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Short Communication

The proximate and mineral compositions of five major rice varieties in Abakaliki, South-Eastern Nigeria

Oko A. O.* and Ugwu S. I.

Department of Biotechnology, Ebonyi State University, Abakaliki, Eboniyi State, Nigeria.

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The proximate compositions were estimated using compositional analysis of Association of Official Analytical Chemists, while the mineral element contents were determined using atomic absorption spectrophotometer. Analysis of variance shows that there is significant difference ($p<0.05$) in the proximate compositions of the rice varieties studied (Sipi>Faro14>Awilo>Faro15>Canada). No significant difference ($p>0.05$) exists in sodium, phosphorous, calcium and magnesium contents of the rice varieties studied. There is significant difference ($p<0.05$) in nitrogen (Canada>(Awilo, Faro15)>Sipi>Faro14) and potassium (Canada>Sipi>Awilo>Faro15>Faro14). Canada and Faro 14 varieties should get more attentions among other varieties in terms of proximate and mineral compositions. The result of this study can be exploited by rice consumers and also rice farmers in Abakaliki and its environs in their choices regarding mineral and proximate compositions.

Key words: Rice varieties, proximate composition, mineral elements, Abakaliki.

INTRODUCTION

Rice is the seed of the monocot plant of the genus *Oryza* and of the grass family Poaceae (formally Graminae) which includes twenty wild species and two cultivated ones, *Oryza sativa* (Asian rice) and *Oryza glaberrima* (African rice). *Oryza sativa* is the most commonly grown species throughout the world today. Rice has been considered the best staple food among all cereals and is the staple food for over 3 billion people, constituting over half of the world's population (Cantral and Reeves, 2002). Minerals like calcium, magnesium, phosphorus are present along with some traces of iron, copper, zinc and manganese (Yousaf, 1992). Rice is grown in all the ecological and dietary zones of Nigeria, with different varieties possessing adaptation traits for each ecology (Sanni et al., 2005). The two commonly cultivated varieties of rice in Nigeria are *O. sativa* and *O. glabberima* (Abulude, 2004; Adeyemi et al., 1986).

Many varieties of rice are grown in Abakaliki and its environs. These varieties (such as Faro 14, Mass, Faro 52, Sipi, Awilo, Canada and so on) exhibit on cooking marked differences in quality. Attempts to correlate quality of rice with its chemical composition have not so far been successful. According to Sanjiva (1999), the differences in the quality of rice may be attributable to the difference in their colloidal structure; furthermore, these workers reported that the extent of swelling of any variety of rice during cooking could be used as index of its quality.

MATERIALS AND METHODS

Sample collection

The different rice cultivars were collected from different farmers at the point of harvest from different places within Abakaliki and its environs.

*Corresponding author. E-mail: austineok@yahoo.co.uk. Tel: +234(0)8032613614.

Table 1. Percentage proximate compositions.

Rice varieties	Moisture (%)	Fat (%)	Crude protein (%)	Crude fibre %	Ash (%)	Carbohydrate (%)
Sipi	18.00±0.10^{a}	0.50±0.01^{d}	1.58±0.01^{e}	2.00±0.10^{a}	1.00±0.01^{b}	76.92±0.0^{e}
Faro 14	7.33±0.01^{b}	0.50±0.01^{d}	6.22±0.01^{a}	1.50±0.10^{b}	1.00±0.00^{b}	83.45±0.1^{d}
Faro 15	6.33±0.10^{d}	1.00±0.09^{c}	4.64±0.10^{d}	1.50±0.10^{b}	0.50±0.01^{b}	86.03±0.01^{a}
Awilo	6.67±0.01^{c}	2.50±0.01^{b}	4.82±0.01^{b}	1.50±0.01^{b}	0.50±0.01^{b}	84.01±0.01^{c}
Canada	3.67±0.01^{e}	3.50±0.90^{a}	4.74±0.01^{c}	2.00±0.10^{a}	2.00±0.10^{a}	85.09±0.12^{b}

Table 2. Percentage mineral compositions.

Rice varieties	Nitrogen (%)	Phosphorous (%)	Potassium (%)	Sodium (%)	Calcium (%)	Magnesium (%)
Sipi	0.25±0.03^{c}	0.54±0.0^{a}	0.17±0.01^{b}	0.13±0.02^{b}	0.09±0.0^{a}	0.19±0.02^{a}
Faro14	0.10±0.01^{d}	0.53±0.01^{a}	0.15±0.04^{b}	0.13±0.02^{b}	0.07±0.0^{a}	0.23±0.01^{a}
Faro 15	0.71±0.01^{b}	0.53±0.02^{a}	0.15±0.02^{b}	0.13±0.01^{b}	0.07±0.0^{a}	0.26±0.01^{a}
Awilo	0.77±0.03^{b}	0.52±0.01^{a}	0.15±0.01^{b}	0.13±0.02^{b}	0.11±0.0^{a}	0.20±0.01^{a}
Canada	1.08±0.01^{a}	0.54±0.01^{a}	0.20±0.03^{a}	0.17±0.01^{a}	0.09±0.0^{a}	0.23±0.02^{a}

Percentage proximate composition

The moisture content was determined using the oven method described by standard official methods of analysis of the AOAC (1984). The ash content was determined using the method reported in the handbook of AOAC (1984).The crude fat was determined using Soxhlet extraction method of AOAC (1984). The crude protein content of the rice samples was determined using the Microkjeldahl method of AOAC (1984). Crude fibre was determined in the sample using the standard methods of analysis of the AOAC (1984). The total percentage carbohydrate content was determined by the difference method as described by Edeogu et al. (2007).

Determination of mineral elements in rice

Calcium, sodium, magnessium and potassium were determined by atomic absorption spectrophotometric method, while phosphorous was determined by molybdate method.

Statistical analysis

Three replicates were analyzed per sample and the data generated was subjected to statistical analysis using analysis of variance (ANOVA) test.

RESULTS

The proximate compositions of the rice varieties are shown in Table 1. Analysis of variance shows that there is significant difference ($p<0.05$) in the proximate compositions of the rice varieties studied.

The mineral contents of the rice varieties are shown in Table 2. No significant difference ($p>0.05$) exists in sodium, phosphorous, calcium and magnesium contents of the rice varieties studied. There is significant difference ($p<0.05$) in nitrogen and potassium.

DISCUSSION

The rice samples contained high quantities of carbohydrates ranging from 76.92 to 86.03%. Although these values are higher than the values obtained by Eggum (1982), they are a bit lower than the values (75.37 to 76.37%) reported by Edeogu et al. (2007) who analysed the proximate compositions of staple food crops in Ebonyi State. Sipi variety had the lowest carbohydrate content. This low carbohydrate content may be attributed to its high moisture content which also affects the milling quality (Online USA Rice Federation, 2002) and other environmental factors. The high percentage carbohydrate contents of the rice varieties show that rice is a good source of energy. The ash content of a food sample gives an idea of the mineral elements present in the food sample. Among the five rice varieties, Awilo rice had the highest protein content (6.22%). This is in agreement with the findings of Ebuehi and Oyewole (2007) who analyzed the effect of cooking and soaking on physical characteristics, nutrient composition and sensory evaluation of indigenous and foreign rice varieties in Nigeria. The percentage fiber contents among the five rice samples were in the range of 1.5 to 2.0%. Although this range is a bit lower than the range (1.93 to 4.3%)

obtained by Edeogu et al. (2007), it is similar to the mean value obtained by Sotelo et al. (1990). Milling of rice generally decreases the fibre contents of rice. Sotelo et al. (1990) who analyzed the chemical compositions of different fractions of 12 Mexican varieties of rice obtained during milling. Sipi variety contained the highest percentage moisture content while Canada variety contained the lowest percentage moisture content. The high percentage moisture content may be attributed to low drying temperature (Xheng and Lan, 2006) and prolonged parboiling. Such high percentage moisture content affects the milling characteristics and the taste of cooked rice (Xheng and Lan, 2006). Ebuehi and Oyewole (2007) reported that the moisture content of rice also affects its storage. It follows that Canada rice variety may have a longer shelf life compared to the other rice varieties due to the lower moisture content. The values for percentage crude protein content are in the range of 1.58 to 6.22%. This range is lower than the range obtained by Edeogu et al. (2007) who analyzed the proximate composition of rice in Ebonyi Sate. This may be attributed to prolonged parboiling which lowers the protein content of rice and some other environmental and edaphic factors. However, the range is comparable with the range obtained by Ibukun (2008). The percentage fat content of the rice is in the range of 0.5 to 3.5%. The results of this study are in agreement with earlier results reported by Willis et al. (1982) and Juliano (1985) who also gave the fat range 0.9 to 1.97% in different milling fractions. However, this range is lower than the range obtained by Edeogu et al. (2007). This difference may be attributed to the degree of milling. Milling of rice removes the outer layer of the grain where most of the fats are concentrated (Frei and Becker, 2003).

The values obtained for minerals are slightly lower than the values obtained by Ibukun (2008). This slight difference might be as a result of fertilizer application, rate of parboiling and the amounts of soil nutrients all of which affect the mineral contents of rice. Rivero et al. (2006) reported that as greater amount of rice bran are removed from grain during milling and polishing, more vitamins and minerals are lost.

Conclusion

The result of this study can be exploited by rice consumers in their choices regarding mineral and proximate compositions. Canada variety was observed to be superior in percentage fat, carbohydrate, percentage nitrogen, phosphorous, calcium and magnesium contents among other varieties studied. Therefore, Canada and Faro 14 varieties should get more attentions in terms of proximate and mineral compositions.

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