

PROXIMATE AND MINERAL COMPOSITION OF SOME FOREIGN AND LOCAL RICE VARIETIES SOLD IN MILE 3 MARKET, PORT HARCOURT, RIVERS STATE, NIGERIA

ABSTRACT

Rice is a staple food in many countries of Africa and it is nutritionally beneficial. This research work compared the proximate composition and mineral composition of some local and foreign rice varieties. Four varieties of rice were analyzed; two types of local rice designated as (L₁ and L₂) and two types of foreign rice (F₁ and F₂). The proximate composition such as moisture content, ash content, carbohydrate content, crude protein, crude fiber and total fat were evaluated using standard methods. The result of the analysis showed that the moisture content was lowest in L₁ (8.56 ± 0.26g) and highest in sample L₂ (9.47 ± 0.48g). All the four varieties recorded high carbohydrate content. The fat content of L₁ and L₂ (1.19±0.20 - 2.48±0.90) were significantly higher (p<0.05) when compared to F₁ and F₂ (1.69±0.30 – 1.99± 0.20a). Crude fiber content for L₁ and L₂ (1.49±0.09 -1.69±0.09) were statistically higher compared to F₁ and F₂ (0.29±0.09b - 0.39±0.01b). Crude protein for L₁ and L₂ (7.89±0.09 – 8.09±0.22) were significantly higher when compared to F₁ and F₂ (6.34± 0.22b – 7.22± 0.66). Ash content for L₁ and L₂ (0.60± 0.01- 0.68±0.32) were statistically lower compared to F₁ and F₂ (0.62±0.08 – 1.20± 0.20) Potassium and Zinc showed no significant difference in all samples apart from F₁ where Potassium and Zinc were significantly different. Calcium values for foreign rice showed significant difference when compared to the values for local rice. Local rice appeared to have a relatively higher level of iron when compared to all the foreign rice samples. The values obtained from this study indicates that Nigerian local rice varieties are nutritionally better compared to foreign rice varieties.

Keywords: Foreign rice, Local rice, Mineral content, proximate composition.

1.0 INTRODUCTION

Rice is a cereal crop (grass family Poaceae) with high energy content and a high biological value of protein (Singh *et al.*, 2014). It is one of the two cultivable species of its genus *Oryza* and originates from Asian countries including India, Thailand and China. For a vast portion of the global population, rice, also known as *Oryza sativa* (Asian rice) or *Oryza glaberrima* (African rice) is primarily consumed as a staple food. Depending on the type and soil richness, the plant can reach a height of 1–1.8 m. The edible seed is a grain (caryopsis) that is 5–12 mm long and 2-3 mm thick. Due to its nutritional quality and higher digestibility, rice is considered as the queen among cereals (Anjum *et al.*, 2007).

Consumption of rice is extremely beneficial for the health because it does not contain harmful fats, cholesterol or sodium. It forms an integral part of balanced diet (Verma & Srivastav, 2017).

As rice is rich in carbohydrate it acts as fuel for the body and helps in normal functioning of the human brain (Umadevi et al., 2012; Zaghum et al., 2022). Rice is an essential commercial crop for diversifying diets, ensuring household food security, and is majorly used in ceremonies (Perez et al., 1987). It is regarded as the primary staple meal in many nations, and the World Health Organization (WHO) notes that it is a significant cereal crop that feeds more than half of the world's population.

Nearly all ecological zones in Nigeria grow rice. As stated by Ibrahim et al. (2021), the varieties produced in Nigeria are *O. glaberrima*, (Ofada) grown in Ofada town in the south west region of the country and new rice (NERICA) a hybrid of the *O. sativa* and *O. glaberrima*.

There is a rise in foreign or imported rice types in Nigeria despite the fact that the country grows a variety of local varieties of rice. The polished rice, also known as "Aroso" rice in local dialect, is a well-known imported and parboiled rice variety made in Thailand, imported into Nigeria, and widely consumed. Foreign rice brands are more commonly consumed in Nigeria than domestically produced types like "Ofada" and "Abakaliki". Low production of these native types is likely a result of lack of knowledge about their nutritional values, the belief that they frequently contain stones and dirt (leftover bran on the rice), the presence of anti-nutrients, and other factors. The physical characteristics of Aroso (imported) rice and its cooking qualities, such as its ability to swell and a quicker cooking time, may be the reason for its acceptance. Both the domestic and foreign rice sold in Nigerian markets are parboiled. The benefits of parboiling include improving the protein and mineral content of the grain as well as other advantages. When rice is parboiled, minerals, proteins, and vitamins from the hull and bran of paddy move to the starchy endosperm, boosting the nutritious content of the grain (Azuka et al., 2020). Local rice has a smaller market share than imported rice since it is thought to be less nutritious than imported parboiled rice. Imported rice has flooded the market as a result of urban inhabitants' reliance on it, while native rice is ignored and kept for the rural and urban poor. This study is aimed to evaluate the proximate composition and mineral content of some local and foreign rice species in order to ascertain the nutritional components of both varieties of rice and its contribution to healthy living.

2.0. Materials and Methods

2.1. Study area

Mile 3 market was selected for this study. Mile 3 market is located in Diobu area of Port Harcourt, Rivers State, Nigeria at latitude 4° 47' 24" N and longitude 6° 59' 36" E.

2.2. Sample collection

Two local rice varieties as well as two foreign rice namely were bought from random sellers at Mile 3 market.

2.3. Determination of proximate composition

Proximate composition of the samples were determined using the Clegg Anthrone method.

$$\frac{(W2 - W3) \text{ weight of ash weight} \times \text{ether extract (True - Blank)} \times \text{Normality of a}}{(W2 - W1) \text{ weight of sample} \quad \text{weight of sample} \quad \text{weight of sample}}$$

2.4. Mineral content analysis

The minerals were determined using Atomic Absorption Spectrophotometer, Search tech instrument Nig

(Spectrum 755s).

2.5. Statistical Analysis

Means \pm standard deviation of triplicate determinations were used to analyze data which were compared with Analysis of Variance using the IBM Statistical package of Biological and Social Sciences.

3.0. RESULTS

3.1 Proximate Composition of Local Rice (LR) and Foreign Rice (FR)

The percentage variation in moisture, ash content, crude protein, total fat content, crude fiber and carbohydrate content of foreign and local rice varieties is presented in table 1. Percentage variation in moisture content for foreign rice ranged from 8.60% -8.69%, local rice ranged from 8.56% -9.48%. The percentage variation in ash content for foreign rice ranged from 0.62% - 1.20%, local rice ranged from 0.60% -0.68%. The percentage variation in crude protein for foreign rice ranged from 6.34%-7.22% local rice ranged from 7.89%- 8.09%.

Table 1: Proximate composition of some foreign and local rice in Mile 3 Market, Port Harcourt

Samples	Moisture content	Ash content	Crude protein	Total fat	Crude fibre	CHO
F1	8.69±0.32 ^a	1.20±0.20 ^a	7.22±0.669 ^a	1.99±0.20 ^a	0.29±0.09 ^b	80.6±0.65 ^b
F2	8.60±0.23 ^a	0.62±0.08 ^b	6.34±0.22 ^b	1.69±0.30 ^a	0.39±0.01 ^b	82.6±0.51 ^b
L1	8.56±0.27 ^a	0.68±0.32 ^b	7.89±0.09 ^a	2.48±0.09 ^b	1.49±0.09 ^a	78.9±0.43 ^a
L2	9.48±0.48 ^b	0.60±0.01 ^b	8.09±0.22 ^a	1.19±0.20 ^b	1.69±0.09 ^a	78.9±0.99 ^a

Values in the table above are expressed as mean \pm standard deviation. Superscripts with different letter indicate that there is significant difference according to the ANOVA ($p < 0.05$)

3.2. Mineral Profile of foreign and local rice varieties

Table 2 shows the result for the concentration of iron, potassium, magnesium, phosphorous, calcium and zinc, for both varieties of rice.

Table 2: Mineral profile (mg/100g) of some foreign and local rice in Mile 3 Market, Port Harcourt

Groups/ Parameters	Calcium	Magnesium	Potassium	Iron	Phosphorous	Zinc
L1	99.40 ^c ±1.92	210.77 ^c ±1.17	187.93 ^b ±0.91	6.18 ^b ±0.01	187.75 ^a ±1.89	4.29 ^b ±0.03
L2	87.27 ^b ±5.29	177.63 ^b ±3.94	168.20 ^b ±7.62	8.46 ^c ±1.50	165.20 ^b ±4.02	4.68 ^b ±0.13
F1	73.52 ^a ±1.14	152.81 ^a ±2.18	296.25 ^a ±0.53	4.70 ^a ±0.30	179.09 ^a ±2.17	3.45 ^a ±0.16
F2	78.57 ^a ±7.07	185.33 ^b ±5.49	195.06 ^b ±3.12	6.50 ^b ±0.00	157.76 ^b ±4.42	3.37 ^b ±0.04

Variables are expressed as mean ± standard deviation (SD). Values with different subscript shows significant difference at the 0.05 level.

4.0. DISCUSSION

Moisture content plays a significant role in the determination of the quality of rice and its palatability. Furthermore, it plays a role in the determination of the shelf life (Oko et al., 2010; Obembe et al., 2022). Percentage variation in moisture content for the four varieties of rice ranged from 8.60% -9.48%. The values obtained in this work corresponds closely to the values reported by Obembe et al., (2022) on proximate composition, mineral and heavy metals concentration of some foreign and locally produced rice in Nigeria.

It was observed that the Ash content for L1 and L2 (0.60%-0.68%) were statistically lower compared to F1 and F2 (0.62% – 1.20%) .Values obtained in this study is higher than the values reported by Faustina & Cleopatra, (2017) on comparative studies of proximate and some mineral composition of selected local rice varieties and imported rice brands in Ghana.

Crude protein for L1 and L2 (7.89%– 8.09%) were significantly higher when compared to F1 and F2 (6.34± 0.22 – 7.22± 0.66).The protein content in this study is in agreement with the values obtained is in close ranged to the values obtained by Obembe et al., (2022). Factors such as handling, water supply, may be the reason for variations in protein content of the varieties of rice studied (Obemebe et al., 2022). The fat content of L1 and L2 (1.19% -2.48%) were significantly higher ($p<0.05$) when compared to F1 and F2 (1.69%– 1.99%). The values obtained in this work is in close range to the values obtained by Faustina & Cleopatra, (2017).

Crude fiber content for L1 and L2 (1.49%-1.69%) were statistically higher compared to F1 and F2 (0.29% -0.39%). Crude fiber are easy digestible polysaccharide which can be in soluble or non-soluble form and increase faecal bulk. They form complexes with protein, sugars and cholesterol. When taken in excess, they help to reduce the risk of colon cancer and scrub out the intestine leaving a much healthier digestive system (Okezie et al., 2017).

The percentage variation in carbohydrate content for foreign rice ranged from 78.9%- 82.6%. The values obtained in this work is similar to the values reported by Ebubechi &Oyewole, (2007).Calcium content ranged from 73.52mg/100g-78.57mg/100g in FR and 87.27mg/100g- 99.40mg/100g in LR with a significant difference ($p<0.05$). Magnesium content ranged from 152.81mg/100g-185.33mg/100g in FR and 177.63mg/100g- 210.77mg/100g in LR.. The values obtained for Magnesium in this work were higher than what was reported by Faustina et al.,

(2014) on Comparative Studies on Proximate and some Mineral Components of Selected Local Rice Varieties and Imported Rice Brands in Ghana... The values of Potassium ranged between 195.06mg/100g- 296.25mg/100g in FR and 168.20mg/100g-187.93mg/100g in LR. Values obtained from this work are higher than those reported by *Obembe et al.*, (2022) on Comparative Study of Proximate and Mineral Composition of Selected varieties of rice *Oryza sativa L.* Values of Iron ranged between 4.70mg/100g -6.50mg/100g in FR and 6.18mg/100g- 8.46mg/100g in LR with statistical difference ($p<0.05$). Values of Phosphorus ranged from 157.76mg/100g- 179.09mg/100g in FR and 165.20mg/100g- 187.75mg/100g in LR. Values for Zinc ranged between 3.37mg/100g -3.45mg/100g in FR and 4.29mg/100g-4.68mg/100g in LR. Values for Iron are not significantly different across varieties.

CONCLUSION

Rice is a vital marketable crop for varying diets, guaranteeing household food security, and is majorly used in ceremonies in Nigeria. It is normally eaten in Nigeria in the following forms: milled rice, boiling, jollof, fried, or rice paste, with or without stew or soup. It is prepared by boiling in water or by parboiling for a short period of time, draining the cooking broth, and then adding water to prepare the rice to a soft, palatable state. There is an increase in the importation of foreign rice of different varieties into Nigeria despite the fact that the country grows local varieties of rice. The result of this study shows that local rice made in Nigeria is highly nutritive and encompasses most of the essential nutrients and minerals. It is more nutritive when compared to foreign rice and thus, preferable to consume. Hence, the need to completely erase or minimize the importation of foreign rice and focus more on the Production of locally made rice to meet the demands of the growing population in Nigeria.

COMPETING INTERESTS

Authors have declared that no competing interest exist. The products used for this research are commonly and predominantly used products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of

knowledge. Also, this research was not funded by the producing company rather it was funded by personal efforts of the authors.

REFERENCES

1. Anjum FM, Pasha I, Bugti MA, Butt MS. (2007). Mineral composition of different rice varieties and their milling fractions. *Pakistan Journal of Agricultural Science*. 44(2): 332-336.
2. Azuka CE, Nkama I, Eze CR, Danbaba N, Asoiro FU (2020). Cooking and functional properties of parboiled milled local rice marketed in the south-east zone of Nigeria. *International Journal of Food Studies*. 9(2).
3. Ebubechi OAT, Oyewole AC. (2007). Effects of cooking and soaking on physical characteristics, nutrient composition and sensory evaluation of indigenous and foreign rice varieties in Nigeria. *African Journal of Biotechnology*. 6, 1016-1020.
4. Faustina DW, Cleopatra A. (2017). Comparative studies on proximate and some mineral composition of selected local rice varieties and imported rice brands in Ghana. *Agricultural and Food Science Research*. 4(1):1-7, 10.20448/journal.512.2017.41.1.7.
5. Ibrahim A, Bashir M, Garba, ZM. (2021). Proximate and Anti-Nutritional Estimation of some Local and Imported Rice (*Oryza Sativa*): A Comparative Approach. *Dutse Journal of Pure and Applied Sciences*. 7: 1-9.
6. Obembe OM, Olowolafe DE, Adedoyin IA. (2002). Comparative study of proximate and mineral composition of selected varieties of rice *Oryza sativa*. *Journal of Research in Environmental and Earth Sciences*. 8(5):27-31.
7. Okezie E, Ugbogu AE, Odungide AA, Atani C S. (2017). Proximate, antinutritional and mineral estimation of some selected consumed green vegetables in Afaha Eket, Akwa-Ibom State, Nigeria. *American Journal of Food Science and Technology*. 5(5): 182-191.
8. Oko AO, Ugwu SI. (2010). The proximate and mineral compositions of five major rice varieties in Abakaliki, South-Eastern Nigeria. *International Journal of Plant Physiology and Biochemistry*. 3(2):25-27.

9. Perez CM, Juliano BO, Pascal CG, Novenario VG. (1987). Extracted lipids and carbohydrates during washing and boiling of milled rice. *Starch-Starke*. 39(11):386-390.
10. Singh N, Vashist KK, Sharma SMN. (2014). Quality characteristics of rice grains as influenced by varying irrigation regimes in furrow and bed transplanted rice (*Oryza sativa* L.). *International Journal of Agricultural Sciences*. 10(1): 216-220.
11. Umadevi M, Pushpa R., Sampathkumar KP, Bhowmik D. (2012). Rice-traditional medicinal plant in India. *Journal of pharmacognosy and phytochemistry*. 1(1): 6-12.
12. Verma DK, Srivastav PP. (2017). Proximate composition, mineral content and fatty acids analyses of aromatic and non-aromatic Indian rice. *Rice Science*. 24(1):21-31.
13. W. H. O. (2003). Diet nutrition and the prevention of chronic diseases. Report of a joint WHO/FAO expert consultation. WHO Technical report series. 916, 34-38.
14. Zaghum MJ, Ali K., Teng S. (2022). Integrated genetic and omics approaches for the regulation of nutritional activities in rice (*Oryza sativa* L.). *Agriculture*. 12(11):1757.