

UPDATE ON FOOD AND NUTRITION RESEARCH
IN THE INSTITUTE FOR MEDICAL RESEARCH

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ABSTRACT

This report gives an update of the food and nutrition research activities in the Institute for Medical Research (IMR) in the past decade, as well as those currently being carried out. These activities provide a constant up-date of the food and nutrition issues in the country. Data and information collected serve as inputs to the relevant authorities for the implementation of appropriate intervention programmes and activities. Several areas of thrust have been identified.

Studies into the nutritional status of communities have emphasized on identifying nutritional problems of various rural communities, and include studies carried out in 14 villages in Peninsular Malaysia, malaria endemic villages of Bengkoka Peninsula of Sabah, Kampung Bongkol Settlement Centre in Sabah, and several villages in Perak and Kelantan. Studies on food consumption focused on understanding the knowledge and attitude of pregnant women, as well as a comparative study of the food consumption and pattern of selected Chinese New Villages, Malay Kampung and Indian Estates. Studies into specific nutrient deficiencies include investigations into the problems of nutritional anaemia during pregnancy, and endemic goitre. Other community studies carried out include examining the role of intestinal parasites in malnutrition and the evaluation of the school supplementary feeding programme.

At the same time, attention was also given to the problem of nutritional excesses among urban communities. The prevalence of coronary heart disease risk factors was investigated amongst a group of urban

executives. Nutritional studies into the role of fats and oils in coronary heart disease, particularly palm oil, have also been given particular attention.

In the area of nutritional evaluation of foods, a systematic approach was taken to establish a comprehensive food composition database. As a result of a collaborative programme with several other institutions in the country, a comprehensive food composition table was published. Other studies into the nutritional value of foods include the analysis of cholesterol, dietary fibre, available carbohydrates, and carotenoids and vitamin A in locally available foods. Greater emphasis has been given to studies in food safety in the last ten years. Large scale studies into the problems of contamination of foods by lead and boric acid have been carried out. An investigation into the problem of aflatoxin contamination is continued.

INTRODUCTION

Nutrition research in the Institute for Medical Research (IMR) dates back to 1900, when the Institute was founded. The earliest nutrition studies were carried out to investigate the etiology and pathology of beri-beri. This pioneering work on beri-beri, subsequently proven to be due to vitamin B1 deficiency, stimulated interest on other disorders arising from vitamin deficiencies in the diet, such as xerophthalmia, rickets, pellagra, and angular stomatitis. With the setting up of the Division of Nutrition after the war in 1946, nutrition research in the IMR was extended to cover various other nutritional problems including protein-energy malnutrition, nutritional anaemia, and certain aspects of nutritional

toxicology.

Nutrition research in the Institute has thus had a long history and a wide variety of food and nutritional problems which have been investigated. Over the years, there has been a definite change in the trends in nutrition research, in response to the change in the pattern of food and nutritional issues in the country (Tee, 1989a). The various studies have been carried out with the general objective of constantly up-dating knowledge on food and nutrition in the country. Data and information collected serve as inputs to the relevant authorities for the implementation of suitable intervention programmes to overcome the food and nutritional problems faced by the communities.

This report presents an update of various food and nutrition research studies carried out in the past decade, as well as those that are being carried out in the Institute. Various thrust areas have been identified, and are geared towards food and nutritional issues that are of relevance to the country. Most of the studies have been carried out by the Division of Human Nutrition, although in many of the studies, there has been collaboration with other Divisions in the Institute, as well as with other Institutions in the country. Studies carried out in the various thrust areas are highlighted. It would be possible for this report to discuss the findings of the studies. The appropriate references are however provided.

NUTRITIONAL STATUS OF COMMUNITIES

Over the years, the Institute has carried out numerous studies to identify the nutritional problems faced by various communities in the country, to understand the etiology, and estimate the magnitude of these problems. Studies carried out in the early 80's include those reported by George *et. al.* (1981) on a group of children with severe protein-energy malnutrition in Kuala Lumpur, Chong and Hanis (1982) on birthweight distribution and trends in Kuala Lumpur, and that of Chong *et. al.* (1982b) and Tee (1988a) on the nutritional status of the armed forces. Several more recent studies reported by the IMR are outlined below.

In addition, the Institute has issued various reports pertaining to the overall nutritional status of communities (Chong 1982, 1983, 1984; Kandiah, 1982; Tee and Khor 1986; Tee, 1989a; Khor *et. al.*, 1990), as well as some dealings with the nutritional assessment methodologies (Chong 1980; Ng 1984; Tee 1985a).

Status of Community Nutrition of Rural Villages, Peninsular Malaysia

A series of nutrition surveys conducted at approximately yearly intervals between September, 1979 and September, 1983 were carried out to provide an understanding of the nutritional problems faced by rural under-served communities (Chong *et al.*, 1984). The studies involved the clinical examination and anthropometric measurement of about 3 600 persons. These subjects were from 14 villages in the states of Kelantan, Johore, Kedah and Perak and include various agricultural communities, viz. padi-growing, rubber-tapping and fishing. Blood specimens were obtained from about 3 000 individuals, and urine from half that number for the determination of various nutritional biochemical parameters. Another 1 500 persons provided stool samples for parasite examination. Visits were made to 548 houses for collection of data on socio-economic characteristics, food consumption and pattern, food beliefs and practices.

Malnutrition in Malaria Endemic Villages of Bengkoka Peninsula, Sabah

In a smaller study in Sabah, carried out by the IMR and the Sabah Medical Services, the nutritional status of 96 pre-school children and 61 women of child-bearing age in three poor and remote villages in the Bengkoka Peninsula was studied (Kandiah *et. al.*, 1984). The subjects were examined by a combination of anthropometric, biochemical and food consumption techniques. The majority of the inhabitants of the main village of Pantai were the Rungus, and practised the slash and burn type of subsistence farming. In the peripheral village of Taradas, the inhabitants were also mostly Rungus. Delima, another peripheral village studied, consisted mostly of the Bajaus who were mostly engaged in fishing. The interaction of malaria infection and

helminthic infestation with nutrition was examined.

Kampung Bongkol Settlement Centre (Pitas District), Sabah

In another study carried out in collaboration with Sabah Health Services, a total of 170 children (0-72 months of age) were examined clinically, their weight and height measured, and blood collected for haemoglobin and plasma albumin determination (Jai Mohan *et al.*, 1984). Stool of 118 children was also examined for intestinal helminths. Sixty-two households in the settlement were also studied for their socio-economic characteristics, food consumption and pattern of the community.

Nutritional Status of Pre-school Children in Two Areas Selected for the SEAMEO Pilot Project for Integrated Community-based Human Resources Development

The Project was aimed at identifying areas with health and socio-economic problems and providing solutions through community participation. The importance of instilling awareness among the population of their nutritional problems through seminars, particularly for the Development Service Team, as well as village leaders, has been given emphasis. This would include inculcating proper and correct knowledge, attitude and practices amongst the vulnerable groups.

The two areas selected for the study were Kampung Gajah in Perak and several villages in Kota Bharu District of Kelantan. Two hundred and three pre-school children between 1-5 years were studied, particularly using anthropometric indicators. Findings of the study indicated the need for increasing the quantity and improving the quality of diet for this group of children. Recommendations put forth included intensified efforts at preventive nutritional care and supervision of children under 5 years at the rural health centres and strengthening and reorientation of nutrition education activities. The need for encouraging the growth and development of cottage industries to increase cash flow, utilization of idle land were also emphasized (Kandiah and Lim, 1989).

FOOD CONSUMPTION AND PATTERN

Various studies on food consumption and pattern of communities have revealed a host of factors that could contribute towards the poor nutritional status of the children, as well as the nutritional well-being of the women. The low prevalence of breast-feeding, poor child feeding practices, and poor dietary pattern of households have been pointed out in various studies. These form important components of nutrition surveys carried out by the Institute described above. In addition, two specific studies in this area were completed.

Infant Feeding Study : Knowledge and Attitudes of Selected Pregnant Women

The IMR, in collaboration with the Ministry of Health, recently reported findings of a study on mothers' knowledge and attitudes towards infant feeding practices prior to delivery, conducted on a group of antenatal women attending clinics at two semi-urban health centres near Kuala Lumpur (Kandiah and Ooi, 1984). A total of 74 mothers in their third trimester of pregnancy were interviewed. Information collected include knowledge and attitude of the mothers towards breast feeding and supplementary feeding of their young children.

Comparative Food Consumption and Pattern in Selected Chinese New Villages, Malay Kampung and Indian Estates

The Division of Community Health of the Institute conducted a comparative health status survey among rural population living in kampung, new villages and estates. A food consumption and food habits study was also carried out by the Division of Human Nutrition as part of this survey. Six communities in two districts, namely Ijok in Kuala Selangor and Kinta in Perak were studied. The food consumption study was conducted by interviews on selected households with the aid of a predesigned questionnaire that sought information on food pattern and consumption of households, infant and young child feeding practices, and food habits and beliefs of the communities. A total of 348 households were studied,

representing 40% of the total households sampled for the overall health survey (Ayyamni *et. al.*, 1988).

SPECIFIC NUTRIENT DEFICIENCIES

Aside from the general surveys into the nutritional status of communities described above, other studies have dealt with specific nutrient deficiencies in greater detail. Anaemia has been the most frequently studied problem in the country, and many studies deal with the problem as encountered among pregnant women. A review on the subject was recently published (Tee, 1985b). Iodine deficiency goitre is the other problem studied by the Institute. Although it is not a major nutritional problem in the country, high prevalence rates have been reported in certain endemic areas of Sarawak, Sabah and the northern part of Peninsular Malaysia.

Nutritional Anaemia in Pregnancy: A Study at the Maternity Hospital, Kuala Lumpur

A study of the prevalence and pattern of nutritional anaemia in pregnancy was carried out in the Maternity Hospital, Kuala Lumpur (Tee *et. al.*, 1984). A total of 309 pregnant women in their third trimester, of Malay, Chinese and Indian origin from the lower socio-economic strata were randomly selected for the study. Haematological indices (including haemoglobin, packed cell volume, mean corpuscular haemoglobin concentration and total red blood cell), serum iron, transferrin saturation and ferritin, serum folate, as well as protein and albumin were determined. Prevalence of anaemia amongst the three ethnic groups was studied in relation to birthweight of the infants and parity.

Endemic Goitre in Kedah

A study was carried out in seven villages in Kedah, in the districts of Sik, Baling and Kuala Muda, to determine the prevalence and aetiology of endemic goitre. Four of the villages studied were in the remote areas, two of them near town areas, and one by the coast. A total of 1 075 people, representing about 80% of the total population between ages 5 to 85 were examined. Examination for thyroid

hypertrophy was performed using the technique of Perez recommended by WHO. The differences in prevalence of goitre amongst the various villages were discussed (Hanis *et. al.*, 1987).

NUTRITION AND PARASITIC INFESTATION

Impact of Ascariasis and Trichuriasis on Growth in Early School Age Tamil Malaysian Children

A double-blind one-year prospective study was conducted to determine the impact of *Ascaris lumbricoides* and *Trichuris trichiura* on nutritional status of 710 grade II Tamil children. The children were stratified based on various factors, and each resulting stratum was randomly assigned to a treatment with anthelmintic or placebo. Several anthropometric and biochemical parameters were measured at 6-month intervals. Stool examination was performed three weeks after the first treatment, one month before each subsequent treatment and at the end of the study (Foo, 1986).

Impact on Growth and Iron Nutritional Status of Alternative Interventions in Anaemia Associated with Hookworm Disease

In view of the widespread occurrence of anaemia and growth retardation among children living in areas where infection with hookworm is endemic, a study was initiated to determine the extent to which hookworms contribute to these conditions. Anthropometric, haematological and parasitological data were first collected from 1 064 primary school children, aged 7-9 years, living in areas where hookworm infection was known to be prevalent from previous studies. The data were examined for epidemiologic evidence of an association between hookworm infection and anaemia and growth retardation. Children found positive for hookworm ova and free from haemoglobinopathies and other chronic diseases (n=369) were selected for the study. The children were stratified according to various factors. Subjects from each resulting stratum were randomised to one of four treatment groups: Group I, placebos, Group II,

400 mg albendazole, Group III, 150 mg iron, and Group IV, 150 mg iron + 400 mg albendazole. Iron, in the form of ferrous sulphate, was given daily. Albendazole was administered every three months. Anthropometric, biochemical and parasitological evaluations were carried out every four months (Foo, 1988).

EVALUATION OF NUTRITION INTERVENTION PROGRAMMES

Nutritional Impact of the School Supplementary Feeding Programme

The study was aimed at evaluating the impact of the school feeding programme on the nutritional status of participating children. The study was initiated in 1985, and schools in two separate districts in Peninsular Malaysia were identified for the study, namely Sepang in Selangor and Temerloh in Pahang.

A group of 400 primary one school children receiving the food supplement, a cooked meal chosen from standardized menu, were selected as the experimental group. As controls, another group of 200 children from comparable rural backgrounds in schools that were not participating in this feeding programme were chosen. Nutritional status of the children were monitored using clinical examination, anthropometric measurements, various nutritional biochemical parameters and dietary intake determinations over a two year period. Other student characteristics that were studied were scholarstic achievements of each child through assessment of school performance records and special mental function tests (Kandiah, 1989).

NUTRITION AND CHRONIC DISEASES

Coronary Heart Disease Risk Factor Survey

Studies into the ill-effects of nutritional excesses are increasing in prominence in the country (Tee, 1989a). An area that has received greater attention by researchers is diet and cardiovascular disease. The Institute has been involved in studies in this field for some years. The recent publications of Chong (1981), Chong *et. al.* (1982a), Foo and Chong

(1982), Chong and Ng (1985) and Chong (1986) are of relevance.

More recently, a study was initiated to determine the prevalence of coronary risk factors such as hyperlipidemia, glucose intolerance, hyperuricaemia, obesity, undesirable lifestyles and hypertension amongst middle-aged executives in the city. Over 400 male volunteers in apparent good health, between 30-50 years, and holding executive positions in large firms and factories, as well as Government Departments around Kuala Lumpur and Petaling Jaya have been studied. Interviews were conducted on the subjects for information on medical history and lifestyle. Weight, height and blood pressure were recorded. A fasting blood sample was collected for the determination of serum lipids, glucose and uric acid (Teo *et. al.*, 1988).

Nutritional Studies on Malaysian Processed Palm Oil

Processed palm oil is widely used locally for cooking and frying purposes and thus forms an important component of the Malaysian diet. It would thus be important to both manufacturers and consumers to understand fully the nutritional value of this oil, especially in relation to cardiovascular diseases, in line with current focus on the importance of dietary factors in the prevention and control of the disorder. A number of studies of Malaysian processed palm oil were carried out in the IMR, in collaboration with PORIM.

Initial studies carried out, using rats as experimental model, were aimed at:

- a. Evaluating the nutritive quality (digestibility, rate of absorption, feed efficiency and caloric availability) of refined palm oil and its fractionation products, palm olein and palm stearin;
- b. Studying the effects of the feeding of palm olein and palm stearin which have been subjected to frying operations;
- c. Investigating the effects of a prolonged feeding of processed palm oil on blood

biochemistry, platelet function and atherogenesis (Ng *et. al.*, 1987, 1988). The production of polar material as a result of repeated use of oil for deep-frying was investigated in a separate study (Ng, 1986). These polar compounds are non-volatile and their accumulation in heated fats leads to objectionable flavour and taste, and the consumption of these components may be harmful to health.

A subsequent study was carried out to investigate the hypocholesteremic effects of a palm olein diet on human volunteers, in comparison with coconut and corn oils (Ng *et. al.*, 1991). Further study was also carried out to investigate the comparative effects of palm olein and olive oil on serum lipid and eicosanoid (thromboxane and prostacyclin) levels in human volunteers (Ng, 1990).

NUTRITIONAL EVALUATION OF FOODS

Studies into the nutrient composition of Malaysian foods have been carried out for many years in the IMR. These activities took on a more systematic approach in the 80's with the initiation of a programme by the Institute to arrive at a comprehensive, up-to-date food composition table for use in the country. A variety of studies have been carried out in this area of nutritional evaluation of locally available foods.

At the same time, the Institute established linkages with various regional networks established to promote the generation of food composition data. The IMR participated in the inaugural meeting for the formation of ASIAFOODS (Tee, 1985c) and was appointed the national focal point for this newly formed regional organization for cooperative acquisition and exchange of food composition data. Closer to home, the IMR worked closely with the ASEAN Foods (Tee, 1989b). More recently, linkage was also established with the Asia-Pacific Food Analysis Network (APFAN) (Tee, 1991a).

Compilation of a Malaysian Food Composition Table

The first phase of the project was to review all

available reports on the composition of local foods to assess the situation regarding studies into nutrient composition of Malaysian foods (Tee, 1981). Data were also selected from these reports and compiled into a Preliminary Malaysian Food Composition Table, released for interim use in 1982 (Tee, 1982). Using this preliminary table as a guide and reference, systematic chemical analyses on local foods were carried out to fill in the gaps in this table, to update published values using improved methodologies, as well as to increase the types of foods analysed. The analysis programme was carried out as a joint effort between the Division of Human Nutrition of this Institute, the Food Technology Division of MARDI, the Faculty of Food Science and Technology of UPM, and the Department of Food Science and Nutrition of UKM. Results obtained from this programme were compiled and an up-dated version of the Preliminary Table published (Tee, 1985d). In the final stage of the programme, a comprehensive Table was published in 1988 (Tee *et. al.*, 1988a).

Further Studies on Specific Foods and Nutrients

To provide further input and refinement to the food composition database that has been set up, the subsequent phase of the food composition programme placed emphasis on the analyses of selected groups of foods for which information is lacking, nutrients which have not been given sufficient attention, as well as studies on analytical methodologies. Effort was also placed on the improvement of the management, storage and retrieval of the large amount of data that has become available.

Two groups of foods which the government was encouraging their consumption, but for which composition data were lacking were studied. In the first group, 19 types of local vegetables, used mainly as *ulam-ulam*, were studied. The nutritional value of 20 species of fresh-water fishes (Tee *et. al.*, 1989a) were compared with that of 50 species of marine fishes from 31 families (Tee *et. al.*, 1987). In response to the great interest generated on the consumption of snack food, the nutritional value of these foods was also examined (Tee *et. al.*, 1989b). Studies into analytical

methodologies placed emphasis on several nutrients, including vitamin C, calcium and iron (Tee *et. al.*, 1988b; Tee *et. al.*, 1989c, 1989d).

Studies on several specific nutrients were carried out. In response to increasing interest in the dietary fibre content of foods, a study of this "neglected nutrient" was initiated. In conjunction with this unavailable carbohydrate, the "available carbohydrate" content of foods was examined, to obtain more accurate data on carbohydrate content, as opposed to results obtained "by difference" (Siti Mizura, 1989). The study of cholesterol content of foods was initiated, to meet increasing demand for these data in the control and prevention of cardiovascular disease.

There has been a great deal of interest in the vitamin A and carotenoid contents of foods in recent years, in relation to their importance to vitamin A deficiency, as well as to their possible roles in the prevention of cancer (Tee, 1988b). Much progress has been made in the development of analytical methods for more accurate determination of these two groups of closely related nutrients (Tee and Lim, 1991a). A systematic project to develop an improved method for the analysis of retinol and carotenoids was thus initiated (Tee and Lim, 1990). The HPLC method developed was found to be suitable for the simultaneous analysis of retinol and carotenoids in a variety of fruits and vegetables (Tee and Lim, 1991b), as well as foods of animal origin (Tee and Lim, 1991c). Besides making available an improved methodology, the project has also resulted in making available the carotenoid composition of these foods, to provide more accurate estimations of the vitamin A values of foods.

Further to the above-mentioned completed project on the development of a HPLC method for more accurate analysis of retinol and carotenoids in foods, two other studies were carried out. In the first study, the HPLC method developed was successfully adapted for the simultaneous determination of retinol and carotenoids in blood sera. For the first time, the carotenoid composition of a sample of "normal" sera of Malaysians has become available. The method would be useful for more accurate determination of these

nutrients in human subjects, e.g. in the assessment of vitamin A status. In order to provide more accurate data on the vitamin A value of foods, the biological utilization of carotenoids in selected plant sources was investigated using experimental rats in the second study (Tee, 1991b).

FOOD SAFETY

The Institute has, in recent years, placed greater emphasis on studies into food safety, in response to greater consumer awareness for safe food supplies. Two reviews on some relevant toxicants have been published on the subject (Mat Isa and Tee, 1984; Tee and Siti Mizura, 1984). Studies carried out during the last decade include an investigation into the contamination of lead and boric acid in local foods, and an on-going project on aflatoxin contamination.

Lead Content of Some Malaysian Foodstuffs

Considerable amount of attention has been directed towards determining the levels of lead in foods and beverages, since these are important sources of lead exposure. However, there have been few studies into the extent of lead contamination of Malaysian foods. The IMR completed a study of lead level in a variety of local foodstuffs. A total of 80 food items from 11 food groups were studied. Samples were analysed using the organic extraction and spectrophotometric procedure. Findings of the study have been submitted for publication (Siti Mizura *et. al.*, 1987).

Occurrence of the Prohibited Preservative Boric Acid in Foods

Many countries, including Malaysia, has prohibited the use of boric acid as a food additive. It is, however, suspected that it is still widely and illegally used in this country. Due to the lack of information on this practice, a study was carried out to unravel the occurrence and the level of this prohibited preservative. The first phase of the project involved a detailed comparative study of three methods for the analysis of boric acid (Siti Mizura *et. al.*, 1991a). In the subsequent phase of the project, a wide variety of commonly consumed foods were studied using

the identified analytical method, to identify the extent of contamination of boric acid (Siti Mizura *et. al.*, 1991b).

Aflatoxins and Toxin-producing Moulds in Selected Foodstuffs and Food Consumption Patterns and Exposure to Aflatoxins and Toxin-producing Moulds in Selected Population Groups

A major project on food safety was initiated in 1990. The project was aimed at determining the frequency of contamination of a variety of commonly consumed foods by aflatoxin-producing fungi from retail outlets in selected geographical locations in Peninsular Malaysia, and to determine the levels of aflatoxins in these contaminated food samples. In an associated study, food consumption patterns and exposure to aflatoxins and toxin producing moulds in selected population groups is investigated. It is envisaged that findings of the project will, firstly, facilitate a meaningful evaluation of the significance of aflatoxins as environmental carcinogens in Malaysia and secondly, encourage studies by the relevant bodies to identify the point of highest risk to mould invasion and aflatoxin contamination and subsequently to the formulation and application of suitable control measures by the authorities to prevent aflatoxin contamination (Siti Mizura, 1990).

FUTURE RESEARCH ACTIVITIES

A project identified for implementation in the next five years during the 6th Malaysia Plan is a large scale study of the nutritional status of various functional groups in the country. This is an attempt at providing a more accurate picture of the nutrition situation. Scheduled to commence in 1992, the project will be jointly carried out by IMR and the Department of Human Development Studies of UPM.

It is anticipated that clinical nutrition research in the IMR will be strengthened in the 6th Malaysia Plan period. Two medical officers have recently been recruited to intensify research in this area of nutrition. A WHO consultant in clinical nutrition has been appointed to assist in the task and he has commenced his appointment since July this

year. A new dimension in nutrition research in the IMR is expected to arise from these new inputs.

Research in the other thrust areas identified in this report is expected to continue. While the emphasis will continue to be in the rural under-nutrition, a great deal more attention will also be given to nutritional problems of the urban poor, as well as chronic disorders associated with nutritional excesses. Another new area for study that is being planned is studies into the nutritional problems of the elderly.

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