Special Communication

PROTEIN REQUIREMENTS WITH SPECIAL REFERENCE TO PAKISTAN

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Protein are nitrogen containing compound and are important constituents of all living matter. Nearly half the dry matter of an adult man is composed of proteins and next to water it is the most abundant material in the human body. Optimal growth and development are dependent upon the food proteins we eat. The supply of adequate amount of protein consequently is of great importance from the view-point of good health and well-being.

Protein Requirements

How much of protein is actually required for proper functioning of human body is still a moot point. About a century ago, Karl Voit was the first to set up standard for protein requirement. He recommended 118 g proteins per day for a moderately active man. His views were challanged by several investigators, particularly Chittenden, who studied the physique of very active persons such as soldiers and athletes who consumed no more than 50-55g protein and were in perfect health. In 1935, the Technical Commission of the Health Committee of the League of Nations advocated a level of one g of protein per kg of body weight, and that this protein should come from a variety of sources of which one-third should be from animal sources. Same allowances were recommended by the U.S. Food and Nutrition Board in 1945. Researches of Osborne and Mendeal, Rose, Block and Mitchell showed the existence of differences in protein quality which were found to be due to difference in amino acid makeup of protein particularly the eight essential amino acids that it contains.

As a result of these studies of protein quality coupled with existence of protein deficiency diseases in young children in many parts of the world, Food and Agriculture Organisation of the United Nations (FAO) convened a "committee on protein requirement" which was the first pioneer effort at international level to consider protein needs. The Committee published its report in 1957 and recommended protein allowances for various age groups in terms of "reference protein" i.e. 100% utilizable protein such as whole egg protein. In 1963 an FAO/WHO Joint Expert Group on Protein Requirements was convened to revise the 1957 report in the light of newer knowledge. The Committee pro-

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posed slightly higher allowances for adults but those of infants and children did not differ appreciably from the previous report. They also modified the amino acid pattern of ideal protein.

A number of dietary surveys that were conducted during sixties and early seventies pointed out that, although the quantity of protein consumed as judged by the FAO was adequate but people particularly young children continued to suffer from protein malnutrition. Nutritionists brought forward evidence to show that efficiency with which protein is utilized in human body not only depended upon the quality and quantity of protein but also upon other dietary constituents, calorie (energy) content of the diet and physiological state of the individual. It was soon realised that periodic food shortages and those brought about by ravages of nature, such as cyclone and floods, seriously limited the food intake of the under-privileged, and so part of the protein already available in the diet was burnt just to provide energy, which is the primary need of the body, and precipitated protein-calorie malnutrition (PCM) also called Energy Protein Malnutrition. Having thus realised the interaction of nutrients and particularly the role of energy content of the diet on the utilization of protein, FAO/WHO convened an ad hoc Expert Committee on "Energy and Protein Requirements" in 1971. This report was published in 1973 and put forward a new set of caloric and protein requirements in the light of advanced knowledge for different population groups. Their findings were so weighty that the name of "Protein Advisory Group of the United Nations" was changed to "Protein-Calorie Advisory Group of the United Nations". So, within a span of 15 years protein and amino acid requirements have been revised thrice. For the benefit of readers the protein requirements for different ages as recommended in FAO/WHO reports in 1957, 1965 and 1973 are given in table II. In the last column protein requirements for protein of net utilization value (N.P.U.) of 60% has been shown. This is based on the work carried out in PCSIR Laboratories Peshawar after bioassays of meals

eaten in Pakistan which gave N.P.U. values ranging from 50-70% with an average value of 60%. It simply means that our dietary proteins are utilized with an efficiency of 60%, the rest is converted into energy. U.K. diets have N.P.U. of around 80 because of higher content of animal proteins and less drastic cooking.

Table 1: Protein Allowances for Different Age Groups ilat.

Subjects	*Age years*	*Reference Protein ilat. g/day* FAO 1957	FAO 1956	FAO 1973	N.P.U.-60 *Protein*
(1)	(2)	(3)	(3)	(5)	(6)
Infant	0—1	2—1.3 g/kg	2.3—1.2 g/kg	2.4—1.44 g/kg	—
Toddler	1—2	24	12.7 (1—3 yrs)	16 (1—3 yrs)	27
Child	4—9	29	24.8 (7—9 yrs)	25 (7—9 yrs)	41
Adolescent (Male)	—	61	48.5	38	63
Adult	—	34	46.1	37	62
Lactating mother	—	76	54	46	76

*Calculated from the figures given in column 5. May be over-estimates as explained in the text.

It will be observed from table I that protein requirements for adolescents, adults and lactating mothers have been progressively reduced except for adults in 1965 report. Another important point stressed in 1973 report is that for human adults, a mixed diet based on vegetable protein i.e. cereals, pulses and vegetables has similar protein value to one based on animal protein. In other words, quality of protein does not matter much in the case of adults and therefore previous allowances of protein needs for adults were over-estimated (some experts do not agree with this view). Thus about 40 grams of proteins are just sufficient to cover the protein needs of human adults. These are 50% less than what were considered necessary a couple of years ago. A simple calculation will show that if 80% of the calories are obtained from wheat alone in a mixed diet (this is the dietary pattern in our rural areas) the protein needs of adults are fully satisfied.

Are We Deficient in Protein?

It is clear from the above paragraphs that if sufficient food is available protein requirements of adults can be fully taken care of. But what about growing children, expectant and nursing mothers whose protein requirements as well as calorie requirements are higher than those of adults? Unfortunately no surveys showing food consumption of individual family members have been conducted so far. However, it will be useful to determine the average protein requirement for Pakistan, and then compare it with that obtained from food consumption surveys. In 1974, Planning Commission held a workshop on 'Nutritional Problems of Pakistan' and convened several expert group meetings in which some foreign experts also participated. The Expert Working Group on Data Requirements calculated the average protein requirement for Pakistan taking into account individual requirements of different age groups, sexes and their body weights. This is presented in Table II.

It will be observed from table II that per capita requirement of reference protein for Pakistan is 27.7 grams. As stated earlier the N.P.U. of average Pakistani diet is 60%. Hence protein requirement comes to 27.7x100/60=46.1g. Nutrition survey carried uot by the Ministry of Health (1970) showed that even the poorest household was consuming protein over 46 grams per day. Hence, it can be safely stated that on the average protein supplies meet the present demand and there is no protein gap as was concluded in the report of National Science Council Protein Committee in 1968.

Causes of Protein Deficiency Diseases

As stated above dietary survey in Pakistan has not indicated any shortage of protein, yet there are cases of protein deficiency as evidenced by :(1) high infant mortality, particularly in the age groups 1-4 years, which is considered a good index of protein malnutrition, (2) general low heights and weights of Pakistani children and (3) wide prevalence of nutritional marasmus in 3-12 months old infants. In the following paragraphs some of the reasons for high incidence of protein deficiency diseases in our country are explained.

Caloric Deficiency

One of the main reasons of protein deficiency

is caloric restriction as a result of low food intake. Food consumption surveys have shown that on an average caloric intake in urban areas of Pakistan is 86% of the recommended intake. This may seem very low but when maldistribution of food in our country i.e., the rich can take as much as they like sometimes more than 25% of their actual requirements is taken into account, it is quite conceivable that some sections of the population may be subsisting on marginal diets and these are the groups who despite having adequate protein may be wasting their food protein just to provide energy to the body. From an analysis of data of Pakistan Nutrition Survey it has been found that there are only 13% families whose diet are deficient in protein but when caloric restriction is taken into consideration the number of families suffering from protein deficiency increases to 38%. This is what is termed energy conditioned protein-deficiency.

There is also maldistribution of food at the family level, the adult earning member eating too many calories and protein (in sedantry workers this may be actually harmful) and the rest of family members eating the left-over. Sons are more favoured than daughters. No wonder in poor and middle class families with limited budget, females are the first victims of malnutrition.

Other groups whose diets may be severely restricted are infants and pre-school children. In a survey of Gowalmandi area conducted by the Department of Child Health, Mayo Hospital, Lahore noted that 50% of the infants were getting inadequate food (milk and supplementary food) at one month, 74% at 6 months and 87% at one year. It means that majority of our weaned infants do not get enough food. No wonder, in the same survey, 84% of the children population had sub-optimal growth. If mothers are educated about the nutritional requirements of their babies and government realises the need for providing supplementary foods to the needy children, high incidence of PCM in the country can be averted.

Table II: Per Caput Requirement of Safe Level of Protein Intake for Pakistan

Age Years	*Population in* 000	*Average Body Weight* (*kg*)	*Requirement/ Kg Body Weight/day* (*g*)	*Requirement per Caput per day* (*g*)	*Total Requirements* (*g*)
1	2	3	4	5	6
0—1	2250	11.43	—	—	—
2—3	9886	13—61	1.19	15.9	157187
4—6	5034	20.68	1.01	20.4	102694
7—9	5035	26.70	0.88	24.7	124365
Males					
10—12	2336	36.7	0.81	29.9	69876
13—15	2337	38.5	0.72	27.7	64735
16—19	3888	49.0	0.60	29.4	111307
Females					
10—12	2107	38.0	0.76	28.9	60892
13—15	2108	38.0	0.63	23.9	50381
16—19	3566	45.0	0.35	15.8	56343
Adult Men	16079	57.0	0.57	32.5	522568
Adult Women	15180	50.0	0.52	26.0	394680
Allowance for pregnancy	—	—	—	5.5	13640
Allowance for lactation	7620	—	—	17.0	129540
Total population	Per Caput Requirement of Reference Protein $\frac{1861208}{67200}$ = 27.7 g				

Protein (N.P.U. 60) = $27.7 \times \frac{100}{60}$ = 46.2 g

Infection

Infection induces some degree of depletion of body stores of protein and increased nitrogen losses as a result of increased urinary excretion which in turn is due to greater adreno-cortical activity. There is evidence from animal experiments that during infection protein is utilized inefficiently. For example, the biological value of a protein when tested in malarious rats was 25% less than when tested in healthy ones. During episodes of diarrhoea, food is passed undigested and thus both ingested calories and proteins are lost. This plays havoc with child suffering from malnutrition and he is caught in a vicous circle of infection. Unfortunately the first step taken by the mother is over-dilution of milk or feeding of thin starchy gruels which are both short of calories and protein and the practice continues long after the attack is over. This leads to protein deficiency and the typical form which is commonly seen in Pakistan, is nutritional marasmus. This disease is characterised by severe wasting of muscles, the weight is often less than 60% of the normal weight of the child for his age.

Thus cleanliness and good-housekeeping for maintenance of hygienic conditions in the house are as well important besides having good nutrition. Vaccination against small pox, cholera and typhoid etc., should be carried out regularly to avoid infectious diseases which result in wastage of calories and protein.

Food Taboos

Faulty dietary habits and food taboos are often the cause of prevalence of PCM. For example, eggs are considered heavy for babies. During pregnancy and after its termination there is voluntary restriction of food. In some families the grandmother insists on giving nothing but breast milk upto the age of two years. The examples can be multiplied. There is a need for nutrition education at all levels to apprise our people about the role of good nutrition in health and disease.

III-balanced Diets

In a diet calories and protein are not enough but other nutrients i.e., vitamins and minerals, in adequate amount must also be supplied. These are obtained from a balanced diet composed of cereals, fats, vegetables, meat etc. There are evidences that in the absence of accessory food factors protein is less efficiently utilized. It is commonly seen that children in a hurry to reach school in time often take very little breakfast. Most of them cannot buy food and what is available is not nutritious. Under-nutrition, besides affecting health and development of the child also reduces its learning ability.

Revised Approach to Protein Problem

It will be clear from the above paragraphs that as far as adults and grown-up children are concerned, they have ample protein supply provided they take adequate amount of balanced food in keeping with their bodily activities. However, infants, expectant and nursing mothers need special attention as they may not get enough food of the right kind to provide enough calories and protein due to wrong beliefs and feeding practices. Invalids and convalescents and the elderly are other vulnerable groups who due to loss of appetite or loss of teeth cannot take adequate amount of food. Of particular concern are infants and pre-school children who because of poverty, malnutrition and prevalence of infection suffer from varying degrees of PCM. These are the groups who need foods, containing concentrated source of calories and protein.

In view of 1973 report it does not seem to be necessary to fortify 'atta' with amino acids or protein concentrates (enrichment with iron and certain vitamins would be worth while) derived from unconventional sources which was considered desirable a couple of years ago. These can be better utilized for raising milk and meat in which we are extremely deficient. What is needed is a varied diet containing cereals, pulses, oils and fats, vegetables (especially leafy greens) and some animal protein to provide essential nutrients such as vitamin B_{12}. A well planned nutrition education programme will be necessary to inculcate the advantages of a balanced diet. If enough of balanced diet is eaten, it can be reasonably assured that all the dietary essentials will be supplied. This does not apply to therapeutic diets, e.g., in the case of diabetics consumption of starch has to be curtailed and more protein-rich food supplied instead. The same applies to overweight individuals who need all the nutrients but restricted supply of calories. Weaned infants are another group who need foods concentrated in energy and protein. The capacity of an infant stomach is limited (200 ml) and therefore bulky food must not be given to the child. Breast milk alone cannot meet the energy and protein requirements of infants after about six months of age, hence they need supplementary/weaning foods for optimal growth and development. PCSIR is paying special attention to the nutritional problems of weaned infants and a number of low-cost nutritious processed weaning foods have been developed to cater to their needs. One of them Protofex, is already being produced on pilot scale for limited distribution. It is gratifying to note that the Government of Pakistan is also taking keen interest in these developments and efforts are a foot to manufacture one or more infant foods within the country.