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NUTRITIONAL QUALITY OF SOME POPULAR RICE VARIETIES

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IN the last twenty years, rice production in India has increased from 21 million tonnes in 1951 to 39 million tonnes in 1965. The projected figure for 1971–72 is between 48–50 million tonnes. Only 17% of increase in the production has been attributed to an increase in area and the rest has been assigned to the increased production through better agronomic practices and the use of superior high-yielding photoinsensitive varieties.[1]

Until very recently, Indian yields of rice per acre were among the lowest in the world. The first and foremost drawback was the plant-type itself. The subspecies *indica*, the traditional type of rice grown in Indian conditions, is characterised by tall growth habit, profuse number of narrow light-green drooping leaves, delayed flowering and late maturity. Though ideally suited to cloudy and rainy season, it succumbs to the modern high fertility farming. Additional fertilizer results in rapid vegetative growth and profuse leafing. These additional leaves mutually shade the plants and lead to the decreased photosynthetic efficiency in accumulating the carbohydrates. The plant-type bottle-neck to higher yields has been broken through algeny[2] and now we have a rice plant that is photoinsensitive, erect, short, has high capacity of tillering, matures early and possesses wide, dark and green leaves that remain photosynthetically active right upto the grain-filling stage. Twin characters of non-lodging and reduced mutual shading of the leaves have enabled it to stand very heavy doses of fertilizers to produce very high yields. It is in the background of this plant-type that the nutritional aspects of the present and future rice varieties should be discussed. The composition of rice differs with plant-type, variety, soil conditions, manuring, location, soil moisture and weather conditions prevalent at the time of grain filling. A systematic investigation on these factors has just begun.[3] Quantitative as well as qualitative characters are being considered in this context. From the studies, so far conducted, it could be concluded that among the above-mentioned factors, the genotype of the strains is most important.[4]

In the present study, an attempt was made to compare six popular rice varieties for their protein, carbohydrate and amino-acid composition. The length/breadth ratio and swelling number was also obtained to assess the cooking quality of these varieties. The data are presented in Tables I and II. In Table II, the reference aminogram for rice has been taken from Eggum (1968) for comparison.[5] It is clear from the figures presented that with reference to protein content, there is significant difference between two distinct sets of varieties. Varieties Basmati-370, Sabarmati and Hamsa are having roughly 2% higher protein than Padma, Jaya and IR-8. These differences have been clearly discriminated by D.B.C., as well as microkjeldahl estimation. The starch properties as reflected by the amylose content are not widely different. However, if cooking quality is judged on the basis of swelling number and L/B ratio, it is evident that Sabarmati and Hamsa are similar to Basmati-370, therefore highly acceptable.[6] Varieties Padma, Jaya and IR-8 seem to be inferior on the basis of these two criteria.

TABLE I

Quality characters of some important rice varieties

(On 10% moisture basis)

S. No.	Variety	1000 Kernal weight	Protein %		D.B.C. value (Abs.)	Amylose %	Swelling number*	Length/Breadth	
			Kjd.	D.B.C. basis				Before cooking	After cooking
1	Basmati-370 ..	16·2	10·5	10·2	0·22	24·0	375	4·0	5·3
2	Sabarmati ..	14·2	10·8	10·2	0·22	23·5	329	3·0	3·3
3	Hamsa ..	18·2	10·7	10·2	0·22	27·0	328	3·5	3·4
4	Padma ..	16·1	8·6	8·7	0·19	26·5	315	2·7	2·7
5	Jaya ..	22·0	8·0	8·1	0·19	27·0	299	2·1	2·3
6	IR-8 ..	19·5	8·0	8·1	0·18	25·7	293	2·2	2·4
	Mean ..	17·7	9·43	9·25	·206	25·6	323·2	2·92	3·21
	Standard deviation ..	2·8	1·32	1·06	0·02	1·52	29·2	0·74	1·10

* Weight of water in grains imbibed by 100 gm. of rice cooked at 98° C.

TABLE II

Amino-acid composition of six rice varieties

(gm. amino-acid/16 gm. N., calculated to 100% recovery)

Amino-acid	Basmati-370	Sabarmati	Hamsa	Padma	Jaya	IR-8	Eggum (1968)
Aspartic acid ..	7·84	9·74	9·18	10·38	10·83	8·13	8·23
Threonine ..	3·82	4·16	3·71	4·41	4·36	4·05	3·25
Serine ..	6·40	8·01	7·90	6·41	6·61	7·08	4·40
Glutamic acid ..	25·54	20·48	23·09	22·24	20·50	22·06	17·18
Glycine ..	5·10	8·46	7·33	6·78	6·86	6·24	3·88
Alanine ..	5·07	8·87	8·11	6·95	7·06	6·04	5·11
Valine ..	6·34	8·09	4·82	6·99	6·28	6·14	5·43
Cystine ..	2·04	2·57	2·19	2·83	2·61	2·04	1·30
Methionine ..	1·33	2·95	1·96	2·32	2·48	2·40	2·07
Isoleucine ..	4·72	5·02	4·28	5·02	5·49	4·48	4·46
Leucine ..	9·93	7·26	9·10	8·36	8·90	7·40	7·95
Tyrosine ..	4·19	4·64	4·69	3·76	3·98	2·82	5·09
Phenylalanine ..	3·65	6·94	5·11	5·73	4·04	5·02	5·22
Lysine ..	3·89	4·00	3·72	4·30	4·21	3·01	3·49
Histidine ..	2·69	2·02	2·20	2·02	2·87	2·09	2·24
Arginine ..	7·68	5·77	6·53	8·18	8·11	6·82	7·81
Tryptophan ..	0·99	1·07	1·12	1·05	0·82	0·92	0·60
Actual recovery % ..	97·0	101·0	96·4	90·5	92·9	89·0	..
E.A.A.I. % ..	77	85	76	85	84	75	..

Table II gives the amino-acid content of all the rice varieties. When the essential amino-acids were used to estimate the Essential Amino-Acid Index (E.A.A.I.),[7] it was found that Sabarmati, Padma and Jaya are significantly superior to Hamsa, Basmati-370 and IR-8. The variety IR-8 stands lowest on the basis of this score. Since E.A.A.I. has been found to have a high positive correlation with the protein efficiency ratio (P.E.R.)[8] it could be concluded that varieties Sabarmati, Padma and Jaya have comparatively high biological value than varieties Basmati-370, Hamsa and IR-8. Tables I and II are self-explanatory.

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