

MINIREVIEW

Concerning the Study of Nutrition in China (41468)

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This special minireview is a historical overview of past and present research on nutrition in China. It was written by Dr. H. C. Hou, who, at the time of its submission, was one of the few Western-trained nutritional scientists still active in China. It was adapted by Professor Hou from his lecture given at the Institute for Human Nutrition, Columbia University. We have recently been informed of the death of Dr. Hou in Beijing in April 1982.

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Historical Background. One of the earliest records on the concept of nutrition in China is found in an old Chinese medical classic, *Huang Di Nei Jin Su Wen* (Chinese Canon of Medicine or Classics of Internal Medicine), said to be written by Huang Di (the Yellow Emperor) over 4000 years ago but actually written by later scholars about 2000 years ago (1). Therein were statements concerning dietary and nutritional principles that are regarded as sound from the latest nutritional point of view, as for example, "Wu gu wei yang; wu guo wei zhu; wu chu wei yi; wu cai wei chong," which may be literally translated as "Five grains for nourishment, five fruits for supplement, five domestic animals for benefit, five vegetables for complement." In the modern sense these mean "Grains and beans shall be the staple food, which will be benefited by animal meat. Fruits shall be supplementary and vegetables be complementary."

Subsequently there were over 200 ancient books describing foods and diet in relation to nutrition, health, and disease. To name a few: *Qianjinshizhi* (Thousand gold dietotherapy) by Sun Si Miao, AD 581-682; *Shiliaobencao* (Dietotherapeutic herbal) by Meng Xian, AD 621-713; *Yinshanzhengyao* (Principles of dietetics) by Hu Si Hui, 14th century; *Jiuhuangbencao* (Famine herbal) by Zhou Ding Wang, 15th century; and *Bencaogangmu* (Chinese materia medica) by Li Shi Zhen, AD 1518-1593.

Such books deal mainly with the use of conventional and unconventional edibles of plants, animals (including fishes), and minerals, as well as their prepared products for curative and preventive actions, morphological descriptions, and methods of preparation. Many of the food remedies have been found effective experimentally. As examples, seaweed, now found to be rich in iodine, was used in the third century for the treatment of goiter, and beans rich in vitamin B₁ were used for the treatment of beriberi in the seventh century. Rice polishings, also rich in vitamin B₁, were advocated for the prevention of beriberi at about the same time; liver was used to treat night blindness long before it was found to be rich in vitamin A (2).

In these books mention was also made of the use of different foods at different seasons of the year and for different symptoms or illnesses, as well as the danger of eating the wrong combination of certain foods (3). These concepts, however, need experimental support.

Modern nutritional studies actually began during the first decade of the present century concurrent with the advent of the rapid growth of nutritional sciences in the West. By the second and third decades there were many fundamental and applied nutritional studies conducted in many biochemical, chemical, and agricultural departments of universities and colleges, and in many research institutes, hospitals, and clinics. The results of these studies were

published mainly in such journals as the *Chinese Journal of Physiology*, the *Chinese Medical Journal*, *Journal of the Chinese Chemical Society*, *Nutrition Bulletin of Peking Agriculture Institute*, *Bulletin of the Institute of Biology of the Sino Academia*, etc. In 1926 nutrition workers participated in the organization of the Chinese Physiological Society, which was inaugurated in February of the same year; thus it was founded about 2 years prior to the inauguration of the American Institute of Nutrition. But it was not until December 1946 that nutritionists of the Chinese Physiological Society inaugurated the first Chinese Nutrition Society and subsequently published the *Chinese Journal of Nutrition*. Prior to that time, the *Chinese Journal of Physiology* published many articles on nutrition.

The years from 1938 to 1950 in the history of Chinese nutritional work might be termed the period of hard struggle, when in the first 7 years our country was invaded by the Japanese. Universities, colleges, and research institutes were moved to the interior and nutritional investigation was continued under very difficult conditions. In spite of the lack of adequate facilities such as laboratory space and equipment, nutritional work was carried on in temporary quarters. Prevalence of nutritional deficiency diseases due to the lack of proper foods prompted greater effort in nutritional studies. Two national nutrition conferences were called to discuss the basic nutritional problems of the country in 1941 and 1945, with the presentation of a number of nutritional research papers and the formal adoption of the first Chinese dietary nutrition requirements that were written by the Nutrition Committee of the Chinese Medical Association in 1938 (4).

After the surrender of the Japanese invaders in 1945, universities and research institutes were moved back to their original sites. Even though nutritional problems had become more acute because of the politically unsettled conditions and the difficult economic situation, urgently needed nutritional studies did not progress as they should have. The nutritional status of the

great mass of people remained deplorable.

Soon after the overthrow of the old regime and the establishment of the People's Republic of China, great attention was paid by the government to the nutritional problems of the people. The nutritional status of the people improved considerably. Nutritional deficiency diseases became rare in cities, though in some remote rural areas, owing to ignorance and improper intake of foods, some deficiency diseases such as pellagra, infantile beriberi, goiter and xerophthalmia were still present. Studies in basic and applied nutrition were encouraged and promoted by the new government, and much was accomplished. In April of 1954, the Chinese Nutrition Society merged with the Physiological, Biochemical, Pharmacological, and Biophysical Societies to form the Chinese Society of Physiological Sciences and held local monthly as well as national annual scientific meetings. In 1956 the reorganized *Chinese Journal of Nutrition* appeared as a quarterly. Theoretical, basic, and applied nutrition progressed rapidly until the cultural revolution was usurped by Lin Biao and the "Gang of Four," and nutritional work was much deprecated. Many nutritional workers were forced to suspend activities or to undertake other jobs. We actually lost over 10 years of otherwise very productive work. Nutritional Society activities, including the journal publication, were forced to suspend operations. After the downfall of the "Gang of Four," nutritional work was gradually revived, and research resumed. In October of 1978, the Chinese Society of Physiological Sciences held a one-week conference, in which papers on "recent advances in nutrition," on "diet and nutrition during the 'New Grand March,'" and on "nutritional education and research" were presented and discussed. Over 70 research papers were submitted to the nutritional section of the conference. In September of 1979 a national nutrition conference was held in Cheng Du in which important problems of nutrition, including dietary nutritional requirements and allowances, new dietary protein and lipid sources and nutrition for children and the aged were discussed. In

addition, there were over 180 research papers on subjects relating to basic nutrition, childhood nutrition, nutrition and diseases, new sources of foods, the effect of processing and preservation on food values, nutritional survey and food hygiene submitted to the conference. In October of 1979 a national conference on nutritional requirements and dietary allowances was convened in Tian Jin, and a tentative, revised list of nutritional allowances was formulated and discussed. The final form of the revised recommended dietary allowances was approved at the Third National Nutritional Scientific Conference held in May 1981, and topics of special interest were also discussed, research papers (over 300 were submitted) were presented, and the National Nutrition Society was formally inaugurated. Thus nutritional work has been reinvigorated, and it is hoped that before long nutrition activities will be expanded greatly to meet the actual need of the whole country.

Past Nutrition Studies. The first publication on nutrition investigation in China was "Dietary Studies in Shantung" by Adolph in 1913 (5). This was followed by a paper on the analysis of litchi by Read (6) in 1918 and a paper on a study of the different kinds of milk in Kwangtung in the same year (7). Papers on the nutritive values of soybean products and analyses of Chinese foods appeared in 1920 (8) and 1921 (9). During subsequent years, many more papers on diet and nutrition in China were published on varied subjects: (i) dietary studies in different parts of China, in urban and rural areas, among different groups of people (students, institution workers, factory workers, farmers, soldiers and laborers) were undertaken; (ii) analyses on protein, fat, carbohydrate, mineral, vitamin, water, and crude fiber content of foods in different parts of China were done. Considerable variation in composition of foods from different localities, especially vitamins and certain minerals, were found. Owing to the vastness of our country, great differences in climatic conditions, soil composition, use of fertilizers, selection of genetic strains, agricultural methods, etc., such

variations would be expected. Other topics of research were: (iii) digestion, utilization, and metabolism among different groups of inhabitants and in healthy and diseased individuals; (iv) protein and amino acids in nutrition; (v) vitamins in foods and nutrition; (vi) minerals in foods and nutrition; (vii) nutrition in vulnerable population groups, particularly children; (viii) nutritional value of vegetarian diets; (ix) dietary requirements and allowances for the Chinese; (x) nutritional deficiency diseases among Chinese under different circumstances such as peacetime, wartime, famine years, political and economic disturbances, particularly deficiencies in vitamins A, D, B₁, C, and nicotinic acid as well as protein and iodine deficiencies. Patients with deficiencies were found to be much more numerous during difficult times than during peaceful times. Introduction of iodized salt or other iodine-containing foods greatly reduced the incidence of goiter in endemic areas. In addition to the finding of iodine-deficiency goiter, goiterogenic substances were found in certain foods (10).

Aside from the above nutritional studies there were also organizations or units for the promotion of applied nutrition, nutritional propaganda, and education, with provision for free distribution of food at times of emergency and supplementary feeding of the poor to combat deficiency diseases (11, 12).

Following the establishment of the People's Republic of China in 1949, considerable work on basic nutritional research, applied nutrition, and dietary therapy was conducted at various institutions. The achievements or results of studies were summarized in several papers published in the 10th anniversary publication of the Ministry of Health (13) and various science journals such as the *Progress in Physiological Sciences* (14), the *Chinese Medical Journal*, and the *Journal of the Chinese Chemical Society*. In brief, advancement was attained in investigations on dietary and nutrition surveys, on dietary and nutrition requirements and allowances, that formed the basis for the first revision of Chinese di-

etary allowances; nutritional deficiency diseases, their treatment and prevention; dietary therapy and special diets for patients with various diseases; food composition analyses including amino acids, fatty acids, vitamins, and toxic substances; improvement of nutritional survey techniques; influence of cooking, storage, processing, and preservatives on the nutritive values of foods; effects of environment on nutrition, etc. It was found, for instance, that certain algae were suitable as a supplementary food (15), that low doses of gamma ray radiation for preservation of foods (grains) did not influence the nutritive values nor impart any toxicity to the irradiated foods (16), and that the nicotinic acid in corn was found to exist in bound form and could be liberated as the free form by the simple addition of sodium bicarbonate during cooking and thus become effective in preventing pellagra (17). Keshan disease, an endemic chronic myocardiopathy was found to be related mainly to a lack of sufficient selenium (18). The soil and foods of the endemic areas as well as the blood and hair of the inhabitants were found to be very low in selenium content, and oral intake of small amount of selenium salt greatly lowered the incidence of Keshan disease (19).

Current Nutritional Studies. Both basic (theoretical) and applied nutritional studies are being carried out at institutions throughout the country on such general topics as:

1. The relation between diet, nutrition, and diseases such as studies on foods lowering blood lipids and their relation to coronary heart diseases; on the use of amino acid mixtures or fish protein concentrate in patients with injuries and in malnutrition cases; further studies on the use of the hybrid corn from opaque-2 with a Chinese variety for the prevention and treatment of pellagra; on the cause of "hyperiodine goiter," etc.

2. Food fortification with stable vitamins, amino acids, calcium, and iron in health and disease.

3. Food hygiene, food contamination,

food toxicology, insecticide residues in relation to nutrition.

4. Further studies on food compositions in newer foods, especially with regard to amino acids, fatty acids, vitamins, and trace elements.

5. The interrelationship between nutrients in diets of different compositions in different ethnic groups throughout the country.

6. Nutritional requirements and dietary allowances of various age and sex groups among different ethnic groups.

7. Nutritive values of newer vegetable proteins and novel foods.

8. The relation of diet and nutrition to cancers.

9. Further studies on nutritional factors in Keshan disease.

10. Nutritional problems in relation to agriculture and animal husbandry.

In addition to the above topics, there are certain problems that deserve further consideration:

1. The art of Chinese cooking is well known throughout the world as being tasty, colorful, and artistic, but the influence of the mode of processing and cooking on nutritive values has not yet been well studied.

There are many old methods of preserving foods at times of abundance to meet the need at times of want. Preservation alters the taste and appearance of foods. So far changes in nutritive values during preservation have not been thoroughly investigated.

It will be very interesting and of practical importance to make a thorough study of the various methods of preparing and preserving foods in China with regard to any possible alteration in nutritive value.

2. The incidence of certain cancers is particularly high in certain parts of China. There is every indication that it is related to food habits, the prolonged intake of harmful ingredients in certain foods or the continual lack of certain protective nutritive substances in diets. Further studies may yield fruitful results.

3. Recent surveys indicate that goiter and cretinism are still present in certain

parts of China. This is due mainly to a lack of proper enforcement of the use of iodized salt in endemic areas; it had been the practice in certain districts to roast salt before use, thus causing loss of the added iodine.

It has been noted recently that in certain oil field areas, deep well water containing a very high level of iodine can also induce goiter. The cause of this needs further study. The possibility of the presence of other goiterogenic agents has yet to be ruled out.

4. The lack of selenium has been implicated in Keshan disease, but the presence of other factors, nutritional or otherwise, might play a part. Progress has been made in the elucidation of the multiple factors in its etiology but further clarification is still needed.

5. The last country-wide nutritional survey was made over 20 years ago. The results of that survey were not well assessed. The present nutritional status of the whole country is yet unknown. A country-wide survey in 1982 is planned, the goal of which will be to obtain a concrete idea of the actual nutritional status to be used as a basis for the planning of food production and distribution.

6. Owing to the differences in climatic conditions, soil qualities, fertilizers used, and methods of cultivation, the nutrient composition of foods of different localities varies considerably. Thus the present food composition tables cannot be used in different districts throughout the country. Many more food-analysis data are required, especially with regard to trace elements, amino acids, fatty acids, and vitamins.

7. There are differences in the dietary habits and ways of livelihood of different tribes of people in different localities of the country, and the dietary requirements likely vary. Many more studies are thus needed in order to establish a better understanding of the real nutritional need of every individual and the population as a whole.

8. The production of food in our country at present does not keep up with the growth of the population (birth control is already in

practice). It is necessary therefore to search for newer foods (especially protein-rich food sources), to conserve food (avoid waste), and to use the right combination of foods in order to obtain the highest degree of digestion and utilization so that no food is wasted. Obesity due to overeating and certain associated diseases are not uncommon now. Hence much more nutritional education is needed, both in the training of nutritional workers and in the dissemination of nutritional knowledge to the masses. There is also a need for closer cooperation between nutritional workers and food producers (agriculturists, food manufacturers, and animal husbandry workers).

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