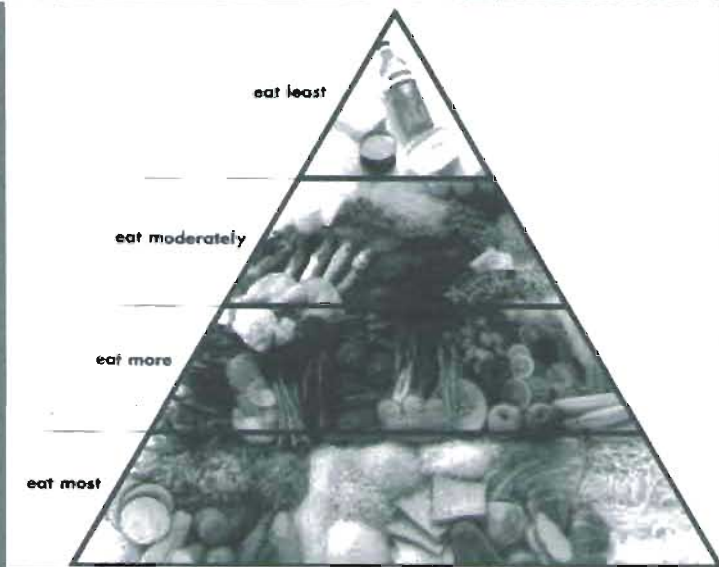


100 Years of the IMR



DIVISION OF HUMAN NUTRITION

DIVISION OF HUMAN NUTRITION

THE BEGINNING OF NUTRITION RESEARCH (1900-1940s)

Research studies into beri-beri

Nutrition is a relatively young science. The most active periods of research was probably around the commencement of this century and also about the time IMR was established. It was around this time that the existence of "accessory food factors" was recognized which later on led to the coining of the word "vitamins" for these factors by Casimir Funk in 1911. The first of such food factors was linked to the disease beri-beri, which was actively researched in several countries in Southeast Asia. First thought of as due to toxins or bacterial infections, it was subsequently proven that the disease was due to the lack of a nutritional factor in the diet. The IMR played an active part and contributed most significantly to this landmark discovery in nutrition science. The first documentation of nutrition research in the Institute and also in Malaya was thus in 1900, on investigations into the etiology and pathology of beri-beri.

At the end of the 19th century, various hypotheses on the etiology of the disease were proposed and actively investigated. Earlier theories suggested that the disease was infectious in nature. An early proposal was that it was a "cross between intermittent fever and typhoid fever". There were also suggestions that it was linked with rheumatoid arthritis, kidney diseases and pernicious anaemia. There was even a claim that a micrococcus was isolated as the causative organism of beri-beri. There was also a suggestion that since the disease occurred mainly among white rice eaters, the causative factor could be a toxin in the rice. Some attention was also given to the possibility that the disease was of nutritional origin. Several studies suggested that changing the amount of protein or carbohydrate in the diet improved or eliminated the disease.

Such was the scenario on beri-beri research when the IMR was established. As the disease was rife at that time, it was to be expected that the Institute participated in the investigations. The first Director of the IMR himself, Dr Hamilton Wright, devoted a considerable amount of time to the study of the disease from 1900-1903. He did most of his work amongst prisoners and paid a lot of attention to the diet of these inmates. He was satisfied that the diet in the prisons was physiologically appropriate and thus concluded that "diet per se is not a causative factor of beri-beri". He rejected the theory of a toxin or a specific microorganism growing in the rice. He felt that the causative factor was (intromural) and was due to a specific organism that could lie dormant in certain localities.

Dr C.W. Daniels took over as Director of the IMR from 1903 and continued on the investigations into the cause of beri-beri, also amongst prisoners. Based on his observations, he concluded that diet was not the causative agent and that the disease is infectious in nature.

After the departure of Dr Daniels from the Institute, studies into the disease were taken over by the next Director, Dr H. Fraser. He worked closely with Dr A.T. Stanton who was a bacteriologist in the Institute. Extensive work by these scientists led to the conclusion that the disease was unlikely to be of infectious origin. The disease also could not be attributed to the lack proteins, fat, carbohydrates or salts (minerals) in the diet. It was however clear that the disease was closely related to the consumption of white or polished rice. Further detailed and pain taking studies using fowls led to the conclusion that a substance in rice millings or polishing that prevented or cured the disease, was lost when rice was highly milled. Attention was then given to extracting and identifying this factor or substance but without much success.

More importantly, however, these scientists were concerned with the practical implications and applications of their discoveries. It was felt more urgent to do something to prevent and cure beri-beri than in the isolation of the actual causative agent. They described in detail the method for the preparation of extract of rice polishings for distribution to hospitals and dispensaries for the treatment of beri-beri patients. They also advocated the prohibition of the use of white polished rice in all

government institutions. Subsequently, the message of the danger of eating white rice was widely disseminated in Chinese and English to the local populations. These measures helped to reduce markedly the incidence of beri-beri in the Federated Malay States.

All these remarkable investigations into the etiology and pathology of beri-beri have been documented in numerous equally remarkable documentations of the IMR. Summaries of these have been documented in the Jubilee Volume of the Studies of the Institute for Medical Research published in 1951. Detail documentation of these studies had also been published in numerous monographs of the IMR.

Other nutrition studies

Investigations into nutrition and health widened and increased in importance from the 1920s onwards. After having defined beri-beri as a deficiency disease after a decade of active research, the importance of food deficiency diseases was further recognised by researchers all over the world. In 1927, some of the severe anaemias in Malaya were suspected to have a nutritional cause, and within a few years, pellagra, xerophthalmia and "burning-feet" were recognized by the healthy staff and ascribed to deficiency disorders. From then on till the 1940s, these disorders were actively investigated in the Institute. The need for accurate information on the composition of local foodstuffs became increasingly urgent as the list of possible nutritional deficiency diseases grew. The contribution of the Institute in these early years was data on chemical analyses of rice arising from the beri-beri problem.

The growing interest in the problems of nutritional deficiencies suggested the need for more accurate information the diets of the communities and the prevalence of these deficiencies throughout the country. The first organised surveys during this period were done among Malays by Vickers and Strahan in Kedah in mid-1930s. Various aspects were covered in this large-scale study including malaria, nutritional deficiencies, dietary study, water supplies and socio-economic conditions. Some 10,000 persons were examined for nutritional deficiency and more than 9,000 subjects for haemoglobin levels.

In the late 1930s, Dr A. Neave Kingsbury and Dr P. Fasal conducted a study of over 1,600 Malay children and 3,600 Tamil children and young adults living on 37 rubber estates in Perak, Selangor and Negri Sembilan. Weight and height and several other anthropometric measurements of the subjects were taken.

ESTABLISHMENT OF THE DIVISION OF NUTRITION - 1946

With increased number of activities on nutrition going on in the Institute, the need for a permanent nutrition division was soon recognized. The Division of Nutrition was thus established in the later half of 1946, with Dr R.C. Burgess as the first Senior Nutrition Officer. Right from the beginning, the Division took on a variety of roles in nutrition research and activities. Assessment of the nutritional status of communities was one of the main activities and comprised clinical, dietary and biochemical investigations. Economic and agricultural surveys were also conducted as part of these investigations. Another important activity of the Division was in assisting various institutions in drawing up diets. The Division also provided advice to the administration on general nutritional policy, which included the types of foodstuffs to be imported, the processing of foodstuffs and the supplementary feeding of needy segments of the population. Nutrition education to the community was also reported to be an important activity of the Division.

In 1945, a number of nutrition activities were carried out by the British Military Administration when British forces re-occupied Malaya following Japanese withdrawal. The headquarters for these activities were set up at the IMR. An important activity carried out was nutrition education to the communities, conducted through talks through radios and vans, exhibitions, and recipe contests. Other activities included the distribution of milk and supplementary foods in welfare centres, hospitals and schools. Finally, another important activity was the conduct of a nutrition survey of some 15,000 persons in different parts of the country. The survey included clinical examinations, weight and height measurements and haemoglobin level determination. No gross starvation was reported, but there was widespread moderate malnutrition. The results of this survey and also a report of the various activities

mentioned above were contained in a report by Lt Col. Geoffrey H. Bourne who headed the above activities.

Dr R.C. Burgess reported a study in 1948 of Malay children in Malacca coastal area, which included income and expenditure, food consumption pattern, clinical examination, intestinal helminthiasis, haemoglobin level and weight and height. Also around the same time, Burgess and Laidin bin Alang Musa reported the state of health and the diet and the economic condition of a group of Malays employed in smallholder agriculture, Malay fishermen and Indian labourers in a rubber estate. A detailed report of the various investigations conducted was published in an 80-page monograph in 1950.

From 1949, field studies in nutrition were seriously interfered by the increasing tempo of the Emergency. Other activities in the Division were also curtailed somewhat with the departure of Dr Burgess and the inability to obtain a suitable replacement as Senior Nutrition Officer.

NUTRITION IN THE 1950s

In the early 1950s, Dr Simpson, the Senior Biochemist took charge of the Nutrition Division, in addition to his own duties until 1955 when he was appointed Senior Nutrition Officer. In 1958, Mr Chong Yoon Hin and Mrs Ruth Lim joined the Division as Biochemist and Nutrition Officer respectively. Thus, nutrition activities continued in the IMR and several nutrition surveys were conducted during this period. A study was conducted in 1957 amongst Malay toddlers in Kota Bahru, Kuala Terengganu, Kuantan, some kampungs near Kuala Kangsar and some rural and town areas in Selangor and Malacca. A detailed study was also conducted near Parit on the Perak River. The areas chosen were Lambor Kanan and Kiri, known to have a high incidence of protein malnutrition and Layang-layang Kanan and Kiri, suspected to have improved over the years.

With the appointment of Dr P.W.G. Tasker in 1953, work on anaemia in the Nutrition Division intensified. For several years, he embarked on a series of studies into the problem besides surveys of its prevalence. These studies included looking into more exact diagnosis of the types of anaemia that were most commonly encountered and the etiology of anaemia. The role of iron, vitamin B₁₂ and folic acid in anaemia were thoroughly investigated. Studies into worm infestation and the use of radioisotopes were also conducted. Unfortunately, due the untimely death of Dr Tasker at the very young age of 35 years in March 1960, studies on anaemia were temporarily stopped.

Following on the work on rice in the early years of the 20th century, the Institute continued with various chemical studies on the nutritional value of rice in the late 1940s and continued into the 1950s. Nutrient content was studied in relation to the various methods of milling rice and washing and cooking of rice. The different conditions of parboiling padi on the nutritional value and quality of the resulting milled, parboiled rice were studied in detail. The effect of soil, cultural conditions and variety on the content of some nutrients in rice was also investigated. Much of these work were conducted in collaboration with the Division of Biochemistry. There was in fact close collaboration between the two divisions in other nutrition related projects.

A systematic programme to analyse the more common varieties of marine fish on the local market was conducted from 1957-1960. One of the main objectives was to examine the extent of variations of the macronutrients and a few minerals. Thus analysis was carried out on the same species of fish caught in different places and at different times of the year. From 1960, several fresh water fishes were included in the analytical programme. Analysis of other foodstuffs was also carried out during the period, e.g. samples of rice purchased through government tenders and some fruits.

The importance of nutrition education as a means of improving the nutritional status of the population has been recognized early. As mentioned above, the Nutrition Unit of the British Military Administration, based in the IMR, conducted a series of nutrition dissemination activities to the population in the late 1940s. The Division also published booklets and other materials for nutrition education activities. In the 1950s, Dr Simpson was invited by the Health Education Committee of the Federation and provided valuable input in the development of nutrition education in the country. The

teaching of nutrition and hygiene were subsequently introduced into the primary and secondary school curriculum. The teaching of nutrition was also increased in several other institutions and organisations for example the teachers' training college, rural health centres and Women's Institute, the Rural and Industrial Development Authority and local government officers. Staff members of the IMR participated in these activities. From 1958, the Division also conducted a series of travelling exhibitions to bring knowledge on health and nutrition to the kampung people. A notable development was the organising of the first training course in applied nutrition in November 1956 in the IMR. The Chief Minister of the Federation of Malaya, Y.T.M. Tunku Abdul Rahman Putra declared open the seminar, attended by local Government Officers and members of voluntary organizations.

Another important activity of the Division was responding to various dietary enquiries. This included providing advice to various organizations and institutions in the development of ration scales. The Division also provides advice in the formulation and implementation of supplementary feeding programmes for school children.

POST INDEPENDENCE PERIOD (1960s - 1980s)

Datin Dr Lady Thomson was appointed Senior Nutrition Officer of the division from 30 August 1961, following the retirement of Mrs E.B. Merry (Ms E.B. Cheek). Dr Chong Yoon Hin took over as the first Malayan head of the Division from 17 May 1965. In 1968, Mr Lim Ju Boo joined the Division and served till 1971. In the 1960s, nutrition research and activities increased in scope and intensity in the IMR. There were however frequent complaints of staff shortage in the Division of Nutrition.

In the early 1970s, Ms Foo Li Chien, Mr Tee E Siong and Mr Tony Ng Kock Wai joined the Division as Nutrition Officers and had been serving the Institute till the present moment. All the three nutritionists subsequently obtained post-graduate training and received their PhDs. Other nutritionists who joined the Division were Ms Rozia Hanis Hussein in 1976, Ms Siti Mizura Shahid joined in 1981 and Ms Mirnalini Kandiah. These officers, however subsequently left the Division in the late 1980s and early 1990s. A few medical officers also joined the Division, but they did not stay long in the Institute.

When Dr Chong Yoon Hin was appointed the Deputy Director of the Institute, Mr Tee E Siong took over as Head of the Division. A historical record of heads of the Division from the time it was established in 1946 till the present time is as follows:

July 1946-July 1950	Dr B.C. Burgess
July 1950-1954	Dr I.A. Simpson (Officer-in-charge)
1955-19 Nov 1957	Dr I.A. Simpson
20 Nov 1957- 28 Aug 61	Ms E.B. Cheek (Mrs E.B. Merry)
29 Aug 61 - 16 May 1965	Datin Dr Lady Thomson
17 May 1965 -	Dr Chong Yoon Hin
1984 - present	Dr Tee E Siong

RESEARCH

Assessment of Community Nutritional Status

Work on anaemia resumed in the Division, with the appointment of Dr Lie-Injo Luan Eng, formerly of the University of Indonesia in Jakarta in November 1960. Dr Lie had already established a reputation for her work on abnormal haemoglobins. This detailed work was subsequently carried out in the Division of Haematology while the Nutrition Division carried on with studies of the prevalence of anaemia among various community groups.

There was a great deal of emphasis on detailed investigations into infant and child nutrition and growth curves of various races in the 1960s. A group of healthy children was also examined in detail for comparison with children from rural areas as well as with children from other countries. Detailed examinations of large numbers of primary school children were also conducted in Selangor, Perak in the

1960s. A large-scale study of birth weights of infants from the three major ethnic groups in the country was carried out from 1960-1965. From 1966-67, a study of the nutritional status of pregnant mothers in the Kuala Lumpur Maternity Hospital was conducted. Other notable community studies include those conducted in Telok Datuk and Ulu Terengganu in the late 1960s.

In 1962, the United States of America Army conducted the Interdepartmental Committee on Nutrition for National Defense (ICNND) Survey in September-October. The Division of Nutrition collaborated fully in this national nutrition survey which included clinical examination and weight and height measurements of 8,172 subjects and detailed examination of 1,569 subjects from different parts of Malaya.

The Division continued to focus on studies of community nutrition studies in the 1970s. A study of birth weight of infants born in the Kuala Lumpur Maternity Hospital was carried out around the mid 1970s. Nutritional anthropometry of urban kindergarten children in Petaling Jaya and Kuala Lumpur provide data for comparison with growth of children in other countries as well as international references.

A detailed study of fluoride in human nutrition was carried out in the 1970s. This included the study of urinary fluoride excretion and teeth fluoride in fluoridated and non-fluoridated areas. The fluoride content of local foodstuffs and water were also analysed.

Towards the end of the decade, a study of factory workers in 1977 in Shah Alam, was conducted in collaboration with Occupational Health Unit of the Ministry of Health Malaysia. A group of army personnel in 4 camps in Selangor, Negri Sembilan and Pahang was examined for their nutrition status in 1979. In a different setting, the nutritional status of two fishing communities in Kelantan was investigated.

A series of studies on the nutritional status of poverty villages in Peninsular Malaysia was conducted from 1979 to 1983. These studies involved the examination of about 3,600 persons drawn from 14 kampungs in the states of Kelantan, Johore, Kedah and Perak. Blood specimens were obtained from about 3,000 individuals while 1,500 persons provided stool and urine samples. Visits were made to 548 households for collection of data on socio-economic characteristics, food consumption and pattern, food beliefs and practices. Findings from each of the 4 areas were separately presented as well as in a combined monograph.

Several other notable studies of the nutritional status of communities were conducted during the period. A biochemical assessment of the nutritional status of Shah Alam industrial workers was carried out in the late 1970s. A study of preschool children and women of childbearing age in three poor and remote villages was carried out in the Bengkoka Peninsula, Sabah in the early 1980s. Around the same time, a large study of pregnant women in their third trimester, of Malay, Chinese and Indian origin from the lower socio-economic strata was conducted. A large number of biochemical and haematological indices were studied on the subjects.

Serum lipids and coronary heart disease

Studies into over nutrition and associated disorders are relatively recent undertakings in the country. No reports on this subject were documented prior to 1960. From the late 1960s, the Division embarked on the analysis of serum lipids for a variety of community groups. The tests were also offered to physicians in hospitals for the diagnosis of hyperlipidemia (see later section on diagnostic service).

From then on, there was much emphasis by the Division on the establishment of new analytical techniques in the area of serum lipid chemistry in order to bolster research involving the triangular relationship of dietary fats, hyperlipidaemia and coronary heart diseases (CHD). This saw outdated "corrosive" laboratory methods for serum cholesterol and triglycerides being replaced by new ones. Backed by its participation since the early 1970s in the external quality control programme for serum cholesterol (TC) and triglycerides (TG) managed by the Centre for Disease Control, Atlanta, the Division became the reference laboratory for serum lipid and lipoprotein analyses in the country. Soon, upper

limits of normality ("cut-off" values) for serum cholesterol and triglycerides were established for age categories by decade for the local population.

Between 1962 and 1964, one of most extensive investigations on the chemical composition of human lipoproteins was undertaken. These studies were prompted partly by the suggestion that it is the chemical modifications to the beta-lipoproteins [low-density lipoproteins (LDL)] that lead to their deposition in the arterial wall, which eventually clogs the artery. Thereafter, an analytical method for serum LDL based on turbidimetry was introduced which enabled us to measure the "bad cholesterol". In the 1970s, the analysis of high-density lipoprotein cholesterol (HDL-cholesterol: the "good cholesterol") was included in the serum lipid package offered by the Division. This enabled the calculation of LDL-cholesterol by the reliable Friedewald formula, which obviated the need for actual chemical analysis for this class of lipoproteins. The sum of these analyses, i.e. serum TC, TG, HDL-cholesterol, and LDL-cholesterol was then offered as a serum lipid profile package by the Division.

The Division also adopted the new indicator "percentage of HDL-cholesterol", i.e. with serum TC as the denominator, as a more sensitive index of CHD risk than the absolute values of HDL-cholesterol, which bolstered serum lipid diagnosis and research. Adults with percentage HDL-cholesterol values of >25 and <15 are considered at "low risk" and at "increased risk" to CHD, respectively.

During the 1970s and mid-1980s, lipoprotein phenotyping based on Frederikson's Classification system for hyperlipoproteinaemia was carried out in the Division to spearhead serum lipoprotein research in the country. Much work in this area of lipid research was centered on the study of familial hyperlipidaemias in hospital patients presenting with typical clinical symptoms such as tendon xanthomata and arcus corneae before the age of 40 years. Our findings imply that familial hyperlipoproteinaemias are by means very rare in Malaysia and that Type II is the most common phenotype.

In the same period, a flurry of research activity was centered on the influence of the environment on the serum lipid profiles of the Orang Asli residing in jungle, peri-urban, and urban areas. Interesting, it was shown that these indigenous people possessed very low mean serum TC (<160 mg/dL), low blood pressure, and did not suffer from coronary heart disease. All these seemed to change for the worse as the Orang Asli began to migrate first to peri-urban areas, and then to urban areas, and we see a marked rise in the serum lipid values, as well as in blood pressure.

Palm oil research

In the early 1980s, there was a paucity of information on the nutritional and health effects of palm oil. It was then that the Director General of the Palm Oil Research Institute of Malaysia, Datuk Dr Augustine SH Ong (presently Tan Sri) visited the Institute for Medical Research (IMR) and emphasised the urgent need for collaborative palm oil research between the two Institutes to generate scientific data, which, could be used to support the Malaysian Palm Oil Industry. This was all the more important as anti-palm oil activities were already brewing at the time in certain western countries, which culminated in the launching of the Anti-Palm Oil Lobby in the United States in 1987.

In 1984, the first PORIM-funded palm oil research at the IMR entitled "Nutritional studies on palm oil" was carried out in the IMR, and signalled the beginning of many more collaborations of a similar nature. Soon basic nutritional criteria for palm oil and its fractionation products, palm olein and palm stearin, such as digestibility, absorption and food energy were published for the first time.

Studies were also conducted on the unsaponifiable fraction of palm oil, focusing on the effects of the vitamin E vitamers, tocopherols and tocotrienols, on blood platelet aggregation and on serum lipids in the rat model. By stripping palm olein off its vitamin E content and then adding back separately either a palm tocotrienol-rich fraction or alpha-tocopherol at different levels to the diet, we were able to establish that the anti-thrombotic effects of palm oil was attributed to the tocotrienols and not the tocopherols.

In 1989, a placebo-controlled *palmvitee* (encapsulated vitamin E-rich preparation from palm oil) feeding trial was conducted at the IMR, using young adult volunteers who were undergoing a three-year programme at the then School of Laboratory Technology located at the Institute.

The greatest impact of palm oil research at the IMR arguably came from two human feeding trials. The first study conducted in 1989, involving 83 adult volunteers from a hostel population, compared the cholesterolemic effects of palm oil, corn oil, and coconut oil (positive control) when used as the sole cooking oil in food preparation. The highlights of the findings which were published in the American Journal of Clinical Nutrition in 1991 included: a) palm oil was significantly more hypocholesterolemic than predicted by the Keys equation (a regression equation used widely at the time to predict changes in serum TC brought about by a change in dietary fats); and b) palm oil is very different from coconut oil. The bottom line is that palm oil does not raise serum TC in the subjects but actually lowered it by 9% when compared to corresponding baseline values at entry into the study.

Nutritional value of local foods

Activities on analyses of local foods continued in the 1960s. The systematic programme to analyse the nutrient content of fresh water fish, which started in 1960, continued for several years. A wide variety of other foods were also analysed, including several food products provided as supplementary foods for young children. Particular attention was also given to detailed studies of rice, continuing from work of the early years. A programme to analyse the beta-carotene content of vegetables was carried out in the early 1960s in which a chromatographic method was used to obtain more accurate data on beta-carotene, after separation from other carotenoids. Around the same time, nutrient analysis was also carried out a large number of breast milk samples with particular focus on vitamin A and carotene content.

In the 1970s, the analysis of foods continued. This included the analysis of a variety of combat rations and vitamin pills received from the Ministry of Defence. In 1975, the analysis of cholesterol and fatty acid composition of a number of local foodstuffs was completed. The Division also assisted in the analysis of a variety of food samples from the Ministry of Health, the Food Technology Division of MARDI and the Veterinary Department.

Malaysian Food Composition Programme

The Division has been conducting work on the analysis of nutritional value of local foods from the 1950s, described earlier in this chapter. Data were obtained to provide information for the preparation of educational material for health staff as well as used by dieticians and doctors in providing information to patients. Recognizing the importance of data on nutritional value of local foods to food and nutrition activities, it was realised that the previous ad hoc efforts are insufficient. A systematic programme to compile a comprehensive food composition table for use in Malaysia was thus initiated in 1980, headed by Mr Tee E Siong. The first phase consisted of a definition of the state-of-the-art of food composition studies in the country and compilation of a preliminary table for immediate use in 1982. In the second phase, systematic chemical analysis of local foods commenced and was carried out as a collaborative programme among the Institute for Medical Research (IMR), the Malaysian Agricultural Research and Development Institute (MARDI), Universiti Pertanian Malaysia (UPM) and Universiti Kebangsaan Malaysia (UKM). To execute the Programme, a Working Group was formed, comprising scientists from the participating institutions. Financial assistance for the analyses was obtained under the ASEAN Protein Project, which was funded by the ASEAN-Australian Economic Cooperation Programme (AAECP). At the end of the second phase, an update to the preliminary table was published in 1985.

The analysis and compilation programme continued for another four years into its third phase. Continued financial assistance was obtained from the AAECP under the ASEAN Food Habits Project. The climax of the programme was the publication of Nutrient Composition of Malaysian Foods 1988. Besides the printed copies the database was also available in dbase format. In cognizance of the need for continuous interaction between food composition data generators and users, a Workshop for Users of Food Composition Data was organised in late 1988. The primary objective of the Workshop was to understand the needs of data users and to maximise the distribution and effusive use of data.

Nutritionists, dietitians, food scientists and educationists provided inputs for improvements to the 1988 Table as well as recommendations for future work in food composition data generation and compilation.

With the publication of the comprehensive edition of the Food Table in 1988, the systematic food composition programme in Malaysia has achieved an important stage of development. Work on the programme continued and current activities emphasise on providing further input and refinement to the database established. These included analyses of selected nutrients, which have not been given sufficient attention, selected groups of foods for which information is lacking, as well as studies on analytical methodologies. Effort was also made to improve the management, storage and retrieval of the large amount of data that has become available.

There increasing interest in the vitamin A and carotenoid contents of foods, in relation to their importance to vitamin A deficiency as well as to their possible roles in the prevention of cancer. Much progress has been made in the development of analytical methods for more accurate determination of these two groups of closely related nutrients. A systematic project to develop an improved method for the analysts of retinol and carotenoids was thus initiated in the Division. The HPLC method developed was found to be suitable for the simultaneous analysts of retinol and carotenoids in a variety of fruits and vegetables, as well as foods of animal origin. 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 analysts of retinol and carotenoid 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 utilisation of carotenoids in selected plant sources was investigated using experimental rats in the second study.

Coordination with regional networks

The Malaysian food composition programme in Malaysia has been developed in coordination with various international and regional networks. At the commencement of the programme in the early 1980's, the establishment of the International Network of Food Data Systems (INFOODS) in 1983, aimed as an international effort to improve the amount, quantity and availability of food composition data had provided additional impetus for the programme. It was comforting to know that Malaysia was not alone in its effort. The following year, Malaysia participated in the inauguration of ASIAFOODS, one of the several regional networks subsequently established.

In the ASEAN region, Malaysia has collaborated fully with other member countries in a number of activities in food analysis. Arising from discussions during several workshops, the ASEAN Food Data Network was established in 1986. Coordinated from Bangkok, various activities have since been organised, including two workshops in 1986 and 1989. Besides discussions on a variety of analytical methods, emphasis was also given to the generation of national food composition databases, quality control and interlaboratory testing and computerised databases. An interlaboratory trial on nutrient analysis among the various laboratories in ASEAN was carried out in 1988.

Toxicants in foods

With the outbreak of Turkey 'X' disease in England in 1960, and the subsequent discovery of aflatoxin as the causative agent, it was suggested that primary liver cancer may be associated with the eating of foodstuffs contaminated with mould toxins (mycotoxins), particularly aflatoxins. Aflatoxins are a group of chemical poisons produced by a very common species of mould *Aspergillus flavus*, and they are not only the most powerful liver poison yet discovered but the aflatoxins are also highly carcinogenic and have been shown to cause liver tumours in many species of animals.

Between 1965 and 1967, several studies were conducted by Dr Chong Yoon Hin and co-workers to determine the level of contamination by aflatoxins in local foodstuffs. Those examined included various types of groundnuts, samples of groundnut oil and fermented soybeans for soy sauce production. It was found that improperly stored kernels (shelled nuts) were most likely to be contaminated. Low levels of aflatoxins were found in imported samples of unrefined ground oil and some local brands of peanut butter. Aflatoxins were however not detected in fermented soybeans for soy sauce manufacture and their absence in fermented soybeans was confirmed by feeding experiments on day-old ducklings, which are known to be very sensitive to aflatoxin toxicity.

Work on the analysis of aflatoxins in the Division resumed in 1976. Funding was obtained through the ASEAN-Australian Cooperation programme for the screening of a large number and variety of products developed by MARDI.

In the late 1980s, a large study of another food toxicant was studied. A total of 80 food items from 11 food groups were systematically analysed. Most of the foods studied were found to contain less than 2 ppm of lead, which is a common legal limit for lead content of foodstuffs.

Also in the late 1980s, a systematic study of yet another food contaminant was studied, namely boric acid. A series of studies were conducted to identify an appropriate method for analysis of boric acid in foods. The selected method was next used to analyse a wide variety of local foods for the extent of contamination of boric acid.

Annotated bibliography of nutrition research

In order to provide easy reference to researchers and workers in nutrition in the country, all the publications by researchers in the country (reports, monographs, scientific papers) were compiled and a summary made of each publication. The first of such compilation was published as a monograph in 1980, with publications from 1900 to 1979. The second volume of this bibliographic compilation was published in 1985, containing publications from 1979 to 1984. A third monograph in this series contained publications from 1980 to 1993 and was published in 1994.

TRAINING

Officers of the Division participated in the Medical Laboratory Technology Course by giving some lectures in nutrition. The Division also provided short-term training of 4-8 weeks to staff of other government departments and other institutions on specific techniques, mostly on laboratory methodologies. Undergraduates of local universities were also accepted for attachment for 8-10 weeks for practical training.

CONSULTANCY

The Division continued to respond to dietary enquiries from a variety of institutions, organizations and even individuals. These enquiries ranged from simple questions on nutritive value of various foodstuffs or suitability of a food for a particular condition to detailed planning of diets and menus for institutions.

Senior staff members of the Division served in an advisory capacity in various technical committees of the Ministry of Health and other government departments and agencies. In the 1960s and 1970s, these included the Defence Science Committee, Applied Nutrition Programme, Women's Institute, Standards Institution of Malaysia (various technical Committees of different food commodities), National Food and Nutrition Policy Committee, Food and Drugs Committee, Fluoridation of Water Supplies Committee, Improvement of Hospital Dietary Service Committee, Maternal and Child Health Advisory Committee and School Health Committee.

DIAGNOSTIC SERVICES

From 1968 onwards, there was a marked increase in the workload for biochemical tests of nutritional significance, bringing the total to over 1,000 tests. The greatest demand was for analyses of serum carotene and vitamin A, iron and iron binding capacity, red blood cell transketolase and serum lipids (cholesterol, triglycerides, lipoproteins). The service was thus utilised mostly by physicians and paediatricians in the diagnosis of nutritional deficiencies. In 1970, the total number of tests tripled that of 1968 and 77% of the total was for analysis of serum lipids. With the realisation that hyperlipidemia increases the risk to early onset of coronary atherosclerosis, more physicians were making use of the service not only for the prognosis of hyperlipidemia patients, but also for the routine screening of apparently healthy subjects. In 1975, the total number of tests further increased sharply to 17,000 and more than 95% was for serum lipids. At the end of the decade, the total further escalated to 34,000 while 82% of this was for serum lipid profile. From the early 1970s, and for a period of 10 years, the Division participated in a triglyceride and cholesterol standardisation programme conducted by the WHO Lipid Standardisation Laboratory, Centre for Disease Control, Atlanta. This was to maintain a high laboratory standard in the routine analysis of these lipid parameters.

In the 1980s, the workload for diagnostic service declined steadily. In 1980, the total number of tests declined to about 30,000 and further declined to 22,000 in 1987. By the end of the decade, demand for this analyses declined to a low of 12,000. This decline was mainly due to the drastic reduction in requests for serum lipid profile. During that period, many laboratories in hospitals and clinics established their own capability in these analyses. This also worked well for the institute as it was emphasising on de-centralising these routine tests to other laboratories.

HONOURS AND AWARDS

Dr Chong Yoon Hin was awarded the Kesatrian Mangku Negara (KMN) by His Majesty the King of Malaysia, Yang DiPertuan Agong in June 1980.

LINKAGE WITH THE NUTRITION SOCIETY OF MALAYSIA

A landmark development in nutrition science in the country and in which the IMR played an active role was the establishment of the Nutrition Society of Malaysia in 1985. The registered office of the Society was the Division of Human Nutrition of the IMR. Dr Chong Yoon Hin was elected the first President and Mr Tee E Siong the Honorary Secretary of the Society. The Division continued to play an active role in the activities of the Society in the following years, till the present time.

NUTRITION RESEARCH TODAY (1990s)

RESEARCH

Assessment of nutritional status

The Division was the first laboratory in the country that has developed expertise in conducting comprehensive assessment of the nutritional status of the community, employing a variety of techniques including clinical examination, anthropometric measurements, biochemical determinations and dietary study. After many years of experience, the Division has developed a pool of expertise in this field. Data from many of these studies have provided information on the nutritional status of the communities in the country although they may not be considered as national nutrition surveys.

Nutritional status of major functional groups in Peninsular Malaysia

From 1992-1995, the IMR conducted another large-scale assessment of the nutritional status of communities, after the study of 1979-1983 on several poverty villages. In this recent series, jointly implemented with Universiti Putra Malaysia and Division of Family Health Development of the Ministry of Health, a comprehensive methodology (including clinical examination, anthropometric measurement, selected biochemical determinations and dietary study) was applied to identify the nature, magnitude and influencing factors of under- and over-nutrition affecting rural and urban communities in the country and to recommend measures towards alleviating these nutritional problems. The unique characteristic of this study is that the subjects assessed were according to their "functional groups" in the rural areas namely, padi farmers, rubber small-holders, coconut small-holders, fishermen and estate workers. Instead of studying the rural poor as one large community as is conventionally practised, findings obtained from the "functional classification" approach would be specific for the nutritional situation of each group. In turn this approach facilitates the identification of intervention efforts, which are appropriate and sensitive to a particular functional group. In the absence of national nutrition surveys, such studies do provide some information on the nutritional status of population groups. A series of reports/papers on the study have been published or in the process of preparation. Findings from the study clearly showed the manifestation of the dual forms of malnutrition in the communities examined, namely, the persistence of under-nutrition in children and the emergence of indications of over-nutrition in adults.

Studies on micronutrient deficiencies

The Division is one of the few laboratories in the country equipped to carry out biochemical analyses of many of the micronutrients of concern to developing countries. The focus in recent years has been on iron deficiency anaemia (IDA) and iodine deficiency disorders (IDD), the two main micronutrient deficiency problems in the country as well as vitamin A deficiency. The Division contributed towards understanding the epidemiology and treatment of these deficiencies.

Effectiveness of weekly iron supplementation in adolescent school girls

Malaysia participated in the inter-country project of the WHO/UNICEF/United Nations University collaborative programme on anaemia prevention by carrying out an investigation into the effectiveness, safety and feasibility of weekly iron (plus folate) supplementation in adolescent girls. It was felt important to place emphasis on subjects in this age group as adolescence, with the start of menstruation, is a particularly important time for replenishing iron stores to ensure that the periodic blood loss of women will not become a major determinant of anaemia. The study, involving over 500 subjects was conducted in 3 schools in Samarahan, Sarawak, jointly implemented by the IMR, MOH and Sarawak Health Department. The school teachers were responsible for providing the supplements for 22 weeks. The use of weekly iron + folate supplements is a promising immediate measure for the control of nutritional anaemia in adolescent girls while dietary improvement is advocated for a long-term solution.

Assessment and control of iodine deficiency disorders (IDD)

Iodine deficiency disorders (IDD) is a collective term for the disease states caused by iodine deficiency, which range from simple goitre to severe mental and physical retardation. The IMR's role in relation to IDD began with the need to find an alternative vehicle to deliver iodine to remote Sarawakian villages where problems of accessibility have made IDD control through iodised salt distribution difficult. A fact-finding visit in late 1993 by Foo and Zainab to Lubuk Antu district, an area of long-term iodine deficiency in Sri Aman Division, identified water as the ideal vehicle for introducing iodine in the diet of these longhouse-village populations. As each longhouse shares a common piped water supply (courtesy of the Rural Health Division, Ministry of Health Malaysia), adding iodine to this water will quickly bring about community-wide supplementation. In early 1994, Foo, in collaboration with Goh, developed a technique for the iodisation of the longhouse water supply. A controlled trial carried out in 6 longhouse-villages in the Lubok Antu district during 1994-1995 showed a significant increase in the median urinary iodine concentration with concomitant reduction in the prevalence of goitre and hypothyroidism in villages provided with the water iodisation system. The success of the trial led to prompt implementation of water iodisation for the control of IDD in other longhouses in the interior of Sarawak.

The strategy has now been extended to correct iodine deficiency in Orang Asli settlements in Peninsular Malaysia. The iodisation system is sustained by renewing the iodine source once a year. The cost of providing supplemental iodine through this means is RM0.40 per person per year after the first year (RM4.00 per person for the first year).

Recognising that eternal vigilance is required to assure quality throughout the national effort to eliminate IDD, Foo developed simple and low cost kits for the estimation of iodine in water as well as salt. To date, over 15,000 of these have been distributed throughout the country for the quality control of salt and water iodisation. At the same time, Foo, Nafikudin, Zulfiqar and Fadzil developed locally appropriate age/sex- and body surface area/sex-specific thyroid volume reference for interpreting survey and surveillance ultrasonographic data among school-age children. This has enabled the Ministry of Health Malaysia not only to identify areas of iodine deficiency but also to track progress towards its elimination. Foo and colleagues are currently evaluating the utility of neonatal thyroid stimulating hormone (TSH) level - the data for which will be routinely available once universal screening of new-borns is introduced in the country - as an indicator of IDD status.

The introduction of iodine in areas of long-term iodine deficiency is not without side effects. Iodine induced hyperthyroidism (IIH) has been observed to occur in some individuals with multinodular goitre - a manifestation of long-standing iodine deficiency. This is not regarded as a contraindication to iodine supplementation programmes in view of the enormous benefits - improvement in child survival, child learning, economic productivity and quality of life - consequent on the correction of iodine deficiency in the whole population. IIH can be totally prevented in the next and subsequent generations by the correction of iodine deficiency and the absence of large goitres. Nonetheless, Foo and Mafauzy are currently conducting operational research to determine whether there is an optimum level of iodine supplementation that will eliminate IDD with minimal occurrence of hyperthyroidism in susceptible individuals.

Vitamin A deficiency (and anaemia) amongst young children

There is a continuing global emphasis on the need for assessing the vitamin A status of population groups because of its importance in child health and survival in addition to the essential role it plays for vision and eye health. In order to study the prevalence of marginal vitamin A deficiency amongst children, the Division developed a HPLC method for the analysis of micro-volume of blood, which can be obtained from finger prick. A group of 800 malnourished children enrolled into the nutrition rehabilitation programme of the Department of Health in Sabah were selected for the study, which was conducted in 1998. Other important parameters measured include Hb level, growth achievement and food consumption.

Studies on diet-related chronic diseases

The Division was one of the first laboratories in the country to have embarked on the study of serum lipids and their involvement in coronary heart disease, commencing from the 1970s. It continued to play an important role in studies into the risk factors of CHD. In the area of lipid nutrition research, the Division played a key role in the contribution to new knowledge in the area of role in the area of palm oil in human nutrition, which earned the IMR national as well as international recognition. Data from the palm oil feeding trials in humans were used extensively by PORIM and the MPOPC to refute allegations abroad that the consumption of palm oil contributed to CHD.

Serum lipoprotein(a) as an indicator of coronary heart disease risk

An examination of the CHD mortality among the major Malaysian ethnic groups for the past two decades indicated that the CHD "death toll" of the Indians was twice that in the Malays and Chinese, which suggests that a strong positive risk factor was operating in the Indians. An investigation into the serum levels of the genetically-linked positive risk factor, lipoprotein(a) [Lp (a)], revealed that the distribution of the parameter in serum was highly skewed towards low levels. In addition, serum Lp (a) levels in healthy Indians (mean=22 mg/dL; median=15 mg/dL) were about 1.5- 2 times higher than the levels in Malays (mean=16 mg/dL; median=8 mg/dL) and the Chinese (mean=11 mg/dL; median=7

mg/dL). What this means is that we could have provided a genetic explanation for the markedly higher prevalence of CHD mortality in the Malaysian Indians compared to the Malays and Chinese.

The 90th percentile of the overall distribution of serum Lp(a) in the 792 healthy subjects in the study coincided with a Lp(a) value of 30 mg/dL and this level was used as the cut-off for "high CHD risk". When the serum Lp(a) values of 167 confirmed CHD patients from the same medical centre was included in the analysis, an odds ratio of 3.5 was obtained. Further analysis indicated that serum Lp(a) is a much superior marker of CHD risk in the Malaysian major ethnic groups compared with traditional serum lipid profile and apoprotein A-1.

Currently, a follow-up study carried out by the Division looks at the dietary aspects (including lifestyles) of the susceptibility of Malaysian Indians to CHD. The study is expected to be completed at the end of year 2000 and should shed more light in this area.

Alpha-tocopherol, retinol, and carotenoid profiles in health and coronary artery disease

Currently, there is great interest on whether antioxidant nutrients (eg. vitamin E, Vitamin C, and certain carotenoids) actually play the role of free-radical scavengers and protect against CHD, cancer, age-related macular degeneration, and even the effects of ageing. Preliminary findings of the Division show that only total carotenoids in serum are marginally lower in CHD patients compared with healthy controls.

A study of dietary and physical activity patterns of urban primary school children

The overall objective of the proposed multi-country project coordinated by the International Life Sciences Institute (ILSI) Southeast Asia is to build up a database on the dietary and physical activity patterns of urban children aged 7-12 years in various Asian countries. Ethnic, social and cultural factors that may influence diet and activity will also be investigated. Data that would become available through these studies will provide the scientific basis for the formulation and implementation of appropriate health intervention programmes.

The proposed study was first carried out in Malaysia in 1996, followed by Manila and Jakarta. The study in Malaysia aimed to determine the prevalence of obesity amongst 8-10 years old primary school children in Kuala Lumpur using anthropometric measurements and to study their usual dietary and physical activity patterns. The beliefs and attitude of these children towards selected aspects of food and nutrition were also investigated. Weight and height measurements were taken from almost 6,000 school children and another 600 interviewed on their dietary and physical patterns.

Nutritional knowledge, attitude and dietary practices of urban Malay executives in Kuala Lumpur

The project was conducted with the objective of obtaining information on the nutritional knowledge and beliefs of a group of urban Malay executives towards various aspects of food and nutrition. It is also aimed at identifying the current dietary pattern of the subjects and to determine intake of some selected nutrients. Weight and height of the subjects were also measured. The baseline data that will be made available is very useful in order to improve nutritional practices by the subjects. A total of 300 subjects were studied, sampled from various offices in Kuala Lumpur. The same protocol was used and the study simultaneously carried out in 12 other cities in Asia, all of which were concluded in 1996.

Knowledge, attitude and practice of community towards food and nutrition: baseline study for the Health Eating Campaign of the MOH

The Division served as the secretariat and Dr Tee E Siong as coordinator for the above study, conducted among 5 population groups throughout the country. Data were concluded in December 1997 and some 20,000 subjects have been studied. All the state health departments participated in the data collection,

coordinated by the state nutrition officer, health education officer or medical and health officer. Questionnaire forms are being checked and will be scanned for data entry into the computer. Data for primary school children, secondary school children, adults, elderly and food vendors became available to serve as baseline for the Healthy Eating Campaign.

Palm oil research

The Division continued with its research programmes on palm oil research. As mentioned earlier, the greatest impact of palm oil research at the IMR came from two human feeding trials. The first study conducted in 1989, involving volunteers from a hostel population, compared the cholesterolemic effects of palm oil, corn oil, and coconut oil (positive control) when used as the sole cooking oil in food preparation.

The second study conducted in 1990 compared the effects of palm olein and the much extolled "virgin" olive oil (main edible oil of the protective "Mediterranean diet") on serum lipids and platelet activity in 33 adult volunteers. The results which were published in the *Journal of the American College of Nutrition* in 1992 showed that palm olein and olive oil have comparable normocholesterolemic effects. However, palm olein but not the virgin olive oil, also exhibited a beneficial anti-thrombotic effect which prevents blood from forming a thrombus *in vivo*. What this means is that palm olein may be healthier edible oil than virgin olive oil.

Recently, a collaborative project between the IMR and the National Heart Institute was conducted to determine the influence of daily palmvitoe supplementation over 9 months (4 capsules daily, equivalent to a total of about 160 mg tocotrienols and 80 mg tocopherols) on the inhibition of restenosis in coronary angioplasty patients. Currently, the number of subjects is too small for a valid analysis.

The latest contribution by the Division is its theoretical evaluation of a 2,300-kcal diet model prepared with coconut santan or palm oil santan. Replacing coconut santan with palm oil santan in this diet model was predicted to lower serum TC significantly (and hence reducing CHD risk), using the Hegsted equation (1965). The analysis is published in the *Malaysian Journal of Nutrition* 1998.

Malaysian Food Composition Programme

The establishment of a systematic programme to compile a comprehensive food composition table for use in Malaysia by the Division in 1980 has been outlined above. It developed into a collaborative programme of the IMR, the Malaysian Agricultural Research and Development Institute (MARDI), Universiti Pertanian Malaysia (UPM) and Universiti Kebangsaan Malaysia (UKM) with IMR as the coordinator and data compiler. The Division has been recognized as the leader in this field in the country and continued to be coordinated by Dr Tee E Siong.

Expansion of Malaysian Food Composition Database

After 3 preliminary versions of the table, a fairly comprehensive database was established (in a computer file) and a hardcopy published in 1988. It is widely used by nutritionists, dietitians and other health workers involved in food consumption studies, epidemiological studies of relationship between diet and disease, counselling of patients with specific disease conditions, general dietary advice, preparation of nutrition education materials and planning of food feeding programmes. Work on the Programme continued into the 4th phase from 1990. Activities were carried out on a small scale and emphasized on providing further input and refinement to the database established.

Recognizing that there is a need for continuing efforts in the generation and compilation of food composition data, the Division proposed to extend the previous collaborative food composition programme for another 5 years into the 7th Malaysia Plan. The same institutions jointly put up a

proposal to IRPA (Agriculture sector) and were allocated funding for 3 years. The IMR remained as the coordinator of the Programme and the analytical programme has commenced. In the mean time, the Division published a revised edition of the Food Composition Tables in 1997, which should make it more useful.

Development of nutrient analysis software

To further enhance its role in the field of nutrient analysis, the Division (in collaboration with the Computer Unit of the IMR) embarked on developing a computer software for computation of nutrient content of foods, meals and recipes. The software should dramatically improve the speed and accuracy of calculations nutritionists and dietitians need to perform in their dietary studies and recipes preparations. Called "NutriCal", an agreement was reached with the Malaysian Technical Development Corporation to further develop a prototype developed by the IMR and to market the software widely in the country and the region. It is an example of the commercialisation of research findings from the Institute. Several foreign versions of similar programmes are available, but they may be either based on foreign food database, which makes it unsuitable for use in the region, or are too expensive. Being Windows-based and with several useful features for data entry and analysis built-in, the NutriCal is also superior to many of the other programmes available.

Coordination with regional networks

The Division continued to participate in activities of the ASEAN Foods Data Network. Other activities carried out in the period include the publication of an ASEAN-FOODS newsletter in late 1991. In 1997, a consultative meeting was held in Bangkok for the development of an ASEANFOODS Database. A series of activities were subsequently undertaken and the regional database was established at the end of the decade. A printed copy was also published.

During this period, the Asia-Pacific Food Analysis Network (APFAN) was established, with the nucleus in Australia. Activities carried out by the Network include the organisation of regional seminars and workshops. The Division assisted in the organisation of these seminars in Kuala Lumpur and also published the APFAN Newsletter.

These associations with various regional networks have proved useful as they enable sharing and exchange of experiences and the development of harmonised food composition databases. Malaysia continued to work towards strengthening these collaborations, in order to further update and improve its food composition programme, as well as other programmes in the region.

TRAINING

Continuing with the tradition of previous years, the Division provided short-term training of 4-8 weeks to staff of other government departments and other institutions on specific techniques. Undergraduates of local universities were also accepted for attachment for 8-10 weeks for practical training.

CONSULTANCY

Staff members of the Division continued to serve in an advisory capacity on various technical committees of several ministries and government agencies, especially the Ministry of Health. These committees include the following:

- (a) Malaysian Food Regulations Technical Committee;
- (b) National Codex Committee;
- (c) National Codex Sub-Committee on various commodities or subjects including Nutrition and Foods for Special Dietary Uses, Labelling, Milk and Milk Products and General Principles
- (d) Technical Working Group on Nutrition Labelling, Health Claims and Advertisement, Ministry of Health Malaysia;

- (e) National Coordinating Committee on Food and Nutrition;
- (f) Technical Working Groups of the National Coordinating Committee on Food and Nutrition, namely Research, Dietary Guidelines, Training and Nutrition Policy
- (g) Technical Committee for the Healthy Eating Campaign;
- (h) Sanitary and Phytosanitary Committee of the Ministry of Health Malaysia;
- (i) Risk Analysis Committee, Ministry of Health Malaysia;
- (j) Task Force for National IDD Control;
- (k) Working Group on Food Additives and Contaminants;
- (l) Research Review Committee of the Ministry of Health Malaysia
- (m) Research Audit Committee (IRPA), Ministry of Health Malaysia;
- (n) Animal Care and Use Committee, Ministry of Health Malaysia;
- (o) PalmConsult Expert Directory, Palm Oil Research Institute of Malaysia (PORIM);
- (p) Malaysian Palm Oil Promotion Council (MPOPC)
- (q) National Research Committee on IAEA Regional Project on the Use of Radioisotopes in Nutrition Research;
- (r) SIRIM Technical Committee on various commodities, including fresh and processed vegetables and marine foods;
- (s) International Life Sciences Institute (ILSI, Southeast Asian Branch);
- (t) Editorial Board of several scientific journals, eg Food Chemistry and Malaysian Journal of Nutrition; and
- (u) Supervisors of post-graduate students of local universities.

The Division also played a major role in the doping control activities during the Commonwealth Games in 1998. Dr Tee E Siong served as Vice-Chairman of the Doping Control Committee of the Ministry of Health Malaysia during the Games. For the Southeast Asian Games to be held in September 2001, Dr Tee was appointed Chairman of the Doping Control Committee, and Dr Tony Ng Kock Wai as a committee member.

DIAGNOSTIC SERVICES

The diagnostic role of the Division continued to decline in the 1990s. The total number of tests performed each year continued to decline. In 1995, the total number declined to around 8,000 whereas by 2000, the total was less than 2,000. Serum lipid profile still made up the bulk of the tests requested but the number has further declined compared with previous years. The remaining of the tests were requests for the analysis of several vitamins in blood.

HONOURS AND AWARDS

Dr Tee E Siong was awarded the Ahli Mangku Negara (AMN) by the Yang DiPertuan Agong in 1993 and the Kesatria Mangku Negara (KMN) in 1998. Dr Tony Ng Kock Wai was awarded the AMN in 1997.

LINKAGE WITH THE NUTRITION SOCIETY OF MALAYSIA

The Division of Human Nutrition continued to play a lead role in the activities of the Nutrition Society of Malaysia, with Dr Chong Yoon Hin continuing to lead the professional body as the President and Dr Tee E Siong as the Hon. Secretary. A major activity of the Society in the early 1990s was the organising of the 6th Asian Congress of Nutrition in 1991.

Dr Tee E Siong took over as President of the Society in 1996 and has been leading the Society since then. Dr Tony Ng Kock Wai took over as Hon. Secretary. Staff of the Division provided vital support to the activities of the Society. In addition to regular activities of the Society of organising annual scientific conferences and update sessions for members, several major projects were undertaken in recent years. A series of nutrition roadshows were initiated in 1997 to promote healthy nutrition amongst the

communities. The Society, in collaboration with the Ministry of Health Malaysia, published the hugely successful recipe book, *Healthy Recipe, Wise Choice* that sold more than 70,000 copies. Volume 2 of this book is now in preparation.

An important milestone of the Society at the end of the decade was the launching of its official website NutriWeb (<http://nutriweb.org.my>) in March 2000. With this establishment of the first nutrition e-community of the country, the Society is now able to communicate more effectively with its members as well as in the dissemination of nutrition information to the public. In November 2000, the Society embarked on a major nutrition intervention programme for young children, especially those in kindergartens and child care centres. Known as Bright Start Nutrition, the programme has developed education materials for these target groups and will bring these messages to them through roadshows and workshops.

Through his involvement with the Nutrition Society of Malaysia, Dr Tee E Siong also served as council member of the Federation of Asian Nutrition Societies (FANS) and as member of Task Force of the International Union of Nutritional Sciences (IUNS) Committee on Electronic databases for international nutritional guidelines and recommendations.

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