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AMINO ACID COMPOSITION AND NUTRITIVE VALUE OF RICE VARIETIES BASMATI-370 AND IR-6 GROWN IN PESHAWAR REGION

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Abstract. Rice varieties, Basmati-370 and IR-6, grown in the North West Frontier Province were analysed for their amino acid composition by one dimensional buffered filter paper chromatography. Polishing caused significant losses of isoleucine, phenylalanine and highly significant losses of methionine in IR-6 variety, while there was no significant loss of any amino acid in Basmati-370, but the net amount of all the essential amino acids, except lysine were significant in IR-6 than Basmati-370. Polished and unpolished forms of IR-6 contained higher ratio of NPU, apparent and true digestibilities and biological values than Basmati-370.

Rice (*Oryza sativa* L.) is a principal source of calories and of protein among the people living in Asia. The average annual production of rice in Pakistan is about 2.288 million tons. Rice is the next important grain crop after wheat and corn in the N.W.F.P. The total reported production in this province is 0.065 million tons on 0.129 million acres. Protein content of rice is lower than most varieties of wheat and corn, but rice protein is of good quality. Sure and Frances,[8] reported that the NPU values of rice, wheat, rye and corn were 75.1, 60.0, 63.1 and 32 0 in milled forms, respectively.

Cagampang *et al.*[3] analysed milled rice for their amino acid contents and reported that mean lysine content dropped from 4.33 to 3.66 as the total protein of the sample increased from 7.33 to 11.90%. Workers of IRRI[5] analysed rice and reported that protein was negatively correlated with lysine and tryptophan. Juliano *et al.*[6] compared the amino acid composition of polished and brown forms of indica and japonica rice varieties and revealed significant correlations between the varieties and chemical composition.

The present investigation was undertaken to determine the amino acid composition and nutritive value of polished and unpolished forms of Basmati-370 and IR-6 varieties, grown in the N.W.F.P. to establish basis for further nutritive studies.

Material and Methods

Sample. The samples used in these experiments were supplied by the Agriculture Research Institute, Tarnab, Peshawar. Polishing of rice was done by spraying tempering water on the grain, and was then pounded by wooden pestle in mortar, until the husk and brown outer coating (bran) were removed and white polished rice resulted.

Unpolished rice was obtained by removing the husk from each grain by hand. Polished and unpolished seeds were ground in a microsample mill with an opening of 1 mm dia and then finely powdered in pestle and mortar.

Proximate Analysis. Moisture, crude protein, ether extract, ash and crude fibre of powdered unpolished and polished Basmati-370 and IR-6 varieties of rice were determined by the standard methods.[1]

Preparation of Protein Hydrolysate. Finely ground, dried and defatted sample were autoclaved in sealed tubes for 24 hr with 6N HCl at 110°C. Tubes were opend and HCl was removed by evaporation to dryness under reduced pressure on water-bath. Dry hydrolysate was dissolved in 2 ml 10% isopropanol.

Amino Acid Composition. The amino acid composition of unpolished and polished Basmati-370 and IR-6 were determined by one dimensional buffered filter paper chromatography by the method adopted earlier.[2]

Nutritive Value of Rice. In the present investigation net protein utilization, apparent and true digestibilities and biological value of unpolished and polished rice varieties of Basmati-370 and IR-6 were determined by body nitrogen technique of Miller and Bender.[7] The method involves net protein retention in young rats having equal weights and involves a ten-day feeding experiment of test protein and nonprotein diets.

Result and Discussion

The proximate composition of unpolished and polished Basmati-370 and IR-6 varieties shows that the unpolished rice of both the varieties had more nutrients than the polished one (Table 1). Polishing caused significant losses of protein and fat content in IR-6 variety, while highly significant loss of fat content occurred in Basmati-370 during milling.

The amino acid analyses of unpolished Basmati-370 and IR-6 showed that both varieties contained sufficient, amounts of glutamic acid. Unpolished IR-6 contained more leucine, phenylalanine, arginine and tyrosine than unpolished Basmati-370 (Table 2). Juliano *et al.*[6] and workers of IRRI[5] reported somewhat similar values for aspartic acid, glutamic acid, lysine, isoleucine, leucine, tyrosine and valine and lower values for phenylalanine, threonine and glycine than those determined in the present work.

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The amino acid composition of polished rice varieties show that both varieties contained high amounts of glutamic acid than the other amino acids. Polished Basmati-370 contained highly significant quantities of glutamic acid and lysine than polished IR-6 variety. The amount of histidine was constant in the polished form of both the varieties. Polished IR-6 contained significant quantities of arginine, glycine and threonine, while the amounts of tyrosine and proline were highly significant as compared to polished Basmati-370. The amino acid composition in the present investigation compares favourably with those reported by other workers.[3,5,6]

Correlation coefficient between protein content and the individual amino acid of polished Basmati-370 and IR-6 varieties showed that protein had a negative correlation with aspartic acid and methionine while significant negative correlation were observed for glutamic acid and lysine. All other amino acids showed positive correlation with protein.

On polishing IR-6 variety showed highly significant losses of methionine, while losses were significant for isoleucine and pheylalanine. No significant loss was observed in Basmati-370 during polishing. Although there were more losses in IR-6 than Basmati-370, yet the amount of all the essential amino acids, except lysine, were significantly present in IR-6 than Basmati-370.

Nutritive Value of Rice. The results of net protein utilization, apparent and true digestibilities and biological value of unpolished and polished forms of Basmati-370 and IR-6 (Table 3) are in agreement with those reported by F.A.O.[4] and Tasker *et al.*[9] These results show that unpolished forms of both the varieties have more NPU than polished forms and that IR-6 is superior to Basmati-370 in NPU values. The values of apparent and true digestibilities obtained in the present investigation are also in agreement with those reported by Tasker *et al.*[9] It was observed in the present work that polished form of both the varieties had more apparent and true digestibilities that of unpolished forms, while higher values of apparent and true digestibilities were obtained for IR-6 variety. Unpolished and polished forms of IR-6 proved to be superior than Basmati-370 and both varieties of rice showed higher biological value in unpolished forms. These observation are in agreement with those of Sure and Frances.[8]

TABLE 1. PROXIMATE COMPOSITION OF RICE.*

Rice	Moisture (%)	Crude protein (%)	Ether extract (%)	Ash (%)	Crude fibre (%)
Unpolished Basmati-370	10·49	7·03	2·76	1·56	1·29
Polished Basmati-370	10·27	6·57	0·87†	1·44	1·05
Unpolished IR-6	14·00	8·17	2·93	1·74	1·07
Polished IR-6	12·20	7·01‡	1·62‡	1·59	0·93

‡ Significant at 0·05% probability. † Highly significant at 0·01% probability. *Ecah value represents the average of 4 determinations.

TABLE 2. AMINO ACID COMPOSITION OF UNPOLISHED AND POLISHED RICE* (CALCD. TO 16%N).

Amino acid	Unpolished		Polished		Correlation coeff.
	Basmati-370 (g/100 g)	IR-6 (g/100 g)	Basmati-370 (g/100 g)	IR-6 (g/100 g)	
Alanine	7.68	8.08	8.16	7.98	+0.11
Arginine	8.10	11.33	9.10	10.41*	+0.12
Aspartic acid	8.39	9.44	11.11	9.70	—0.53
Glutamic acid	20.10	16.01	25.27†	16.64	—0.96‡
Glycine	6.12	7.37	7.22	8.70‡	+0.49
Histidine	2.99	3.10	3.28	3.28	+0.32
Isoleucine	3.84	5.72	4.88	4.99	+0.36
Leucine	7.25	10.63	7.53	9.25	+0.55
Lysine	3.41	2.74	4.55†	3.70	—0.69‡
Methionine	2.42	3.71	2.35	2.14	—0.08
Phenylalanine	8.82	14.93	9.10	11.41	+0.17
Proline	5.40	7.28	6.29	7.13†	+0.61
Serine	6.40	6.69	7.06	6.96	+0.63
Threonine	6.97	7.04	8.16	9.41	+0.54
Tyrosine	2.84	5.25	3.29	5.13	+0.94‡
Valine	5.12	7.04	5.65	6.70	+0.34

‡ Significant at 0·05% probability, † Highly significant at 0·01% probability, * Each value represents the average of 2 determination.

TABLE 3. NUTRITIVE VALUE OF RICE.

Rice	NPU (%)	Apparent digesti-bility (%)	True digesti-bility (%)	Biological value (%)
Unpolished Basmati-370	55·2	64·4	83·7	65·9
Polished Basmati-370	53·7	65·7	86·2	62·3
Unpolished IR-6	59·2	69·1	87·1	67·9
Polished IR-6	57·3	70·7	88·9	64·4

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