NUTRITION SEMINAR

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AN eight-day seminar in Nutrition was organized by the Biochemistry Department of the Maharaja Sayajirao University from 15th to 22nd February, 1970 under the auspices of the University and the University Grants Commission. The scope of the seminar was comprehensive covering as it did various aspects ranging from brain biochemistry to solutions of the food problem and gave an opportunity for scientists concentrating on a particular field to acquire an overall perspective.

The seminar started with an excellent inaugural address by Dr. C. S. Patel, the Vice-Chancellor of the University, whose address neatly summarized the varied scope of nutrition as a science and emphasized the need for studying problems such as nutritional adaptation.

The first day started with Pirie's review of different potential protein sources of food for man and emphasized that leaves are unsurpassed in their ability to trap the energy of sunlight into carbohydrates, fats and proteins. Narendra Singh, the next speaker, reported that in his extensive investigations on 27 leafy plants the highest yields of protein, in kg./ha. were obtained from plants such as lucerns (800) and knolkhol (165) whereas pulses such as horsegram (20) and *Phaseolus trilobus* (44) gave the lowest yields. In 15 species the contents of essential amino-acids, expressed as g./16 g. N, were methionine, 1·4–2·1, lysine, 5·0–6·5, and threonine, 4·5–6·8. The nutritive values of these proteins were brought nearly up to those of milk protein by fortification with lysine and methionine. Similar though less detailed findings were obtained by R. N. Joshi on leaf proteins from some plants of Aurangabad.

Much detailed information on single-cell protein from petroleum hydrocarbons was provided in two separate reviews by M. S. Iyengar and V. R. Siste. Experimental results in Dartmund on green algæ, *Scenedesmus*, were described by W. Feldheim. A short paper by Mrs. Baruah gave a most interesting account of protein obtained from blue-green algæ, a traditional food in Lake Chad. The nutritional aspects of single-cell protein were discussed by H. D. Singh.

Other foods which are produced by conventional techniques but not widely used were reviewed by Kamala Sohonie and A. D. Phadnis. Radha Pant discussed the protein composition of wild legumes.

The morning of the second day was devoted to the important subject of nutrition and brain function. A very good review by R. J. C. Stewart on maternal diet and development of the offspring was presented as a tape recording with accompanying slides owing to Dr. Stewart's inability to come to India. Several members of the Baroda team headed by Dr. Rajalakshmi and Prof. Ramakrishnan spoke on the effects of different types of nutritional stress on selected enzymes of glutamic acid metabolism as well as certain behavioural parameters. Some of the aspects presented were neonatal food restriction, comparative effects of calorie and protein deficiencies, minimal level of dietary protein needed to prevent brain changes, the relative importance of maternal and post-weaning diets, effects of vitamin deficiencies, and protein quality of the diet, effects of glutamic acid supplementation, etc. (E. Jacob, P. S. Joshi, M. Parameshwaran, Suresh Sail, P. Subba Rao, K. V. Thrivikraman and C. M. Upadhyay). Some interesting findings that emerged from the tremendous mass of data presented were that protein deficiency affects brain glutamic dehydrogenase and decarboxylase and that this effect is found even in adult animals. In contrast calorie deficiency was without such effect except in the neonatal period. Vitamin A deficiency produced effects similar to those of protein. The protein content of the post-weaning diet seemed more crucial than that of the maternal diet. Glutamic acid was found to reverse the effects of a low protein diet. The addition of leafy vegetables and legumes to the poor Gujarati diet was found to increase brain enzymes to normal levels. Some papers were presented on the regional distribution of metabolites and enzymes in different regions

of the brain and their susceptibility to change with protein deficiency.* The session concluded with a comprehensive review on nutrition and brain function by Ramakrishnan.

The session aroused considerable interest among several participants and an additional panel discussion was arranged at their request over which Dr. Johnson presided. Prof. Udani Dr. Rajalakshmi, Dr. Kaul, Dr. Parikh, Dr. Shanmugasundaram and Prof. Ramakrishnan participated in this discussion. Prof. Udani also gave a talk later on the brain changes found in children who died of severe malnutrition which resembled the histological changes found in experimental animals by Platt and Stewart.

The afternoon session dealt with the fortification of foods. A review by P. R. Krishnaswamy dealt with amino-acid fortification of cereals. The fortification of processed foods with limiting amino-acids was discussed in a review by Parpia, Swaminathan and Daniel. The technology of fortification was presented by G. C. Jain from the Salt Research Institute. A short paper reported studies on rats in which salt fortified with calcium, iron, lysine or vitamin A had a beneficial effect on the relevant parameters, namely, bone calcium, blood hemoglobin, liver, iron, serum protein and liver vitamin A (A. K. Charles). Another short paper compared the nutritive value of modern bread with that of a standard 10% casein diet and 'debras' (rotis) made of cereal, 80 g., legume, 20 g. and greens, 20 g. Unexpectedly weight gain with modern bread (6–7 g. per week) was less than that obtained with the other 2 diets (10–11 g.) (P. Subba Rao).

The morning of the third day was devoted to energy metabolism. A comprehensive review by Banerjee gave valuable data on basal energy requirements in different groups of Indians and the energy cost of different types of activities. The basal energy requirements were reported to be 15–20% less per square meter of body surface than Aub Dubai norms. An interesting paper presented by Guharay compared oxygen utilization of Indian and Swedish coal miners for similar types of work and found the same to be similar when differences in body size were taken into account. Another paper presented raised the question of energy balance during lactation as food intakes were 400 calories less than estimated requirements in nursing mothers who were not losing body weight. A similar discrepancy was not found in groups of pregnant and control women (G. Subbulakshmi).

The afternoon session was held in Anand in collaboration with Sardar Patel University and dealt with food production targets and possibilities. A review by Wokes summarized FAO data on world food production and consumption in 1960–1975. He pointed out that instead of the proposed increase in intake of animal protein from 9–15 g. it would be better to plan on an increase from 9–12 g. as this economy would enable the production of an additional 15–30 g. of plant protein and wipe-out protein calorie malnutrition. Other papers presented discussed the possibility of attaining self-sufficiency in cereals and pulses (V. S. Vyas), of high yielding strains (A. K. Kaul) and the potential increase in milk production (B. M. Patel). A review by C. V. Ramakrishnan discussed the present gap between consumption and recommended intakes of different nutrients in different age groups and emphasized that increased cultivation of tubers, pulses, leafy vegetables, and other vegetables and fruits rich in carotene can correct all the deficiencies in the poor man's diet without involving much additional pressure on land or purse.

The morning of the fourth day was devoted to a discussion of protein. Experimental techniques for the assessment of protein quality was discussed by M. Narayana Rao. An interesting paper on amino-acid changes in the cereal grain with maturation because of the increase in certain protein fractions was presented by A. S. Naik. A review on serum protein and albumin and changes in the same and in the albumin, globulin ratio in different conditions was presented by G. Rajagopal. The effects of variations in dietary protein content and quality on lipid metabolism were discussed in a review by T. A. V. Subramanian. A most interesting paper on prolonged negative balances with regard to nitrogen in apparently healthy subjects in New Guinea was presented by H.A.B.P. Oomen. Fecal losses often matched or exceeded dietary intakes in these subjects. This could be explained by the presence of N_2 fixing bacteria found in the feces. The question whether the protein synthesized by these bacteria is of any value to

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* R. Rajalakshmi and C. V. Ramakrishnan, *Nutrition, Learning Performance and Brain Biochemistry.*

the host remains to be answered by further investigations. Comparative data on maize and jowar suggested that the niacin deficiency in both may be the result of an amino-acid deficiency as well as imbalance (D. Peramma). Comparative studies on school boys consuming wheat, rice, and maize in Banaras, Madras and Gujarat respectively showed practically no difference in the nutritional status as judged by height, weight, serum protein, albumin, vitamin A and vitamin C, blood Hb and the urinary excretion of creatinine, thiamine, riboflavine, vitamin C and nicotinic acid. No differences were found in performances on selected psychological tasks. The urinary excretion of thiamine tended to be somewhat lower in the Madras group whereas that of N'-methyl nicotinamide was somewhat lower in the Gujarat group (K. N. Chandrasekaran).

The fifth day started with a short but interesting session on nutrition and infection. Dr. De Sweemer gave a valuable review of the work of Scrimshaw and his colleagues and her own detailed findings in selected villages in Punjab. In these villages a combination of nutritional and medical care was found to achieve a substantial reduction in morbidity although either alone had also some effect.

An interesting paper by Ina Dhanda presented the effects of protein deficiency in monkeys on phagocytic activity of the reticuloendothelial system.

The next session on carbohydrates and fats began with an excellent review by B. C. Johnson on physiological and biochemical responses of carbohydrates or fats as sole energy source. Short papers were read on effects of variations in the content of sugar, groundnut oil and hydrogenated fat on rat growth, liver vitamins and serum cholesterol (A. M. Rao and K. N. Dileepan). All the three produced increases in serum cholesterol; greatest increases were found with sugar and the least with groundnut oil. The results suggest that both quality and quantity of fat determine the levels of serum cholesterol. A clinical syndrome characterised by diarrhea retarded growth and irritability in some children fed large quantities of milk (80 ounces) without sugar was described by Usha Parikh. Dramatic improvement was noted with reduction in the quantity of milk and the introduction of sugar.

The sixth day started with a very interesting paper on the nutritive value of different strains of rice and the effects of different doses of fertilizers on the same was presented by A. K. Kaul.

The subsequent sessions for the day were concerned mainly with vitamins A, C, and B_{12}. Comprehensive reviews on the function of vitamin A at molecular level (B. C. Johnson) and on vitamin A and carbohydrate metabolism (V. N. Singh) raised many interesting questions. Papers reporting animal and human studies suggested the excellent availability of carotene in leafy vegetables (Kamala Chari and Suresh Sail). A comprehensive review on vitamin C metabolism with special reference to nutritional factors was presented by G. C. Chatterjee. The next paper gave convincing evidence of a negative balance with regard to vitamin C in lactating women (G. Subbulakshmi) in spite of which normal blood levels of the vitamins were maintained. A short paper described the mutual effects of thiamine and riboflavine supplementation on the urinary and liver concentrations of the vitamins in rats (G. A. Tamam). A review on vitamin B_{12} in nutrition with special reference to neurological aspects and cyanide metabolism was presented by Wokes. The next paper on the effects of B_{12} supplementation on blood hemoglobin and psychological performance in poor man suggested that it is not a limiting nutrient in diets consumed by the poor (Suresh Sail). The effects of vitamin B_{12} deficiency and excessive intakes of valine and methionine on RNA metabolism in micro-organisms were discussed by B. C. Johnson.

The next session of the day was devoted to processing procedures such as fermentation, sprouting, roasting and parching. The role of different bacteria in the production of traditional foods such as bread-wine, fermented milk, cheese and soya-bean products (*e.g.*, miso, natto and tempeh), the preparation of fermented products from rice, African locust, maize, cabbage taro, peanuts, blackgram and other Indian pulses was described in a scholarly review (J. V. Bhat). Papers were presented on the effects of sprouting and fermentation on nutritive values, including vitamins B_1, B_2, niacin and C (K. K. Sakariah) and studies on micro-organisms involved in dhokla fermentation (S. R. Nadkarni). The development of several processed foods for infants and young children was described by M. R. Chandrasekhara.

The morning session concluded with a paper on the chemical composition and biochemical

make up of the placenta in poor and upper class women (L. J. Parekh) and an important review on gestation and lactation performance of poor Indian women by R. Rajalakshmi.

The afternoon session dealt with toxic factors in foods. There were important reviews on trypsin inhibitors and hæmagglutanins (K. Sohonie), mycotoxins (E. R. B. Shanmugasundaram), neurotoxins (R. Shanmugasundaram), aflatoxins (L. Vishwanathan), pesticide residues in foods (Mazumdar) and food adulterants (O. S. Chadha) all providing much useful information. These were supplemented by papers on hæmagglutanins in Indian legumes (L. D. Mange), trypsin inhibitors from eggs (O. M. Simlot) and steps to limit pesticides in foods (S. V. Pingale).

The morning session of the seventh day started with a valuable review on problems concerning calcium requirements by R. Rajalakshmi. This was followed by papers on the effect of dietary protein content and quality on bone calcium (C. M. Upadhyaya) and calcium incorporation in acid foods (S. Vijayaraghavan).

The second session in the morning dealt with anemia. An interesting review on hyperlipoprotenemia was presented by H. G. Morgan. This was followed by papers on the etiology of nutritional anemia in pregnancy by R. V. Bhatt and the etiology and incidence of nutritional anemia by Meera Mathur. The former said that maternal mortality was associated with very low levels of blood hemoglobin. The data presented by the latter confirmed the general impression that iron deficiency was the major etiological factor in the widespread incidence of anemia in this country.

The afternoon session was devoted to nutrition education and applied nutrition programmes. Comprehensive reviews dealt with a blue-print for a mass communication programme (S. Ghose), the sociopsychological and nutritional dimensions of nutrition education (D. Deulkar), the food and nutrition problems of India *vis-a-vis* the applied nutrition programme (Ram Das) and the role of AFPRO in alleviating malnutrition (A. P. Perquin). R. P. Parlato gave a talk on the scope and objectives of the CARE programme, which, he said, included nutrition. There was also a short paper on nutrition education by M. B. Buch.

The final session on the eighth day was held in Ahmedabad ATIRA auditorium under the joint auspices of Community Sanskar Kendra and dealt with the nutrition and growth of children. Ramakrishnan gave a review on the formulation and evaluation of low cost meals for pre-school children in which he described dietary formulations based on cheaply available foods for young children which were tested by field trials for two consecutive periods of 7 months each. The next paper on longitudinal studies on children from birth to 5 years (G. Subbulakshmi) described studies on children in the low income group who were investigated every three months. They showed considerable growth retardation after the first 6 months but no psychological retardation was found. In contrast, children suffering from kwashiorkor were found to show gross impairment in psychological performance. The difficulties in getting reliable measurements on height and the greater reliability and sensitivity of weight as an index of growth in young children were described by C. De Sweemer in her paper on methodology of growth surveilliance in children under 5 years. A. S. Chikrumani read a paper on pediatrician and the problem of childhood under nutrition.

The seminar was a very stimulating and enjoyable one with plenty of scope for lively discussion. Contemporary problems such as fortification with lysine and other nutrients the use of processed foods and hybrid strains were subjects of lively debate.†

† Some selected reviews and papers presented at the seminar are to be published by the Department of Biochemistry as "Perspectives in Nutrition". Interested individuals and institutions should contact Prof. C. V. Ramakrishnan, Head of the Biochemistry Department, M.S. University, Baroda, India.