth and continues for the first six months of life. Thus, during this period, the brain is vulnerable to severe malnutrition and undernutrition causes reduction in brain weight and number of brain cells.

NUTRITIONAL NEEDS AND RECOMMENDED DIETARY ALLOWANCES:-

Nutritional needs of Sri Lankans:-

The nutritional needs of humans vary from person to person according to age, sex, physical activity, climate and physiological status. Even within an individual, the nutritional needs of different cell types in the body vary, e.g. liver cells and brain cells.

The nutritional status of an individual is determined by its nutrient intake and physiological status. Nutrient intake is controlled internally by a hypothalamo pituitary mechanism which regulates hunger and appetite, while externally it is determined to a great extent by the per capita availability of food.

The actual amount of food consumed depends on quantity and quality of food available, food habits and preferences, cultural taboos, and the individual's potential in obtaining food. The potential of obtaining food depends on the income capacity (per capita income) and availability of food in the open market. The availability and income depend on the economy of the country, production and import of foodstuffs, distribution of food supplies, and marketing and planning patterns. All these statements show that a complex number of factors interact with each other in providing food to individuals. If there is any breakdown or wastage in the proper interaction of factors, the ultimate result is that the nutritional needs of a person are not met, and there is starvation.

At this point, it is necessary to consider why an individual needs food. Food could be described as fuel which is broken down and burnt (oxidised) to provide energy and nutrients to the body. The body needs energy for basal metabolic activities and other activities. Energy requirements are usually calculated in terms of kilo calories, and consumption of 1 gram of Carbohydrate, Fat and Protein yields 4, 9, and 4 kilo calories respectively.

1/ 1 kilo calorie = 4.184 kJ.

Basal Metabolic Activities - Energy required for cellular anabolism, respiration, membrane transport, activity of Heart, Brain, Neural tissue, etc.

Alcohol provides 7 kilo calories per gram. These are net values allowing for energy lost in faeces, sweat, urea and other nitrogenous products.

Studies have shown that merely satisfying the energy intake, does not mean that the individual is well nourished. If only fats and carbohydrates are consumed, nutritional deficiency diseases due to lack of proteins and minerals appear.

Recommended Daily Dietary Allowances (RDA):-

These allowances are defined as "the levels of intake of essential nutrients considered in the judgement of the Food and Nutrition Board, on the basis of available scientific knowledge, to be adequate to meet known nutritional needs of practically all healthy persons."^{2/}

These allowances are calculated with the objective of providing standards to serve as a goal for good nutrition.

The limitations of RDA is that they cover average groups and do not meet requirements of individuals due to differences in genetic and environmental factors.

These allowances are also calculated on the basis of healthy people and the term "health" is broadly defined as a state of complete physical, mental and social well being and not merely absence of disease or infirmity.^{3/}

These allowances have been calculated by determining the requirement of a healthy and representative group of people for each age group. The statistical variability of the group is next considered, and the average requirement of each group is calculated. The usual method is use of food table analysis, dietary surveys and consumption patterns of people. Experimental trials on human subjects are more accurate - but are very costly, time consuming and difficult.

^{2/} National Academy of Sciences, (1974) Recommended Dietary Allowances.

^{3/} WHO classification.

In Sri Lanka, attempts have been made by Physiologists such as Cullumbine^{4/} to estimate the minimum dietary allowance for adult Sri Lankan males. His findings in 1949 were:

Minimum dietary allowance for adult Sri Lankan male:- (RDA)

Calories	2,200 (labourer 2,500)
Protein	65 gm
Calcium	500 mg
Iron	15 mg
Vitamin A	10,000 IU
Thiamine	1.2 mg
Riboflavin	1.5 mg
Nicotinic acid	12 mg
Vitamin C	40 mg

These allowances are similar to the present day allowances recommended, except that the protein requirement recommended by Cullumbine is much higher.

Per capita recommended daily allowances (RDA) for Sri Lankan male (1973)^{5/}

Calories	2,200
Protein (g)	48
Calcium (mg)	519
Iron (mg)	23
Vitamin A (mg)	642
Riboflavin (mcg)	1,220

The recommended daily allowances given by the Department of Nutrition, MRI,

^{4/} Cullumbine, H.; Bibile, S.W.; Wickremanayake, T. - A study of the diets of various Ceylonese Communities - Department of Physiology and Pharmacology, University of Ceylon, Colombo.

^{5/} Source: L.N. Perera et al., "The effects of Income on Food Habits in Ceylon" Marge Journal Vol. 2 No. 1 - 1973.

recommend 2,530 k calories for an adult male and 1,900 k calories for an adult female. The protein requirement is around 41 gms for females and 52 gms for males. (Refer Tables 8 and 9).

The allowances recommended for females is less, due to their smaller build. Adjustments have also to be made for the degree of physical activity. For persons engaged in heavy manual work the energy needs are higher.

Adjustment factor for activities:-

Light	0.90
Moderate	1.00
Very active	1.17
Exceptionally active	1.34

In athletes and others who need to increase their muscle mass, an increased intake of protein is needed as well. Infestations and infections affect the protein and caloric requirement, by depleting the body of Nitrogen.

Wasting diseases such as Tuberculosis, Malignances and Chronic debilitatory diseases cause depletion of body protein. The quantitative effect of acute episodes of infection on the protein needs of an individual depend on frequency and severity of infections. Host factors such as the prior nutritional status of individuals also affect protein requirements during an infective episode. Thus, it is somewhat difficult to measure the amount of excess nutrients needed in such cases. It is well recognized among paediatricians and nutritionists that a higher protein and calorie intake is necessary in a poorly nourished child or adult suffering with repeated bouts of acute infections or chronic disease.

XV. SUPPLEMENTARY FEEDING PROGRAMS:-

The types of supplementary feeding programs in Sri Lanka are:-

1. The food stamp program - distribution of raw foodstuffs to a large population.
2. Thriposha distribution program - A pre-cooked blended food intended as a weaning food or a diet supplement for pregnant women, children and individuals. Thriposha is distributed as a take away food, and in some instances, fed on site.
3. School feeding program - distribution of biscuits to primary school children in selected schools for feeding on site.
4. Other feeding programs - kola kenda,^{1/} milk feeding centers.
5. Emergency feeding programs - in times of natural disasters, crop failures, etc.

1. The Food Stamp Program:- This program began in late 1979 and is presently targeted to low income families earning less than Rs. 300/= per month. Approximately seven million are beneficiaries of the program. This scheme makes available a basket of commodities consisting of rice, flour, paddy, bread, sugar, pulses, milk powder, dried fish and kerosene. Kerosene is given since this fuel is used in most low income homes, and its price (although subsidised) is high in the open market.

Evaluation of the present food stamp scheme has been done several times, to include the maximum number of eligible persons and to dispense with unintended beneficiaries. The present cost of the program is 7% of government expenditure. The scheme is expected to cover approximately 6 million

^{1/} A gruel "kenda" made by cooking rice, leaves and pulses and distributed as a hot or cold soup.

by 1982. Surveys done on food stamp expenditure show that 90% of stamps are spent on rice and only 5% on milk consumption, despite higher food stamp values being given to children below 8 years of age.

2. Thriposha distribution program:- Thriposha is a supplementary food and is made from a blend of corn, soyabeans, ICSM (Instant Corn Soya Milk), a blended food; vitamins and minerals. The program began in October, 1973, with distribution of Wheat Soya Blend, a United States Government gifted commodity under the PL 480 Title II program. CARE (a voluntary U.S. organization), distributes Thriposha to pre-school clinics in the island. The goal of the program is to progressively incorporate indigenous pulses and legumes into the formula till a totally indigenous, high protein, cereal-based food is obtained. In 1980, Instant Corn Soya Milk (ICSM)^{2/} was introduced instead of Wheat Soya Blend to satisfy the transition to a wholly indigenous formula. A thriposha Processing Complex was built at Kapuwatte, Ja-ela in 1980, to produce large quantities as the program expanded.

The aim of the project is to combat nutritional disorders existing in Sri Lanka, and distribution of Thriposha is mainly through Maternal and Child Health clinics. The target population which is served by the program consists of:

1. Infants (from time of weaning to 12 months of age).
2. Pre-school children (1 - 5 years of age).
3. Ante Natal and lactating mothers.
4. Primary school children (grade I - V).
5. Ward patients.

Categories 1, 2, 3, 5 are selected according to medical criteria, while

^{2/} ICSM - a commodity gifted under the PL 480 Title II Program.

category 4 (primary school children) are selected on the basis of school enrollments i.e. Schools which had approximately 40% of malnutrition of children in grades I - V.

The program is administered by CARE on behalf of the GSL and is operated at field level by Medical Officers of Health and voluntary organizations such as Sarvodaya, the Lions Club and U.S. Save the Children Federation. The distribution of Thriposha by the U.S. Save the Children Federation, at the Kirillapone shanty, is of special interest as Thriposha is mixed with coconut and sugar and is fed on site to children. The Thriposha which is distributed through MHC Clinics and Estate Polyclinics monthly, are taken away to individual homes for consumption. The pattern and length of consumption varies from household to household.

The Thriposha program entered the field of commercial marketing in 1980, and CARE hopes to sell a packet of Thriposha at Rs. 5.50 per 454 gram box. This commercial program is mainly directed to low income groups, who need a low cost weaning food. A market survey is presently being conducted, and reports are expected in the near future. The nutritional contribution of Thriposha is given in Table 10.

3. School Feeding Program:- This program began in 1956, and is managed by the Ministry of Education and CARE organization. This project involves the feeding of primary school children with a quota of six to eight biscuits per day. According to current reports, children are receiving five biscuits per day, and a larger number of schools are being covered by the project. There are about 9,052 schools in the island, and approximately 7,700 schools are included in the program. According to CARE reports, in FY 1980, 1,250,000 children received a daily ration of biscuits.

4. Other Feeding Programs:-

These include a large number of home made preparations such as kola kenda, mung kiribath, mung kenda, etc. All these contain cereals and rice in varying amounts. "Kola kenda" consists of leafy green vegetable juices as well. This gruel is rapidly gaining popularity, especially among the lower income groups and even adults are seen drinking this before going for work. The composition of the gruel varies as the quality and quantity of raw materials used is somewhat variable. The Ministry of Indigenous Medicine is working on a project to feed children with a cup of kola kenda daily, together with the Nutrition Policy Planning Division of the Ministry of Plan Implementation.^{5/} The Sarvodaya organization^{6/} too uses "kola kenda" in feeding children at their day care centers, which are scattered all over the island. The Sarvodaya community kitchens, about 1,164 in number, provide milk powder and Thriposha to children under 5 years. At the community kitchens, the personnel involved are the villagers themselves, and even children contribute to the meal by bringing small amounts of cereals from their homes. Some schools have initiated pilot feeding projects which provide a hot lunch in school for children. This too is community based, with parents providing rice and assisting in the cooking of the lunch. The on site-hot lunches are carried out in predominantly rice growing areas such as Polonnaruwa, Kuliyaipitiya and Matale. Approximately 100 schools were taking part in 1979. The Ministry of Education provides Rs. 0.40 per child per day to cover additional food expenses and CARE has been asked to assist by providing cooking utensils and cupboards for storage of utensils.

^{5/} CDN - 5th October 1981, "kola kenda" for school children.

^{6/} This is a well known voluntary organization concerned with community development.

The selection of schools was done on the basis of a nutritional survey conducted in 1973, where arm circumference (AC) and heights (HT) were measured in 1,122,773 school children aged 6 - 12 years. According to results obtained, 42% of school children were found to be undernourished, and schools having the highest percentage of malnourished children were selected for the feeding program. The goals of the school feeding program are:-

1. To improve the nutritional status of primary school children.
2. To reduce malnutrition among primary schoolers.
3. To promote school attendance.
4. To enhance learning ability.

The biscuits are found to be popular among the school children, provided they are fresh and stored in proper surroundings. The biscuits are only given during the times the schools are open - for 180 days. Of the approximately 7,700 schools, 983 schools provide Thripasha as well.^{3/}

The biscuits are manufactured in Sri Lanka by two companies - Ceylon Biscuits Ltd., and Maliban Biscuits Ltd. The raw materials are 12% soya fortified flour, vegetable oil, sugar and chemicals. The 12% soya fortified flour and oil are gifted by the U.S. Government through CARE under the Pl 480 Title II program, while sugar, packaging materials etc. are provided by the Government of Sri Lanka. The distribution of school biscuits is handled by the Ministry of Education. The biscuits are subject to quality control and are sent periodically to CISIR (Ceylon Institute of Scientific and Industrial Research) or MRI (Medical Research Institute) for testing.

The nutritional contribution of 8 biscuits provides 190 kilo calories and 7 grams of protein. According to UNICEF and press reports, approximately 28% of 6 - 11 year olds are not in school. In the Estate sector attendance is as low as 50%. Of the pupils who enter grade I, approximately 40-50% drop out prior

to completing grade V. Thus, it shows that a large group of school children are being left out of the feeding program, due to not attending school. The nutritional contribution of 8 biscuits provides 190 kilo calories and 7 grams of protein. To those attending school, the biscuit quota provides 44 grams protein (8 biscuits) per child per day. This contributes to approximately 10% of the total calorie requirement of a growing child aged 6 - 10 years. The protein content is about 28%. (This is if the total calories needed by a 6 - 10 year old is considered to be approximately 1,800 k calories).^{4/} According to WHO recommended standards, a typical 9 year old needs 2,190 calories and 25 grams of protein per day. Thus, the contribution of the 8 biscuits would be a lesser percentage of the daily calories and protein required.

The coverage by the program is fairly satisfactory as a large number of schools, including schools in Estates, are covered. The next page gives the number of schools covered and number of children receiving biscuits and Thripasha. The Department of Education wishes to extend the program even further to cover all the primary schools. The present coverage is given overleaf.

XVI. FOOD AND NUTRITION WELFARE POLICIES:-

Nutrition Policies:-

The report on nutrition policy by the President of Sri Lanka reflects the concern expressed by the Government of Sri Lanka at the highest policy level on improving the nutritional status of the Sri Lankan population.^{1/} Six major policy considerations are given in the report:-

1. Formulation of a Food and Nutrition Policy plan for Sri Lanka.
2. Income distribution to be emphasized in all development programs.
3. Essential food distribution schemes and nutrition services to target groups, till groups become self sufficient.
4. Review of pricing structure of food sector, and promotion of production of low cost staple foods, development of nutrition oriented food technologies for poor income groups.
5. Sectoral co-ordination at central and local levels by integrating population, food production, nutrition, sanitation and health care services.
6. Policies aimed at enhancing nutritional status.

The Food and Nutrition Policy Planning Unit was established in 1976 with UNICEF assistance. This was a long felt need as a central coordinating and planning unit was felt to be an essential factor in monitoring all food and nutrition programs. The F&NPPD now has a centrally located data bank and is equipped with macro and micro computers to analyse data. The F&NPPD is presently conducting nutritional surveys on a district wide basis as there appears to be a lack of representative data since the last CDC survey in 1975/76.

^{1/} Cabinet paper presented by the President of Sri Lanka (July 1980).

The objectives are geared to achieve nutritional enhancement of people depending on correct economic, social and technological planning.

1. The division has presently submitted several reports on nutritional and socio economic surveys carried out in various districts.
2. Supplementary food schemes such as the food stamp scheme, Thripasha Program and school biscuit program have been evaluated and reports were published in September 1981.
3. A research and documentation unit of F&NPPD was established in October 1980. Research on food grain storage at village level has begun in 1981 yala season. Research on mental stimulation pertaining to better nutrition is expected to take around six years.
4. A marketing code for infant food products has been drafted. This code is for the promotion of breast feeding, and public marketing of milk substitutes, and was based on WHO/UNICEF recommendations. The aim is to ensure safe and adequate nutrition for infants by promoting breast feeding and to regulate marketing and use of milk substitutes through appropriate advertising strategies.
5. A pilot project for fortification of rice flour and wheat flour, with 5% soya flour has been submitted to the national food and co-ordinating committee. Soya bread making is already taking place in the Matara District, and a seminar was held for bakers to promote soya fortification of bread.
6. Ayurveda Practitioners have been appointed to District food and nutrition co-ordinating committees so that the expertise of the Ayurveda physician can be included in district health work.

7. Other programs such as School Farm Programs, Adult Nutrition Education programs, communication programs, food surveillance and quality control, are now being implemented. These approaches reflect the methodology described as "Nutrition-based development planning approach,^{2/} and is probably the most fully elaborated nutrition planning approach developed so far. This is based on the observation that malnutrition is not simply a problem of food availability, but is a function of poverty and deprivation.

Food Welfare Policies:-

Successive governments have contributed to the welfare of the people by providing free rice, subsidised food rations, food stamps etc. Food welfare, together with free health care and free education services have significantly reduced the mortality and morbidity rates in Sri Lanka, and have elevated the physical quality of life index. However, welfare measures have caused some drawbacks in the country's economy. The present government has recognized these negative aspects and is expanding into developmental and income generating projects to improve the overall economy while retaining welfare programs. Experiments in other countries too have shown that food welfare for long periods causes some negative results so that populations become totally dependent on the State. Heavy dependence on the State is unsatisfactory as the concept of self reliance and self dependence becomes submerged in individuals. If the State infrastructure collapses for some reason i.e. - war, natural disasters, etc., these populations would be unable to survive. Thus, it becomes necessary to instill certain elements of self reliance into long term food welfare programs, and to target food welfare only to those who are starving.

^{2/} Proposed by Joy and Payne.

XVII. THE ROLE OF USAID IN PROVIDING FOOD AID TO SRI LANKA

History:-

Food aid is given to developing countries such as Sri Lanka under the Food for Peace program. Formerly, U.S.A. donated surplus food commodities to private U.S. voluntary agencies for distribution abroad. This began around 1949, after Congressional approval was given through the Agricultural Act. In 1954, Public Law 480 (PL 480) was enacted, and this provided for sales of agricultural commodities on concessional credit terms to poor countries and also for donation of food.

Donation of food is provided through the PL 480 - Title II program and this provides for disaster relief and for distribution to hungry and needy people.

The following organizations are involved in distribution:-

- 1) American voluntary agencies such as CARE, Church World Services, Catholic Relief Services, Litheran World Relief, American Jewish Joint Distribution and others.
- 2) International Organizations such as UNICEF and World Food Program.
- 3) Agencies of the government of the recipient country.

The act of 1954 was amended in 1966 to place more emphasis on use of food commodities as nutritional supplements (especially to aid in the healthy development of infants, children and mothers). This was hoped to promote social and economic development and self help activities in the recipient countries. The amended act also removed the stipulation that a commodity had to be surplus before it was donated abroad. The ultimate objective, however, remains to totally eliminate the need of recipient countries for further food donations, the only exception being emergency relief.

In Sri Lanka, under the PL 480 Title I program, wheat grain is sold under concessional terms and is shipped from U.S.A. The wheat is taken to the Prima Mill in Trincomalee, where it is ground into wheat flour. Wheat flour is distributed throughout the island through cooperatives, bakeries and private traders for the purpose of making bread, cakes, pastries, etc.

Under the PL 480 Title II program, U.S.A. donates 12% soya fortified flour and vegetable oil for the School biscuit feeding programs and Instant Corn Soya Milk for the Thriposha program. The vegetable oil and 12% soya fortified flour are utilized for the preparation of biscuits, and the ICSM for the production of the weaning food called Thriposha. The whole program is handled by CARE/Sri Lanka with the collaboration of the Ministries of Health and Education.

The school feeding program is one of the main programs by which CARE produces biscuits and distributes it to primary school children in the country. The distribution is done by the Ministry of Education and CARE is expected to monitor this program.

CARE is also responsible for the design, operation and management of the Maternal and Child Health program with the collaboration of the Ministry of Health. Thriposha is produced in the factory and distributed to health clinics throughout the country.

USAID is concerned with the overall budgeting and monitoring of the program and is expected to be regularly informed of new developments including disposal of damaged commodities, expenditures and income etc.

According to reports submitted by CARE, the annual requirement for 1981 is:

12% soya fortified flour	- 9,750,000 kgs.
Vegetable oil	- 1,125,000 kgs. (for the biscuits)
ICSM	- 7,473,000 kgs.

The number of recipients receiving Thripasha through the MCH clinics are:-

Mothers	-	100,000
MCH - child recipients	-	390,000
Primary school children receiving Thripasha	-	(100,000)
Other child recipients (pre schoolers) number	-	10,000

The number of recipients receiving biscuits in the schools are:-

Primary school children receiving biscuits	-	1,250.000
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The nutritive values of commodities sent to Sri Lanka through the PL 480 Title I & II programs:-

Nutritive Values Per 100 g. Finished Dry Commodity

<u>Food Commodity</u>	<u>Energy</u> (Calories)	<u>Protein</u> (g)	<u>Crude Fat</u> (g)	<u>Fiber</u> (g)	<u>CHO</u> (g)	<u>Ash</u> (g)
ICSM	380 k cal	20	6	1.2	60	4
12% soya fortified flour	357	16	1.3	.6	72	1.8
Bulk Wheat	330	12.3	1.8	2.3	72	1.7
Soya Bean Salad Oil	884	--	100	--	--	--

Selected Vitamins and Minerals

<u>Food Commodity</u>	<u>Ca</u> (mg)	<u>P</u> (mg)	<u>Fe</u> (mg)	<u>Na</u> (mg)	<u>K</u> (mg)	<u>Vit.A</u> (IU)	<u>Vit.B₁</u> (mg) ¹	<u>Vit.B₂</u> (mg) ²	<u>Niacin</u> (mg)	<u>Vit.C</u> (mg)
ICSM	900	700	18	300	900	1,700	.8	.6	8	40
12% SFF	211.2	162.2	5	2.06	374	882	.64	.36	4.6	-
Wheat	46	354	3.4	3	370	-	.57	.12	4.3	-

*CHO - Carbohydrates

Apart from donations and sales of food, USAID provides aid for Agricultural Development and Irrigation projects in Sri Lanka. The aid provides for both material and human resources.

Milk Feeding Centers:-

Milk feeding centers began in 1981, when the first milk feeding center was opened at Ratmalana with aid from Sweden. These centers feed milk exclusively to pre school children at the site, and are proving to be quite popular. The milk feeding center program has a great deal of political backing, especially by the Ministry of Trade and already ten centers have been opened up in several areas. The centers are mainly situated at temples as the temple is a highly disciplined place where there is no politics. This project has been initiated as a pilot project, and is expected to be expanded to other areas after preliminary results are obtained. At present there are approximately 3,000 children who are fed a pint of milk daily. It is expected that approximately 100 centers would be set up, if the first ten were run successfully.

Emergency Feeding Programs:-

These mainly operate during times of natural disasters. Fortunately, Sri Lanka has had a short history of occasional natural disasters. The last cyclone which affected Batticaloa in 1978 is an example, and presently the Hambantota, Matara and Jaffna areas have been ravaged by intermonsoonal floods.

Soya Foods Extension Project:-

This program originated in 1977 and is implemented by CARE in collaboration with UNICEF/Ministry of Agriculture. The objective is to combat malnutrition and enhance local diet by developing acceptable foods made of Soya.^{7/} This project focusses on promotion of soya beans at 3 levels - commercial, village and homes. The government too is debating on the possibility of fortifying wheat flour with soya at the State Flour Milling Corporation, Colombo. Some bakeries in Matara are already selling soya fortified bread. A factory which produces soya milk is now under construction at Anuradhapura.

^{7/} Source: "CARE Programs in Sri Lanka" - published by CARE. Undated.

<u>SHS Areas</u>	<u>No. of Primary Schools in Ministry of Education</u>	<u>No. of Primary School Children Receiving Biscuits</u>	<u>No. of Primary School Children Receiving Thripasha</u>
Colombo	1,036	226,026	8,250
Jaffna & Mannar	859	95,931	8,528
Puttalam & Chilaw	478	62,850	4,342
Kalutara	429	83,054	2,419
Vavuniya	-	-	-
Kurunegala	709	107,315	9,531
Matara & Hambantota	688	107,052	4,357
Anuradhapura & Trincomalee	635	82,967	12,929
Galle	508	77,744	6,095
Batticaloa & Amparai	649	96,785	9,803
Badulla & Moneragala	459	62,485	1,597
Kegalle	559	93,275	9,709
Matara & Polonnaruwa	-	-	-
Ratnapura	490	84,062	4,264
Kandy & Nuwara Eliya	1,174	180,691	14,694
	<u>8,673</u>	<u>1,360,187</u>	<u>103,518</u>
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TABLE 1
LEADING CAUSES OF DEATHS IN GOVERNMENT HOSPITALS
1980

<u>Cause of Death</u> <u>(1975 I C D Code)</u>	<u>No.</u>	<u>%</u>
1. Slow foetal growth, foetal malnutrition and immaturity (764, 765)	1,940	7.5
2. Other signs, symptoms and ill defined conditions (780.1 - 780.5, 780.7 - 780.9, 781 - 787, 788.1, 788.3 - 788.9, 789.1 - 796)	1,626	6.3
3. Pneumonia, Broncho-pneumonia (400 - 486)	1,525	5.9
4. Acute myocardial infarction (410)	1,322	5.1
5. Other diseases of pulmonary circulation and other forms of heart diseases (415.0, 416 - 429)	1,100	4.3
6. Late effects of injuries, of poisonings of Toxic effects and of other external causes (905 - 909)	1,054	4.1
7. Cerebrovascular disease (430 - 438)	886	3.4
8. Ill defined intestinal infections (009)	732	2.9
9. Other diseases of the digestive system (530, 534 - 537, 555 - 570, 572, 573, 575.2 - 579)	668	2.6
10. Poisoning and toxic effects of Organophosphates and carbonates (989.3)	641	2.5
11. Acute bronchitis and bronchiolitis (466)	568	2.2
12. Pulmonary Tuberculosis (011)	566	2.2
13. Hypoxia, birth asphyxia and other respiratory conditions (768 - 770)	544	2.1
14. Septicaemia (038)	543	2.1
15. Other ischaemic heart diseases (411 - 414)	525	2.1
Total deaths	25,892	

Source: Vital and Health Statistics - published by Medical Statistics Division, Colombo 10. (1981)
(Table 23)

TABLE 2 (a)

CONTROL PROGRAM FOR NUTRITIONAL ANAEMIA IN PREGNANT WOMENNUTRITION IMPROVEMENT FOR PREGNANT MOTHERSBY S.H.S. AREAS

SHS Area	No. of Pregnant Mothers 1976	No. of Mothers Received Thriposha August 1976	No. Moderately Anaemic 1976	No. Severely Anaemi 1976	No. Reached Through Clinics And Homes Visited 1975
Colombo	98,175	3,078	22,000	1,500	38,860
Jaffna	25,179	1,961	7,020	580	11,510
Puttalam	14,289	400	5,800	450	14,147
Kalutara	26,268	529	11,600	800	9,794
Vavuniya	6,765	404	2,300	280	4,545
Kurunegala	37,785	3,551	12,000	1,250	11,158
Matara	33,858	578	7,900	680	7,534
Anuradhapura	23,067	1,284	8,240	4,110	7,629
Galle	26,334	514	8,028	980	17,659
Batticaloa	17,028	380	6,082	3,200	5,082
Badulla	31,086	679	9,190	5,200	8,290
Kegalle	22,968	587	9,900	980	15,536
Matale	18,645	582	5,080	500	18,354
Ratnapura	24,321	581	7,500	980	10,125
Kandy	58,344	3,672	12,300	2,000	18,457
TOTAL	464,112	18,780	134,040	23,490	198,680

Personal Communication - Dr. B.V. de Mel, M.R.I.

Source: Status of Women - Sri Lanka (page 626)
University of Colombo - 1979

TABLE 2 (b)

RATE OF MALNUTRITION IN PREGNANT MOTHERS BY S.H.S. AREAS, 1974

S.H.S. Areas	Maternal Mortality Rate	Number of Pregnant Mothers	Number of Anaemic Mothers	% Anaemic
Colombo	0.5	89,640	16,135	17.99
Galle	0.6	25,260	7,578	30.00
Jaffna	0.7	23,850	4,770	20.00
Vavuniya	0.8	5,790	1,158	20.00
Kegalle	0.8	22,620	6,333	27.99
Ratnapura	0.8	22,560	6,310	27.96
Kalutara	0.9	25,140	7,542	30.00
Anuradhapura	1.1	19,620	5,493	27.99
Kurunegala	1.2	35,010	10,503	30.00
Badulla	1.4	26,430	7,929	30.00
Puttalam	1.5	13,080	3,270	25.00
Batticaloa	1.5	18,060	6,321	35.00
Matara	1.6	31,920	9,576	30.00
Matale	1.6	15,930	4,779	30.00
Kandy	2.6	54,150	16,245	30.00
<u>Weighted Average, Sri Lanka</u>	1.0			
TOTAL		429,060	113,948	26.5

Source: An Evaluation Report of the PL-480, Title II Program in Sri Lanka - Robert Nathan Associates Inc. (page 91) 1978.

TABLE 3

GROWTH COMPARISONSSPECIAL GROUPS AND RURAL SRI LANKAN CHILDREN 48-71 MONTHS OLD

<u>Age (Months)</u>	<u>Special Group</u>	<u>Rural Survey Children ^{a/}</u>
Height-for-Age		
(Percent below 90% of NAS reference median)		
48-59	1.1	49.9
60-71	3.4	46.2
No. children 48-71	438	4686
Weight-for-Height		
(Percent below 80% of NAS reference median)		
48-59	1.6	5.0
60-71	3.6	6.2
No. children 48-71	438	4686
Weight-for-Age		
(Percent below 75% of NAS reference median)		
48-59	6.5	46.6
60-71	11.9	57.3
No. children 48-71	438	4686

a/ Percents calculated from weighted data.

Source: Sri Lanka Nutrition Status Survey, (page 45) 1976
Office of Nutrition
Agency for International Development
Washington D.C. 20523

TABLE 4

NUTRIENT VALUES OF FOODS COMMONLY USED IN SRI LANKA

(values per 100 g. of edible portion)

<u>Name of Foodstuff</u>	<u>Energy</u> (Kcal)	<u>Protein</u> (g)	<u>Fats</u> (g)	<u>Carbohydrates</u> (g)	<u>Calcium</u> (mg)	<u>Phosphorus</u> (mg)	<u>Iron</u> (mg)	<u>Vit.A</u> (mcg)	<u>Carotene</u> (mcg)	Thiamine	Riboflavin	Niacin	Vitamin C	Waste
Rice (Parboiled, home powdered)	349	8.5	0.6	77.4	10	280	2.8	-	9	270	120	4	-	-
Rice (Parboiled, highly milled)	346	6.4	0.4	79.0	9	143	4.0	-	-	210	50	3.8	-	-
Rice (Raw, highly milled)	345	6.8	0.5	78.2	10	160	3.1	-	-	60	60	1.9	-	-
Wheat Flour (70% Ext.)	348	11.0	0.9	73.9	23	121	2.5	-	25	120	70	2.4	-	-
Wheat Flour (95% Ext.)	341	12.1	1.7	69.4	48	355	11.5	-	29	490	290	4.3	-	-
Sugar (White)	400	-	-	100.0	-	-	-	-	-	-	-	-	-	-
Sugar (Brown)	389	0.2	-	97.0	30	-	2.0	-	-	20	10	0.3	-	-
Coconut oil	883	-	99.9	-	2.0	3.0	-	-	-	-	-	-	-	-
Coconut kernel - mature, fresh	312	3.2	28.2	16.0	23	112	2.5	-	-	50	30	0.6	3	52
Soya Bean	432	43.2	19.5	20.9	240	690	11.5	-	426	730	390	3.2	-	-
Winged-Bean (Dambala) Psophocarpus tetragonolobus	404	33.0	16.0	32.0	-	-	-	-	-	80	-	-	-	-
Green Gram (Whole)	334	24.0	1.3	56.7	124	326	7.3	-	94	470	270	2.1	-	-
Manioc (Flour)	342	1.5	-	84.0	55	-	2.0	-	-	40	40	0.8	-	-

Source: Tables of Food Composition - for use in Sri Lanka - by Perera, W.P.A.; Jayasekera, P.M.; Thaha, S.Z. (1979)

TABLE 5

ESSENTIAL AMINO ACID COMPOSITION OF FOOD PROTEINS

Expressed as g. per 16.0 g N. or 100 g. protein

	<u>ANIMAL ORIGIN</u>				<u>PLANT ORIGIN</u>									
	EGG	MUSCLE	HUMAN MILK	COW MILK	RICE	WHEAT FLOUR	MAIZE	LEGUMES	COCONUT LIPOPROTEIN	SWEET POTATO	CASSAVA	POTATO	TOFO	
1. Isoleucine	7.7	6.0	7.2	7.5	5.2	3.8	6.4	5.5	4.8	4.8	2.8	4.4	5.2	
2. Leucine	9.2	8.0	9.8	11.0	8.2	7.0	15.0	7.0	7.3	5.7	4.1	5.0	8.9	
3. Lysine	7.0	10.0	7.2	8.7	3.2	1.9	2.3	6.5	3.6	4.1	4.1	5.3	5.8	
4. Methionine	4.0	3.2	2.2	3.2	1.4	2.0	3.1	1.0	2.0	1.9	0.6	1.3	1.1	
5. Cystine	2.4	1.2	1.6	1.0	1.3	1.9	1.5	1.3	1.3	1.6	1.1	1.0	-	
6. Phenylalanine	6.3	5.0	3.6	5.5	5.0	5.5	5.0	5.0	5.7	5.6	2.8	4	5.2	
7. Tyrosine	4.5	4.0	-	6.0	5.7	3.8	6.0	2.8	2.2	4.5	1.9	1.8	-	
8. Threonine	4.3	5.0	4.6	4.7	3.8	2.7	3.7	3.9	3.0	4.7	2.8	3.9	4.7	
9. Tryptophan	1.5	1.4	1.9	1.5	1.3	0.8	0.6	0.8	1.2	1.7	1.3	1.1	2.4	
10. Valine	7.2	5.5	8.8	7.0	6.2	4.2	5.3	5.5	6.9	7.5	3.0	5.3	6.0	

Coconut lipoproteins constitute 75% of the original proteins in the kernal. Refer R.H. Smith in 'World Protein Resources' Adv. in Chemistry series. 1966.

TABLE 6

NUTRITIVE VALUE OF SOME FOODS COMPARED TO EGG

<u>FOOD</u>	<u>LIMITING AMINO ACID</u>	<u>CHEMICAL SCORE</u>	<u>RELATIVE NPU</u>
Egg (standard)	-	100	100
Cow milk	S(cys + met)	66	75
Beef muscle	S	69	80
Pork	S	69	84
Fish	Trp	75	83
Rice	Lys	46	57
Wheat flour	Lys	28	52
Millet	Lys	27	56
Maize	Trp, Lys	40	55
Potato	S	36	71
Sweet potato	S	55	72
Manioc	S	26	-
Soybean	S	41	36
Other legumes in general	S	36	44
Spinach	S	58	-
Sesame seed (gingelly)	Lys	37	56
*Coconut (lipoprotein)	Lys, S	32	63

$$\text{NPU (Net Protein Utilization)} = \frac{\text{Retained N}}{\text{Intake N}} \times 100$$

$$\text{Chemical score of a protein} = \frac{\text{Content of the limiting amino acid in that protein}}{\text{Content of the same amino acid in egg protein}} \times 100$$

*From R.H. Smith in Adv. in Chemistry Series 1966.

NPU value from FAO/WHO protein requirement No. 37, 1965.

TABLE 7

AMINO ACIDS INDISPENSABLE FOR HUMAN ADULTS

Amino acids indispensable for human adults	Daily requirements of 55 Kg adult		An average Ceylonese consuming daily 340 g cereals consisting of rice (264 g) wheat (77 g) would obtain mg	mg amino acids supplied by					
	minimum mg	optimum mg		one egg	one cup milk (220 ml)	1 oz = 28 g masoor dhal (24% protein)	2 oza. fresh fish	100 g white rice	100 g 70% flour
Ile	550	1100	1350	520	470	330	620	370	480
Leu	865	1730	2490	620	690	440	910	680	890
Lys	630	1260	830	470	540	380	860	240	240
Met	865	1730	810	430	255	50	410	230	250
Phe	865	1730	2470	640	600	280	770	730	700
Thr	365	7730	1010	290	300	220	450	280	340
Trp	195	390	350	100	90	50	110	100	100
Val	630	1260	1720	490	440	340	580	490	530

(1) Cystine can spare 80-90% of the methionine requirement and Tyrosine can spare 70-75% of the phenylalanine requirement in humans. 100 g rice supplies 100 mg cystine and 100 g flour (wheat) contains 240 mg cystine. 264 g rice and 77 g wheat flour would contribute 264 + 185 mg cystine. Therefore this quantity meets more than the minimum requirement of methionine.

(2) Note that cereals alone meet the minimum requirement of indispensable amino acids. The so called optimum requirement is obtained by doubling the minimum requirement. On this basis too, cereals meet all the essential amino acid requirements except in regard to lysine and methionine. This difference would easily be met by such 'complementary' food as fish or meat (2 oza.) or egg (one), milk (2 cups). Pulses like masoor and dhal are complementary in regard to lysine. Soybean (1 oz.) would also meet the lysine deficit but not that of methionine.

Source: Department of Biochemistry, Faculty of Medicine, University of Sri Lanka.

TABLE: 8

RECOMMENDED DAILY NUTRIENT ALLOWANCES BY AGE AND SEX

AGE	Weight (kg)	Calories	Protein	Calcium (meg)	Iron (meg)	Vitamin A (meg)	Vitamin B (meg)	Thiamin (meg)	Riboflavin (meg)	Niacin (meg)	Ascorbic Acid (meg)
Children under 12 years (both sexes)											
7 — 12 months	7.3	818	19	650	10	300	10.0	300	500	5.4	20
1 — 3 years	12.0	1212	24	450	10	250	10.0	600	800	9.0	20
4 — 6 years	18.2	1656	31	450	10	300	10.0	700	1100	12.1	20
8 — 9 years	25.2	1841	35	450	10	400	2.5	900	1300	14.5	20
10 — 12 years	34.0	2414	45	350	10	675	2.5	1000	1600	17.2	20
MALE											
13 — 15 years	49.0	2337	49	650	18	725	2.5	1200	1700	19.1	30
16 — 19 "	51.0	2500	51	550	9	750	2.5	1200	1800	20.3	30
20 — 39 "	55.0	2530	52	450	9	750	2.5	1200	1800	19.3	30
40 — 49 "		2404	52	450	9	750	2.5	1200	1800	19.3	30
50 — 59 "		2277	52	450	9	750	2.5	1200	1800	19.3	30
60 — 69 "		2024	52	450	9	750	2.5	1200	1800	19.3	30
70 + "		1771	52	450	9	750	2.5	1200	1800	19.3	30
FEMALE											
13 — 15 years	40.0	2300	46	650	24	725	2.5	1000	1500	16.4	30
16 — 19 "	43.8	2200	42	550	28	750	2.5	900	1400	15.2	30
20 — 39 "	47.0	1900	41	450	28	750	2.5	900	1300	14.5	30
40 — 49 "		1805	41	450	28	750	2.5	900	1300	14.5	30
50 — 59 "		1710	41	450	28	750	2.5	900	1300	14.5	30
60 — 69 "		1520	41	450	24	750	2.5	900	1300	14.5	30
70 + "		1330	41	450	24	750	2.5	900	1300	14.5	30
Pregnancy:											
First Half		+ 150	46	1000	40	750	10.0	200	1400	15.2	30
Second Half		+ 350	+15	1000	40	750	10.0	+ 100	+ 200	+ 2.3	30
Lactation											
		+ 550	+28	1000	40	1200	10.0	+ 200	+ 400	+ 3.7	30

NOTES: Protein allowances on basis of chemical score of 60 for local diets.

REFERENCE: 1. Energy and protein requirements — World Health Organisation Technical Report Series No: 522 (1973).

2. Handbook of Human Nutritional Requirements — World Health Organisation Monograph Series 61 (1974).

Department of Nutrition, Medical Research Institute, Colombo 8.

SOURCE: Department of Nutrition, Medical Research Institute.

TABLE 9

ESTIMATED AMINO ACID REQUIREMENTS (mg/Kg/day)

Amino Acid	Infants	Children aged 10 to 12 yrs.	Adults
Histidine	28	0	0
Isoleucine	70	30	-
Leucine	161	60	14
Lysine	103	60	12
Methionine and cystine	58	27	13
Phenylalanine and tyrosine	125	27	14
Threonine	87	35	7
Tryptophan	17	4	3.5
Valine	93	33	10

(FAO/WHO, 1973)

Note:

According to observations made at a workshop held in Costa Rica, February 1977 by the United Nations University's World Hunger Programme, the data on the requirements for individual essential Amino acids are highly inadequate and unavailable for various age groups, especially for populations in developing countries. More research has yet to be done to find out current needs.

TABLE 10

NUTRITIVE VALUE OF 50 GMS. OF THRIPOSHA

70

NUTRITIVE VALUE OF SELECTED NUTRIENTS, CONTRIBUTION OF 50 GRAMS DAILY

	<u>Thripasha</u>	<u>Thripasha totally indigenous without mineral and vitamin fortification</u>
Food Energy K cal.	190	185
Protein, grams	10.0	9.9
Crude Fat, grams	3	3.1
Crude Fiber, grams	0.6	0.9
Ash, grams	2.0	1.8
Carbohydrate, grams	30.0	31.5
Calcium, mgs.	450	340
Iron, mgs.	9	6.9
Folic Acid, mgs.	100	
Vitamin B ₁₂ mgs.	2	
Vitamin A.IU	850	698

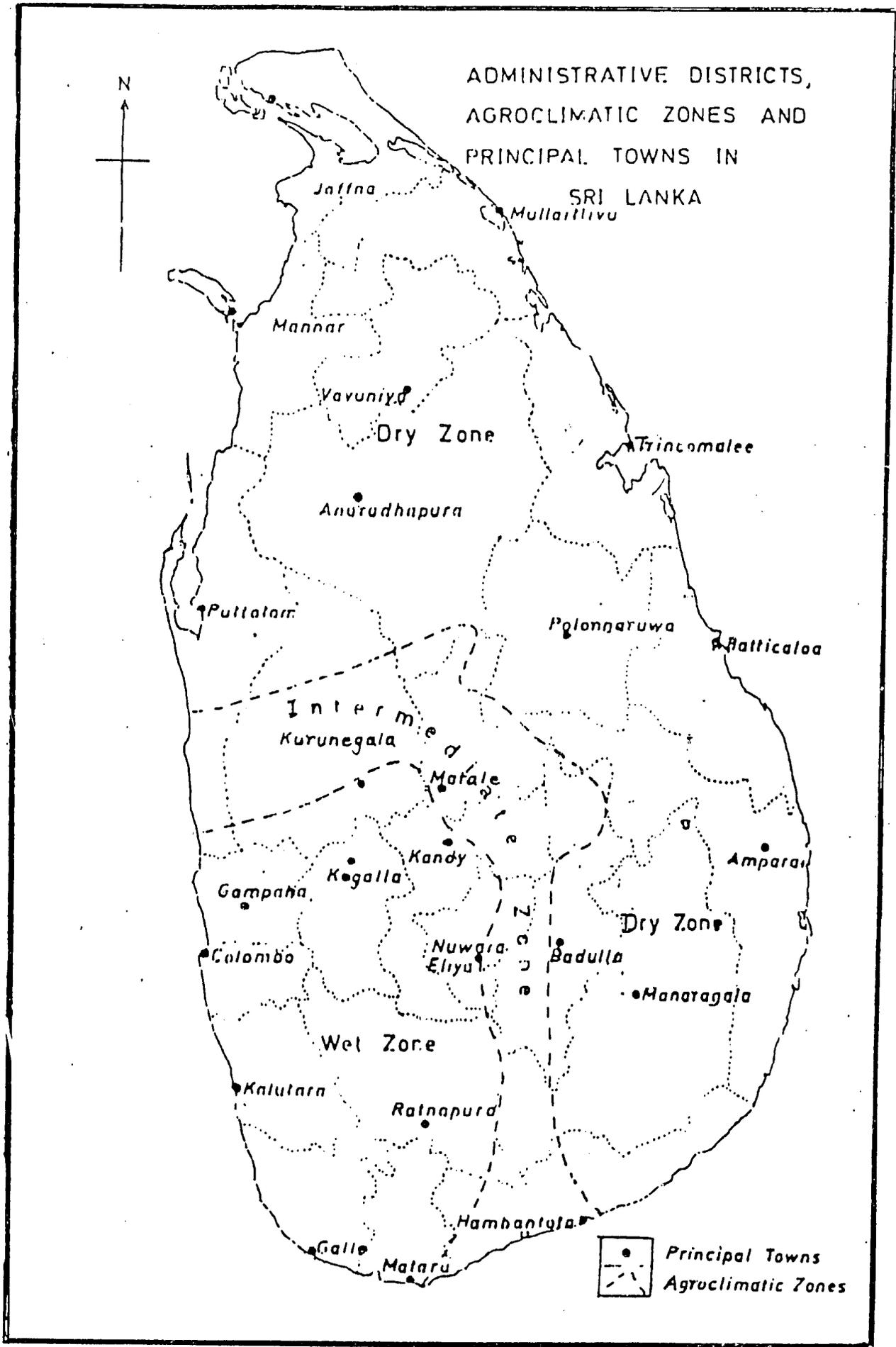
Composition

Moisture	8%
Protein	19%
Carbohydrate	61.2%
Fat	6.2%
Ash	3.9%
Fiber	1.7%
	<u>100.0%</u>
	===

Of particular nutritional interest are the significant concentrations of protein, calcium, iron, vitamin A, folic acid and vitamin B₁₂ and ascorbic acid.

Thripasha contributes approximately $\frac{1}{4}$ or more of the daily recommended allowance for minerals, vitamins for lactating mothers. The Vitamin A contribution is of particular significance in Sri Lanka as it increases the concentration of this vitamin in the mothers milk. For pregnant women, Thripasha contributes at least 25% of all the recommended nutrient allowances with the exception of energy which can however be obtained from many cheap, locally available food sources that are not so rich in other essential nutrients.

Source: Paper presented by Dr. S.M. Gunasekera at the orientation seminar on food and nutrition policy - page 3.



Source: An Analytical Description of Poverty in Sri Lanka -
 Marga Institute, March 1981.

ABBREVIATIONS USED

MCH	-	Maternal and Child Health
GNP	-	Gross National Product
IMR	-	Infant Mortality Rate
MMR	-	Maternal Mortality Rate
RDA	-	Recommended Dietary Allowances
CARE	-	Cooperative for American Relief Everywhere
UNICEF	-	United Nations International Children's Emergency Fund
WHO	-	World Health Organization
F&NPPD	-	Food and Nutrition Policy Planning Division
CDC	-	Center for Disease Control
USAID	-	United States Agency for International Development
MRI	-	Medical Research Institute
CISIR	-	Ceylon Institute of Scientific and Industrial Research
PL 480	-	Public Law 480
ICSM	-	Instant Corn Soya Milk
SFF	-	Soya Fortified Flour
CHO	-	Carbohydrates
Ca	-	Calcium
P	-	Phosphorus
Fe	-	Iron
Na	-	Sodium
K	-	Potassium

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