NUTRITION

Diet in Health & Disease

By

S. B. Lal, M.B.B.S., D.P.H., (EDIN.)

Asstt. Director of Public Health (Nutrition),

Public Health Laboratories, Patna-4.

The Nature of Foods

We have considered the requirements of food and the various nutrients for an average adult Indian. In this section it is proposed to survey the foods eaten, their characteristics and their value in our daily diet. For this purpose foods are classified as follows :—

Group I. Oils and fats such as butter, ghee, hydrogenated vegetable fats or vanaspati ghee, sugars, cereals, pulses and nuts. These are mainly foods which supply energy and calories though they also contain a certain amount of vitamins and salts, as well as protein.

Group II. Animal foods such as milk, milk products, meat, fish, eggs etc., supply the body with body-building materials and here again vitamins and salts are available.

Group III. Fruit and vegetables. Vitamins and salts are obtained from fruit and vegetables and small varying amounts of sugar and starch.

Group IV. Beverages and condiments. The only function of these is to act as appetizers.

Group I.

Cereals. Nearly two-thirds of the total population of the world use cereals as their staple diet of which rice, wheat and maize are the three prominent ones. Rice is quantitatively the most important of the three being the staple diet of nearly half the human race particularly in the greater part of India, China, South-East Asia where it constitutes the daily diet. Nearly 75 per cent of the total world production of rice is in China and India; in India it is the predominant crop in the Eastern parts of India from Cape Comorin through the coast of Bay of Bengal to North-East Assam. In view of its wide utilisation let us consider it from all aspects of nutrition stressing the fact that consumption of a diet largely composed of milled rice leads to the nutritional disease : beri-beri. In common with other cereals, rice is not a complete food, even in the whole unmilled state ; in other words, it does not contain a sufficiency of the nutrients needed for health. Its value is considerably lowered by the losses that take place between harvesting and consumption and the degree of this loss depends on whether the rice is raw or parboiled, homepounded or milled, and, if milled, to what degree *i.e.*, under-milled or polished.

The grain consists of three parts : (*a*) the small germ or embryo, (*b*) the outer layers of the grain which include the pericarp under which is the aleurone layer, (*c*) the starchy endosperm. Some of the vital nutrients are contained in the germ, pericarp and aleurone layers which are separated off during milling, the extent of which depends on the degree to which they are subjected in the process of milling. The losses are greater in machine milling. The nutrient content of rice together with the corresponding figures for wheat and maize are shown in this table. The nutritive value of each should be noted.

Showing nutrients in percentages :

Nutrients	Rice		Wheat		Maize
	Husked	Milled	Whole	White flour	
Protein	8·9	7·6	11·1	9·3	10·0
Fat	2·0	0·3	1·7	1·0	4·3
Carbo-hydrate	77·2	79 4	75·5	77·2	73 4
Calcium	0·084	0·009	0 50	0·020	0·015
Phospho-rus	0·209	0 096	0·400	0·092	0·430
Iron	0 0020	0 0009	0·004	0·00084	0·003
Thiamine	3-5	0·6-1·0	3·3-7·7	0·87	4-4
Calories	356·0	351·0	362·0	355 0	372 0

The total protein content of rice is lower than that of wheat but is of high nutritive value and chemically compares favourably with wheat protein. A biological value of 80-86 for rice protein, 72 for maize and 67 for wheat has been reported.

The vitamin E content of whole rice is considerable while the A and D content is negligible. It compares favourably with wheat so far as its thiamine content is concerned.

The process of called parboiling is peculiar to preparing rice. for human consumption whereby the paddy is subjected to steaming or boiling after being soaked in cold water. This process splits the woody husk and renders its easy removal. The striking changes in the nutritive value of rice resulting from parboiling may be noted in this chart.

Nutritive value of rice.

gram per cent

	Protein	Fat	Calcium	Phos-phorus	Calories per 100g
Raw Home-pounded	8·5	0 6	0 01	0·17	350
Raw milled	6·9	0·4	0·01	0·11	350
Parboiled homepounded	8 5	0·6	0·01	0·28	350
Parboiled milled	6·4	0 4	0 01	0·15	350

It will be observed that there is no change in the protein content of rice by parboiling but during milling there is an average loss of about 15%. This loss though small is of considerable practical importance for those whose diet consists largely of rice only.

The phosphorus content of rice depends on the degree of milling, and as the latter increases so the former falls. In very highly milled samples of rice, only 12 to 30% of the phosphorus constant remains. Phosphorus is also removed by washing and cooking, moreover, about 50% of the total content is unavailable to the human system.

The calcium is low and a person consuming 600 gms. of rice a day would obtain only 0·03 to 0·06 gms. of calcium. Insufficiency of calcium is one of the most important defects in diet of persons subsisting wholly on rice.

The iron content of 1 to 3 milligrams of iron per 100 grams varies with the variety of rice, method of cultivation, nature of soil and lastly the nature of vessel in which it is cooked. Though rice-eaters suffer from anaemia, it has been shown that persons suffering from malaria and hookworm, but who eat parboiled rice, show less anaemia than those eating raw rice ; this is probably due to the fact that parboiled rice contains more iron.

Effect of cooking. In the usual method of cooking, the degree of heat produced has little or no effect on the nutrient present in rice. Some of the nutrients are readily soluble in water and loss occurs during the process of washing before cooking when the cooked rice water is thrown away. The extent of such losses depends on the amount of water used and the number of times it is washed. Methods of preparation, washing and cooking vary from place to place and from house to house so that it is not easy to arrive at an accurate estimate of the loss. Losses from washing and cooking are approximately : calories 15%, protein 10%, iron 75%, calcium and phosphorus 50%. Similar losses occur in the vitamin content as shown here. It may be emphasised here that maximum percentage of losses occur in the first washing of the rice.

	Uncooked rice	*Washed & cooked rice*	*Percentage of thiamine in*		
			Cooked rice	*Cooking water*	*Washings*
Raw home-pounded	2·3	0·7	33	33	33
Raw milled.	0·9	0·1	15	30	55
Parboiled homepounded	2·5	1·6	60	30	10
Parboiled milled	2·1	1·0	45	15	40

On the average about 35% of the thiamine originally present in rice, is retained in the cooked rice. This loss is less with parboiled homepounded rice than with any other type. It is recommended that rice be steeped in a little water rather than washed; then cooked in only sufficient water to cook it.

Digestibility. There is not much difference in the digestibility of the different types and varieties of rice but, to an individual accustomed to a particular type, any change is liable to upset him for the time being. The human stomach takes a long time to accustom itself to a change in daily dietary and if such a change is desired, it has to be brought about slowly and carefully.

Vitamin content. Indians as a rule are a cereal-eating people and meat, fish and eggs form part of the daily dietary of only small percentage of people; consequently the main supply of vitamin B_1 or thiamine comes from cereals. Husked or unmilled rice contains about 3·0 micrograms/gram of thiamine and is lower than whole wheat. Pounding of rice, whatever be the method, removes some thiamine. In general, parboiled homepounded rice contains more thiamine than any other type of rice. With the raw rice, about two-thirds of the thiamine originally present is removed on milling while in parboiled rice the loss is only one-third. This loss in milling depends on the degree of milling. If it is milled and polished thrice, less than 20% of thiamine remain. During the process of parboiling some of the vitamin contained in the germ and pericarp diffuses through the grains into the starchy endosperm and thus cannot be removed even though milling be of a high degree.

Having emphasised the importance of rice as a national food, methods adopted to improve its nutritive value should be kept in mind. Nutrition workers advocate the use of home-pounded or undermilled rice rather than highly milled rice but, in spite of this, the number of rice mills are increasing in every State. The Conference of Far Eastern Countries on Rural Hygiene at Bandoen, Java, in 1937, suggested the desirability of checking the spread of mechanical rice mills in rural areas and "conserving the healthy habit of consuming homepounded rice". This is not only nutritionally but economically sound since it gives employment to the rural population. The next possibility is to use under-milled rice for which there must be regulations to enforce the degree of milling, to which rice is subjected. By under-milling, the yield is increased by about 8-10 lbs. for 150 lbs. of paddy.

To improve the nutritive value of polished rice it is enriched with thiamine and other vitamins. One such brand of rice is sold under the name "Permix" rice. Consider this aspect of the situation a little more seriously. Should people eat parboiled home-pounded or under-milled rice, or the raw polished rice enriched with the vitamins? Naturally preference should be given to foods as little denatured as possible and this should be the ideal for this country.

The human body is like an engine; it needs fuel to make it run and food is the human body's fuel. The right food in quality and quantity.