International Journal of Applied Chemical and Biological Sciences (2021), 2(4), 148-154.
ISSN 2582-788X

RESEARCH ARTICLE

Proximate analysis of processed and unprocessed local rice cultivars in Swabi, KP, Pakistan

Muhammad Baseer Us Salam*, Mehran Khan, Yusra Suleman

Department of Agricultural Chemistry & Biochemistry, University of Agriculture, Peshawar, Pakistan

* For correspondence: muhammadbaseerussalam@gmail.com

ABSTRACT

A comparative study on the nutritional contents for selected rice local cultivars was carried out in March 2021. Rice is a significant staple crop which provides nourishment to almost 50% of the world's populations. Studies have shown loss of nutrients when the rice is processed in mills. Two local rice cultivars i.e., Garma and Kainat were selected in processed and unprocessed forms from District Swabi which lies between River Indus and River Kabul. Proximate analysis was carried out which depicted that cellulose content is highest for Processed Garma while lowest in unprocessed Kainat. Unprocessed Garma showed highest values for moisture, ash, crude fat and crude fiber while crude protein (%) was high for unprocessed Kainat (4.9). Total carbohydrates were highest for Processed Garma while lowest for unprocessed Kainat. In addition to high amount of energy it produced, it was observed in the study that the NFE>Moisture>Protein>Ash>Fat>Fiber.

Key words: Garma, Kainat, Proximate Composition, Rice

1. INTRODUCTION

Rice (*Oryza Sativa*), being an individual of family Poaceae (Gramineae) is a staple food. Rice is the most important and broadly developed food crop for Asian nations including Pakistan. It provides nourishment for almost 50% of the world's seven billion individuals [1]. Rice cultivation is primarily done in Asian locale. South Asia alone creates around 30 % of worldwide rice creation. Consumption of rice is done in different forms including Brown Rice, Milled Rice, and Parboiled Milled Rice.

Rice in Pakistan gives significant segment of every day caloric prerequisite. It is rich wellspring of sugar with considerable measures of protein, fat, fiber, mineral and nutrients. Arrangement and supplement substance of rice differs with assortments and particularly preparing strategy. In Pakistan, two kinds of rice mill namely, husky and automatic rice mill are found. The milling procedure in both the

husky and automatic mills differs. In addition to husking, Husky rice mills do some polishing mostly by using two or more passes through hullers to grind off some of the bran. Compared to husky mills, latest and mechanized techniques are followed in the processing by automatic rice mills which involve pre-cleaning, steam parboiling, drying, husking, and finally polishing [2]. Brown rice during processing is subjected to grating strain for removing grain layers stimulating high, medium or low levels of processing. Removal of grain layers and germ are done in the cleaning process. Their removal brings about loss of supplements, particularly in generous misfortunes of nutrients and minerals. Processing achieves significant loss of supplements and influences the palatable properties of processed rice. Rice gives 45% of calories and 40% complete protein necessity of a normal populace [3]. Diverse rice assortments are developed everywhere on the world and have demonstrated compositional varieties in term of protein, lipid, starch content (amylose and amylopectin), minerals, nutrients, warm properties, surface profile and sticking profile [4]. The variety in piece of rice relies upon the hereditary and ecological variables [5].

Additionally, extraordinary rice assortments are filled in various piece of Pakistan. This research primarily focused on the comparative study of nutritional content on two of the local rice local cultivars i.e., Kainat and Garma alongside the effect of processing on their nutritional contents. District Swabi lies between River Kabul and River Indus in Mardan Division and favors the optimum climates for rice cultivation in the KPK region. Hence lot of farmers opt. to grow rice when the season is feasible. There are many varieties that are cultivated in Swabi district but Kainat and Garma has showed the best results in productivity of rice.

2. METHODS AND MATERIALS

2.1. Sample Collection

Samples of two rice local cultivars namely, Kainat and Garma were collected in processed and unprocessed form from the rice fields and mills. The samples were brought to the laboratory where the samples were cleaned, washed and air-dried. The samples were further placed at 70 ℃ followed by 100 ℃ in oven for complete drying. Furthermore, the samples were grounded with electrical grinder and were stored in labelled jars for further analysis.

2.2. Proximate analysis of samples

Chemical composition of collected samples for moisture, ash, protein, fat, and crude fibers contents were determined as per the methods described by AOAC (2004) [6].Total carbohydrate contents were determined by indirect method (subtract the sum of all other contents from 100 g sample) described by FAO (2004) [7].

2.2.1. Moisture Content

Moisture content was determined by oven drying method. Samples were kept in empty clean crucibles and the oven temperature was set on 105℃ for 24 hours. The percent weight loss in moisture was calculated by equation 1:

Moisture content (g %)= $\frac{A-B}{W} * 100$ ...eq 1

Where:

A = Initial weight of crucible and sample,
B = Final weight of crucible and sample,
W = Weight of sample

2.2.2. Ash Content

Loss on Ignition method was used in order to find out the ash content. Three grams of each sample were taken in clean and dried crucibles followed by charring at 600 °C for 5 hrs in muffle furnace. Ash content was calculated using equation 2:

% Ash = $\frac{A-B}{W} * 100$ ...eq 2

Where:

A = Final weight of crucible with sample,
B = Weight of empty crucible,
W = Weight of sample.

2.2.3. Crude Protein

Crude protein for the samples was determined by Kjeldhal method. Two grams of each sample were taken with the addition of digestion mixture and conc. H_2SO_4 in a Kjeldahl digestion flask. The samples were heated and then distillation was carried out with the alkaline mixture of the samples. The ammonia collected was then titrated with 0.1N HCl solution and titre value was recorded. The percentage of protein content in the sample was computed using protein factor 5.95 as follows (equation 3)

$$\% Nitrogen = \frac{T_s - T_b * 0.1 * 100 * 0.014}{Weight\ of\ Sample} * 100$$

2.2.4. Determination of Fiber

In order to determine the fiber content, firstly acid digestion of the samples were made with 200 ml of H_2SO_4 (0.128M). After filtering the acid digest, the samples were the subjected to basic digestion with 200 ml of NaOH (0.313 M). The digest after filtration was then dried in oven at 130 °Cfor 2 hours. The digest was later kept for 2 hours in a muffle furnace at 550 °C

Calculations:

$$\% Fiber = \frac{W_1 - W_2}{W_S} * 100$$ ...eq 4

Where:
W_1= Weight of Sample,
W_2= Weight of Crucible with Fiber and
W_3= Weight of Crucible with Ash

2.3. Determination of Cellulose

Cellulose in the samples were indirectly directly i.e., via Nitrogen Free Extract

Nitrogen Free Extract (NFE)=

100 – (Moisture + Ash+ Crude Protein+ Crude Fiber) ....eq 5

2.4. Determination of Energy

Energy values were calculated as per AOAC procedures

Energy Value = (Crude protein × 4) + (Total carbohydrate × 4) + (Crude fat × 9) ....eq 6

2.5. Data Analysis

The data was recorded for all the samples and was analysed sing SPSS version 16. The standard deviation and significant difference was recorded.

3. RESULTS AND DISCUSSION

The samples were selected from rice field and mills of District Swabi. Two local cultivars i.e., Kainat and Garma each processed and unprocessed were selected for the experimental purpose. The chemicals and reagents used in the research work were extremely pure with analytical grade. Analysis was carried out in triplicate.

Table 1 depicts the proximate analysis (%) of the local rice cultivars. The data revealed that the mean moisture was found higher in the unprocessed Garma while lowest was found in processed Kainat. Ash content was highest for unprocessed Garma while lowest was for unprocessed Kainat. The highest crude fiber was recorded for Unprocessed Garma while least for processed Kainat. Crude protein was found in the range of 0.84 to 4.9 with maximum for Unprocessed Kainat and minimum for Processed Garma. The highest cellulose (92.38 %) was found in Processed Garma followed by 85.85 % for Processed Kainat while the lowest value (81.47 %) was determined in unprocessed Garma among the selected local cultivars. Fat content (%) varied from 0.24 to 0.42 with highest recorded for unprocessed Garma and lowest for processed Kainat. Dietary energy was observed in a way that Processed Garma > Processed Kainat > Unprocessed > Unprocessed Garma.

Moisture plays a key role in food quality and safety. Higher moisture content results in food spoilage by microorganisms and excessive enzymatic activities. Rice quality is greatly affected by moisture [11]. The selected cultivars were found in acceptable range i.e., 12 % for long term storage [2]. The results for moisture and fiber were in line with the results reported by [13] that carried out nutritional analysis for selected cultivars of rice in Pakistan. The present research was also in reported range i.e., 4.42% to 12.6 % and was matching to the results reported for other rice agreements [14-17]. The average fiber range for rice was between 0.5%-1.0% [11].

The ash analysis depicts the basic knowledge regarding essential micro-nutrients. The acceptable ash content of rice scientific community is among 0.3% to 0.8% based on

Table 1. Proximate Analysis of Rice Local cultivars

	A1	A2	B1	B2
Moisture	8.67+0.01	7.96+0.01	12.6+0.01	4.42+0.01
Ash	1.870+0.02	2.31+0.01	2.49+0.01	2.17+0.01
Protein	4.9+0.02	3.78+0.01	2.94+0.01	0.84+0.01
Fat	0.37+0.01	0.24+0.01	0.42+0.01	0.34+0.01
Fiber	0.4+0.02	0.10+0.01	0.5+0.01	0.19+0.01
NFE(Cellulose)	84.16+0.01	85.85+0.01	81.47+0.01	92.38+0.01
Energy Value. (Kcal)	359.57+0.01	360.68+0.01	341.42+0.01	375.94+0.01

* A1: Unprocessed Kainat, A2: Processed Kainat, B1: Unprocessed Garma, B2: Processed Garma

different milling techniques. Ash analysis for rice, which is another nutritional parameter, showcased the mineral elements of selected rice cultivars [16]. Ash content for the present study slightly differed as reported by [18], the possible reason is the difference of locations and local cultivars.

Protein, Fat and Fiber content also matched to those which were reported by Oko AO, Ugwu SI (2011) and Oko AO, Onyekwere SC. (2010) who studied the proximate and mineral analysis for different cultivars [9-10].

Protein content is also an integral portion when it comes to the nutritional analysis of rice. Research has proven that rice consists of Protein up to 8 % [19-21]. Amino acid sequencing provides distinct superior characteristics to the nutritional profile. Studies have shown that rice contains eight of the essential amino acids due to which special benefit is obtained after consumption. The conducted study showed that protein contents were in-line with some findings [9-10]. The study was compared with Mbatchou VC, Dawda S. (2013), Oko AO *et al.*, (2012) and Rohman A *et al.*, (2014) were found near to and in range [15, 22-23].

Being a best source of essential fatty acids like linoleic fatty acid, the variation in fat content is generally due to difference of varieties and processing techniques. Unsaturated fatty acids are present in rice and hence they are subjected to oxidation when comes intact with atmospheric Oxygen [24]. The results of this study were compared with other studies and were found in range or close [10, 12-13, 15-16, 19-20].

Rice is rich in carbohydrates and is the best source of starch comprising amylose and amylopectin. The carbohydrate level of the present study was compared and in range reported by [20].

The result of this study was compared and it revealed that the carbohydrate level is in-line with the reported ones [10, 13, 17, 22-23, 25]. Starch when present in a high amount makes the rice grains stick to each while stickiness of rice grains is prevented when starch level is low after when it is cooked [16].

The energy levels for each of the processed and unprocessed were also near to and in range determined by [26].

4. CONCLUSION

It was evident from the study that both the local cultivars i.e., Kainat and Garma were high in Carbohydrates. The fiber content was observed very low in both the local cultivars and hence it can't help in the starvation. Compared to Garma, Kainat showed a variation in protein content both processed and unprocessed. It can be considered as a good indicator for the food material in human food. This research recommends to analyze the essential minerals which can help in identification of micronutrients essential for our daily intake.

5. ACKNOWLEDGEMENT

NA

6. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

7. SOURCE/S OF FUNDING

No source of funding

8. REFERENCES

1. IRR, (2013). Trends in global rice consumption: Rice Today. *International Rice Research Institute, Manila*, Philippines.**12**: 1.
2. Zaman K, Tokuzo M, Shuji H, (2001). The Role of Rice Processing Industries in Bangladesh: A Case Study of the Sherpur District. **57**: 121–133
3. Mendis, A. (2006) Sri Lanka Grain and Feed Annual. USDA Foreign Agricultural Service Global Agricultural Information Network, p. 3-4.
4. Fari MJM, Rajapaksa D, Ranaweera KKDS (2011). Quality characteristics of noodles made from selected varieties of Sri Lankan rice with different physicochemical characteristics. *Journal of National Science Foundation Sri Lanka.* **39**: 53- 60.
5. Giri, CC, Laxim V (2000). Production of transgenic rice with agronomical useful genes: an assessment. *Journal of Advances in Biology.* **18**: 653-683.
6. AOAC (2004) Official Methods of Analysis (15th edition). Association of official analytical chemists, Washington, D. C., U.S.A.
7. FAO (2004) Rice is life. Food and Agricultural Organization of the United Nations, Rome, Italy.
8. Anjum FM, Pasha I, Bugti MA, Butt MS (2007) Mineral composition of different rice varieties and their milling fractions. *Pak. J. Agri. Sci*., **44*(2)***,
9. Zubair, M. A., Rahman, M. S., Islam, M. S., Abedin, M. Z., & Sikder, M. A. (2015). A Comparative Study of The Proximate Composition of Selected Rice Varieties in Tangail, Bangladesh. *Journal of Environmental Science and Natural Resources*, **8*(2)***, 97-102.
10. Oko AO, Ugwu SI (2011) 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
11. Oko AO, Onyekwere SC. (2010) Studies on the proximate chemical composition and mineral element contents of five new lowland rice varieties in Ebonyi State. *Int J Biotechnol Biochem*, **6*(6)***: 949–955.
12. Adair CR, Bollich CN, Bowman DH, Joson NE, Johnston TH, Webb BD, Atkins JG. (1973) Rice breeding and testing method in the United States. In: Rice in the United States: Varieties and Production. Department of Agriculture of the United States: 22–27.
13. Saikia S, Dutta H, Saikia D, Mahanta CL. (2012) Quality characterization and estimation of phytochemical content capacity of aromatic pigmented and non-pigmented rice varieties. *Food Res Int*, **46*(1)***: 334–340.
14. Asaduzzaman M, Haque ME, Rahman J, Hasan SM K, Ali MA, Akter MS, Ahmed M. (2013) Comparisons of physiochemical, total phenol, flavonoid content and

functional properties in six cultivars of aromatic rice in Bangladesh. *Afr J Food Sci*, **7*(8)***: 198–203.

15. Mbatchou VC, Dawda S. (2013) The nutritional composition of four rice varieties grown and used in different food preparations in Kassena-Nankana district, Ghana. *Int J Res Chem Environ*, **3*(1)***: 308–315.
16. Thomas R, Wan-Nadiah WA, Bhat R. (2013) Physiochemical properties, proximate composition, and cooking qualities of locally grown and imported rice varieties marketed in Penang, Malaysia. *Int Food Res J*, **20*(3)***: 1345–1351.
17. Shayo NB, Mamiro P, Nyaruhucha CNM, Mamboleo T. (2006) Physico-chemical and grain cooking characteristics of selected rice cultivars grown in Morogoro. *Tanz J Sci*, **32*(1)***: 29–36.
18. USDA (United State Department of Agriculture). 2004. Agricultural Research Service. USDA Nutrient Database for Standard Reference Retrieved January 25, 2015. Retrieved from: https://ndb.nal.usda.gov/ndb/
19. Sompong R, Siebenhandl-Ehn S, Linsberger-Martin G, Berghofer E. (2011) Physicochemical and antioxidant properties of red and black rice varieties from Thailand, China and Sri Lanka. *Food Chem*, **124*(1)***: 132–140.
20. Juliano BO. (1985) Factors affecting nutritional properties of rice protein. *Trans Nat Acad Sci Technol*, **7**: 205–216.
21. FAO. (1970) Amino Acid Content of Foods and Biological Data on Proteins. Rome Nutrition Division: FAO, 122.
22. Oko AO, Ubi BE, Efisue AA, Dambaba N. (2012) Comparative analysis of the chemical nutrient composition of selected local and newly introduced rice varieties grown in Ebonyi State of Nigeria. *Int J Agric Forest*, **2*(2)***: 16–23.
23. Rohman A, Helmiyati S, Hapsari M, Larasati Setyaningrum D. (2014) Rice in health and nutrition. *Int Food Res J*, **21*(1)***: 13–24.
24. Hirokadzu T, Harue T, Keishi F. (1979) Influence of cropping season on lipid content and fatty acid composition of lowland non-glutinous brown rice. *Jpn J Crop Sci*, **48*(3)***: 371–377.
25. Subudhi H, Meher J, Singh ON, Sharma SG, Das S. (2013) Grain and food quality traits in some aromatic long and short grain rice varieties of India. *J Food Agric Environ*, **11**: 1434–1436.
26. Rohilla, R., Singh, V. P., Singh, U. S., Singh, R. K., & Khush, G. S. (2000). Crop husbandry and environmental factors affecting aroma and other quality traits. *Aromatic rices*, 201-216.