COMPARATIVE ANALYSIS OF GENERAL NUTRITIONAL COMPOSITION OF SELECTED RICE VARIETIES GROWN IN NORTHERN PROVINCE OF SRI LANKA

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Introduction

Rice (*Oryza sativa*) is one of the three major cereal crops that belongs to the grass family of the plant kingdom. Rice is the staple food for most of the people living in Asia. Rice grain is a very nutritious source of diet and has been a prominent cereal food since ancient times. Rice is low in fat and high in starchy carbohydrates. Rice is rich in vitamins and minerals and provides excellent source of vitamin B, E and Potassium. Rice protein is of very high quality as compared to other food crops. The amino acid balance of rice protein is exceptionally good. Besides being the main source of calories and protein, rice is an important cereal because it has the highest digestibility, biological value and protein efficiency ratio than other cereals.

The nutritional values of rice vary with different varieties, soil fertility, fertilizer application and other environmental conditions. Whole rice is milled before marketing. The milling process produces four fractions: brown rice, hull, white rice and bran. Each of these fractions can vary in chemical content according to the variety of rice and the type of milling performed. Unmilled rice contains a significant amount of dietary fiber and more nutrients than milled or polished white rice.

Rice is the staple food of Sri Lankans. Rice accounts for about 45% of the per capita calories and 40% of the per capita protein consumption in the average Sri Lankan diet. Farmers grow many new varieties with seemingly better grain yield without considering its nutritional value. Therefore, there is a need to assess the quality of new varieties and compare them with the local varieties in order not to lose the already existing varieties which may even be better than the new ones in overall merit. Therefore, the objective of the research was to investigate on general nutritional composition of the selected local and newly introduced rice varieties growing in Northern Province of Sri Lanka to consider them as excellent candidates for consumption.

Methodology

Plant materials:

The rice varieties At-308, BG-300, BG-358, BG-360, BG-406, 500-1 and CO-10 were collected from Kilinochchi Rice Research Centre. Moddaikkaruppan, Periyavellai and Addahkari were collected from farmers in Kilinochchi. Five replicates of each rice variety were used for each analysis.

Moisture content:

Moisture was determined by standard official methods of Analysis of the AOAC (method 14:004). The crucibles were weighed and their various weights recorded. Then 2.0 g of the finely ground rice samples were put into the crucibles and weighed. The sample plus

crucible were placed inside the oven and dried at 100 °C for 4 hours, cooled and weighed. Then, the moisture content of the rice sample was calculated.

Ash content:
Total ash of the rice sample was determined by using AOAC (method 14:006). About 1.0 g of finely ground dried sample was weighed into a crucible and incinerated at 600 °C for 6 hr in an ashing muffle furnace until white ash was obtained. The ash was cooled in desiccators and reweighed. The % ash content in the rice sample was calculated.

Fat content:
About 500 mL clean boiling flasks were dried in an oven and cooled. Then 2.0 g of samples were weighed accurately into labeled thimbles. The dried boiling flasks were filled with about 300 mL of petroleum ether (boiling point 40 – 60 °C). The extraction thimbles were plugged tightly with cotton wool. After that, the Soxhlet apparatus was assembled and allowed to reflux for 6 hrs. After that thimble with sample was dried in an oven until constant weight was obtained, cooled in desiccators and weighed. Then % fat in the rice sample was calculated.

Protein content: **The crude protein content of the rice samples was determined using the Microkjeldahl method of AOAC.**

Protein digestion:
The rice sample (2.0 g) was weighed into a Kjeldahl flask and 1.0 g of copper sulphate and a speck of selenium catalyst were added into the mixture, and 25 mL concentrated sulphuric acid was introduced. The whole mixture was subjected to heat in the fume cupboard. The heating was done gently at first and increased with occasional shaking till the solution become green colour. The temperature of digester was above 420 °C for about 30 min. The solution was cooled and black particles showing at the neck of the flask were washed down with distilled water. The solution was re-heated gently at first until the green colour disappeared. Then, it was allowed to cool. After cooling, the digest was transferred into a 250 mL volumetric flask with several washings and made up to the mark with distilled water and then distilled using Markham distillation apparatus.

Protein Distillation and Titration:
Before use, the Markham distillation apparatus was steamed through for 15 min. after which a 100 mL conical flask containing 5 mL Boric acid / indicator was placed under the condenser such that the condenser tip was under the liquid. About 5.0 mL of the digest was pipetted into the body of the apparatus via a small funnel aperture. The digest was washed down with distilled water followed by addition of 50 mL of 60% NaOH solution. The digest in the condenser was steamed through for 5 min. after which enough ammonium sulphate was collected. The receiving flask was removed. The solution in the receiving flask was treated with 0.01 M hydrochloric acid. A blank was run along with the sample. After titration, the % nitrogen was calculated from the equation:

$$\% \text{ Nitrogen} = Vs - Vb \times M_{acid} \times 0.01401 \times 100\ W$$

Where, Vs = Volume (mL) of acid required to titrate sample, Vb = Volume (mL) of acid required to titrate the blank, M_{acid} = Molarity of acid, W = weight of sample (g).

The, percentage crude protein in the rice sample was calculated from the % nitrogen as;

% crude protein = % N × F

Where, F (conversion factor), N is equivalent to 6.

Carbohydrate content:

The total percentage carbohydrate content in the rice sample was determined by the difference method as reported by Onyeike *et. al.* in 1995. This method involved adding the total values of crude protein, lipid, moisture and ash constituents of the sample and subtracting it from 100.

Statistical data Analysis:

Moisture, ash, fat, protein and carbohydrate contents of different rice varieties were analyzed by analysis of variance (ANOVA) ($P<0.05$) followed by LSD by using software MINITAB. The results of the one-way ANOVA show that the mean values of the samples are significantly different.

Results and Discussion

Bg-360 variety may have a longer shelf life compared to the other rice varieties due to the lower moisture content. CO-10, 500-1 and Addahkari cannot be stored for a long time because of its high moisture content since less moisture content in foods helps in long-term storage.

Table 1. Comparison of general nutritional composition among rice varieties.

Rice variety	Moisture content (%w/w)	Ash content (%w/w)	Fat content (%w/w)	Protein content (%w/w)	Carbohydrate content (%w/w)
Addahkari	12.31	0.45	1.38	0.71	85.15
At-308	11.85	0.24	2.34	0.63	84.94
BG-300	12.26	1.01	2.68	0.72	83.34
BG-358	12.11	1.10	1.82	0.74	84.23
BG-360	11.57	1.05	3.56	1.05	82.77
BG-406	11.95	0.52	2.99	0.69	83.85
CO-10	12.74	0.12	2.74	0.65	83.76
500-1	12.51	0.83	3.24	0.68	82.75
Moddaikkaruppan	11.97	1.55	3.84	0.88	81.76
Periyavellai	12.19	1.42	0.59	0.80	85.00

The ash content of a food sample gives an idea of the mineral elements present in the food sample. In general, the levels of minerals from some of the varieties like Moddaikkaruppan and Periyavellai were high. This may be due to genetic factors or the mineral content of the soil. The high proportion of unsaturated fatty acids, accounting for up to 80%, causes the liquid consistency of the rice bran oil. Due to its high level of unsaturation, rice bran oil is known to have blood cholesterol lowering effects. Thus, rice

containing higher fat content is good. Because most of the fat content in rice grain is unsaturated. In this regard, Moddaikkaruppan and Bg-360 could be said to be better preferred. The variation in fat value in different rice varieties may be due to oxidation of the fat because most of the fat content in rice grain is unsaturated and undergo oxidation easily by atmospheric oxygen. Bg-360, Moddaikkaruppan and Periyavellai should be highly prized because of their relatively higher percentage of crude protein. The carbohydrate content in the varieties had higher values and ranged between 81.76 - 85.1%. This observed high carbohydrate content among the varieties is not surprising as rice is a well-known carbohydrate food source.

Conclusion

Among the rice varieties Bg-360 possessed some desirable nutritional attributes than other cultivars with respect to greater protein, greater fat (higher amount of unsaturated fat and lower amount of saturated fat) and lower carbohydrate contents. Therefore, this variety could be considered as a healthy food source.

References

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