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Evaluation of local varieties of Egyptian rice

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Rice is the principal food crop of about one half of the population of the world. It is also the principal source of protein in the diets of Southeast Asia. It is considered the staple food of the majority of Egyptians. Egypt could be considered as one of the important countries producing rice. In Egypt new varieties are always induced in order to improve their technological properties and their resistance to different diseases.

The different varieties of rice newly produced in Egypt are Giza 171, Giza 172, and Giza 180. The nutritive value of such newly produced varieties needs detailed investigations especially for the quantity and quality of their protein contents, which are expected to vary from one variety to another.

For these reasons it is thought desirable to investigate the three varieties of rice, which are produced on a commercial basis with special reference to the amino acid content of their protein, aiming to consider the variety more suitable for consumption.

Materials and methods

Different varieties of hulled and polished rice (*Oryza sativa*) named Giza 171, Giza 172, and Giza 180 were brought from ministry of Agriculture, cleaned and finely powdered in a ball mill before analysis.

Moisture was determined by drying to constant weight at 100-105 °C in an air oven.

Total nitrogen was measured by the usual macro Kjeldahl technique (1).

Fiber was determined by the usual method of the A.O.A.C. (1).

Total carbohydrates were determined by difference (100 - [moisture, ash, protein, fat and fibre]).

Ash was determined by heating portion of the foods in crucible in the muffle furnace at 450 °C. The ash was extracted with HCl as described by McCance, Widdowson, and Shackleton (2). Calcium, magnesium, iron, copper and zinc were determined by atomic absorption spectrophotometry using an Sp. 192 instrument (Pye Unicam Ltd.), according to the methods of Price (3).

Inorganic phosphorus was determined as phosphomolybdate by the method of Fisk and Suppa Raw (4).

For the amino acid determination, the ratio of non-essential/essential amino acids in protein hydrolysate was determined using the technique of Abdou and Awadalla (5). This technique was adopted to replace the quantitative determination of amino acids as being easier for comparison of results of different varieties.

Results and discussion

The proximate composition of the different varieties of rice is given in table 1. The varieties examined showed a great difference in their protein content ranging from 4.23 to 7.71 g/100 g for polished samples and from 5.56 to 7.91 g/100 g for hulled ones.

Great variations between hulled and polished varieties are recognized, where polished varieties gave lower values of nutrients than those of hulled ones. These findings keep pace with those reported by the Middle East and East Asian food composition tables (6, 7), which showed the same thing.

Also Kik and Williams (8), working on rice samples, reported that the conversion of brown rice to polished rice thus removed approximately 10 % of protein, 85 % of the fat, 70 % of the minerals and 30 % of the pentosans.

The concentrations of the inorganic constituents measured in the different varieties of rice are given in table 2. Except for Ca, all figures representing elements and trace elements showed a decrease in their concentrations in polished varieties than those of hulled ones. The

Table 1. Proximate composition of different varieties of Egyptian rice (g/100 g fresh weight).

Food Items	Moisture	Protein	Fat	Fiber	Carbo- hydrates	Calories	Ash
Giza 171							
Hulled	9.75	6.00	1.78	0.52	80.91	363.66	1.04
Polished	9.90	4.86	0.70	0.42	83.80	360.94	0.32
Giza 172							
Hulled	9.37	5.56	1.96	0.79	81.20	364.68	1.12
Polished	9.93	4.23	0.85	0.34	84.31	361.81	0.34
Giza 180							
Hulled	9.11	7.91	1.87	0.85	78.81	363.71	1.45
Polished	9.34	7.71	0.86	0.38	81.42	364.26	0.29

Table 2. Inorganic constituents of different varieties of Egyptian rice (mg/100 g fresh weight).

Names	Ca	Mg	P	Fe	Cu	Zn
Giza 171						
Hulled	17.36	95.56	111.0	1.75	0.42	1.24
Polished	17.25	13.56	74.0	0.90	0.44	1.08
Giza 172						
Hulled	17.26	101.38	129.0	2.61	0.31	0.998
Polished	19.66	13.65	111.1	0.75	0.25	0.69
Giza 180						
Hulled	21.09	71.58	324.0	1.98	0.75	1.64
Polished	21.42	14.57	237.0	0.94	0.38	1.22

Table 3. Ratio of non essential/essential amino acids of different varieties of Egyptian rice.

Names	Giza 171		Giza 172		Giza 180	
	Hulled	Polished	Hulled	Polished	Hulled	Polished
Ratio of non-essential/essential amino acids	1.55	1.69	1.80	2.07	1.42	1.66

decrease in figures reported in the present work could be attributed to the process of conversion of brown (hulled) rice to polished rice. These findings are in accordance with those reported by the Middle East and East Asian food composition tables (6, 7). These findings support the idea of Kester and Jones (9) for the enrichment of polished rice with both minerals and vitamins. The polished rice is considered slightly deficient in B vitamins (thiamin, riboflavin and niacin).

Comparing the inorganic constituents of the Egyptian varieties of rice with those of East Asian, it is clearly shown that the Egyptian varieties of rice are lower in their content of both iron and zinc whereas copper showed higher values.

In case of calcium, only the polished varieties gave lower data than that of East Asia.

In case of magnesium the process of polishing decreases its content from 95 and 100 to about 13 mg %. The condition is nearly the same in the East Asian rice.

The phosphorus content of the Egyptian rice showed lower figures than those of East Asian type except for the Egyptian variety Giza 180.

Data for the ratio of non-essential/essential amino acids (table 3) showed that in all varieties the increase in the essential amino acids was accompanied by an increase of the total protein. These findings disagree with those reported by Kymal (10) and Kik and Hall (11), who mentioned that the increase in the protein content of rice was accompanied by a decrease in the amount of the essential amino acids of the protein.

However, recent studies of 16 varieties indicated that not all the essential amino acids are affected by protein content (12).

It was also found that, in polished rice, the ratio of non-essential/essential amino acids is higher than that of the hulled ones. This means that the hulled varieties contain more essential amino acids than those of polished ones whereas Giza 180 showed lower figures in both hulled and polished, indicating that it contains more of essential amino acids.

In general, it could be concluded that Giza 180 is considered as the best Egyptian variety as compared with 171 and 172 from the nutritional aspects.

Summary

The different nutritional ingredients of the Egyptian varieties of rice (Giza 171, Giza 172, and Giza 180) were determined.

1. The nutritive values decreased in polished varieties more than in the hulled ones.
2. A wide variation in the protein content in the different varieties was recognized.

3. Giza 180 could be considered as the best Egyptian variety from the nutritional aspects.

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