The Pharma Innovation Journal 2021; 10(5): 337-340

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(5): 337-340

www.thepharmajournal.com
Received: 07-03-2021
Accepted: 29-04-2021

Shingote AB
Department of Food Process Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Sadawarte SK
Department of Food Process Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Pawar VS
Department of Food Process Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Gaikwad KK
Department of Food Process Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
Shingote AB
Department of Food Process Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Studies on chemical and mineral evaluation of raw rice, sorghum, ragi and green gram

Shingote AB, Sadawarte SK, Pawar VS and Gaikwad KK

Abstract
The rice, sorghum, ragi and green gram are some commonly used but very nutritious ingredients of many food products. The combination of cereals and pulses forms complete food for human beings. The combinations of these four ingredients can be used to improve specific or overall quality of diet or processed products. Each of the selected material has some nutritional advantage and the use of various combinations of them can help to reduce problem of malnutrition.
The locally available varieties of selected materials were collected from the local market of Marathwada region of Maharashtra and analysed methodologically by using standard AOAC (2005) methods and proximate analysis of samples was carried out.
The study was carried out to evaluate proximate chemical and mineral composition of raw rice, sorghum, ragi and green gram and then values are compared to decide which ingredient is richest for a nutrient. Obtained results showed that rice and sorghum have highest carbohydrates as 79.6% and 74.4% respectively and Green gram has highest protein content 22.74% and ash as 3.98% among taken samples. Whereas ragi has highest crude fibre in amount 4%. But all have fat content varying between 0.4 to 1.8%. When major minerals were analysed, sorghum is found as richest source of phosphorous, potassium, magnesium and sodium as 532mg/100g, 566mg/100g, 208mg/100g and 32mg/100g respectively. Ragi proved as richest source of calcium, manganese and iron as 351mg/100gm, 5.92mg/100g and 3.88mg/100g respectively and green gram has highest iron as 9.53mg/100g as compared to other 3 samples. Rice found poor source of all minerals.

Keywords: Chemical properties, rice, sorghum, ragi, green gram, proximate composition, minerals

Introduction
Rice is the world's single most important foodstuff and used as the staple food all over the world. Rice feeds more than half of world population. Being a high energy or high calorie food, Rice is a part of balanced diet. High Biological Value proteins are present in rice. According to International Rice Research Institute, Phillipines, the rice should be having more nutritional value so humans can get more health benefits.
Rice has major contribution in prevention of diseases such as high blood pressure, heart disease, Alzheimer's disease, skin care. It also provides instant energy, and provides vitamin B_1 to human body (Verma and Shukla, 2011) [1].
Sorghum (*Sorghum bicolor* (L.) Moench) is the king of millets and is one of the important food crops in dry lands of tropical Africa, India and China. In India, sorghum is one of staple food crops of many states and is consumed by a large section particularly in the non-irrigated dry land areas with low rainfall. It is grown especially in the arid and semi-arid regions. The major sorghum production areas today include great plains of North America, sub-Saharan Africa, north eastern China and the Deccan plateau of central India, Argentina, Nigeria Egypt and Mexico (Awika and Rooney, 2000) [2]. Like other plant proteins, sorghum protein quality is poor. Inadequate intake of good quality proteins is an important factor responsible for the widespread prevalence of protein energy malnutrition. (Salunkhe *et al*., 1977; Hulse, 1979)[3,4]. Protein quality and essential amino acid profile of sorghum is better than many of the cereals and millets. Sorghum in general is rich source of fibre and B-complex vitamins (Gopalan *et al*., 2000; Patil *et al*., 2010) [5, 6].
Finger millet, also known as ragi (Takhellambam *et al*., 2016) [7] or tamba (Jideani, *et al*., 1996) [8], is consumed without dehulling (Gull *et al*., 2015) [9]. The grains are staple cereal food in some parts of Africa and India (Saleh *et al*., 2013; Siwela *et al*., 2010) [10,11]. Although a gluten-free grain with a low-glycemic index with nutritional and nutraceutical advantages, Finger Millet is neglected and underutilized (Amadou *et al*., 2013; Jideani and Jideani, 2011) [12, 13].

The grains contain a high amount of calcium which is an essential macro-nutrients necessary for growing children, pregnant women and the elderly. This is due to calcium's importance for normal growth of body tissue such as strengthening bone and teeth. Finger millet has also been reported to be rich in essential amino acids, such as methionine, tryptophan and lysine (Jideani, 2012) [14].

Green gram (*Vigna radiata* L.) is consider as principal pulse crop which is more common in Southeast Asia, Central Africa, the warmer parts of China and the United States. Green gram seeds are more digestible than other pulses due to lower content of raffinose, stachyose and oligosaccharides associated with the flatulence and intestinal disorders. Pulses are the major source of protein of the human dietary system and cultivated under variety of growing conditions. They are globally popular as they constitute essential source of dietary calories. They are majorly consumed as staple foods specifically in Asian dietaries (Tilekar *et al.*, 2019) [15].

Materials and Methods

The present investigation was carried out in Department of Food Process Technology, College of Food Technology, VNMKV, Parbhani during year 2020-21.

Materials

The good quality of rice, sorghum, ragi and green gram were procured from Parbhani local market.

Chemicals and Glasswares

Chemicals of analytical grade and glasswares used during study was available in the department of Food Process Technology, College of Food Technology VNMKV Parbhani.

Methods

Analytical methods

The grains were analysed for the chemical composition namely moisture, protein, fat, ash, crude fibre and minerals composition were carried out as per the method given by (AOAC, 2005) [16]. Nutrients were analysed in duplicate and results were expressed on dry weight basis.

Proximate analysis

Different chemical properties of samples were analysed for moisture content, ash, fat, protein and total carbohydrate. All the determinations were done in triplicate and the results were expressed as the average value.

Moisture content

Moisture content was determined as per the method given by AOAC (2005) [16]. It was calculated using following formula:

$$\% \text{ Moisture content} = \frac{\text{Loss in weight}}{\text{Weight of sample}} \times 100$$

Fat

AOAC (2005) [16] method using Soxhlet apparatus was used to determine crude fat content of the sample. The percent of crude fat was expressed as follows:

$$\% \text{ Crude Fat} = \frac{\text{Weight of oil}}{\text{Weight of sample}} \times 100$$

Protein

Protein content was determined using AOAC (2005)[16] method. Percentage of nitrogen and protein calculated by the following equation:

$$\% \text{ Nitrogen} = \frac{TS - T_B \times \text{Normality of acid} \times 0.014}{\text{Weight of sample}} \times 100$$

Where, Ts = Titre volume of the sample (ml),
TB = Titre volume of Blank (ml), 0.014= M eq. of N
% Protein = Nitrogen × 6.25

Total carbohydrate

Total carbohydrate content of the samples was determined as total carbohydrate by difference that is by subtracting the measured protein, fat, ash and moisture from 100 phenol sulphuric acid method as given by AOAC (2005) [16].

Ash

Drying the sample at 100 ºC and churned over an electric heater. It was then ashes in muffle furnace at 550ºC for 5 hrs. It was calculated using the following formula:

$$\% \text{ Ash content} = \frac{\text{Weight of ash}}{\text{Initial Weight of sample}} \times 100$$

Determination of minerals

Two grams of defatted sample was weighed and heated at 550 ºC. Then, the obtained ash was digested with concentrated Hydrochloric acid (HCL) on hot plate. The digested material was then filtered using whatman No. 42 filter paper and the final volume made to 100ml with distilled water that was further used for analysis with respects to minerals contents by using methods of AOAC (2005) [16].

Chemical properties of rice and sorghum

Data pertaining to various chemical properties like moisture, fat, carbohydrates, protein, ash, and crude fiber were investigated and results obtained are depicted in Table 1.

Table 1: Proximate chemical composition of rice and sorghum

Chemical Parameters	Rice	Sorghum
Moisture (%)	11.3 ± 1.2	10.1 ± 1.0
Total Fat (%)	0.4 ± 0.01	1.8 ± 0.05
Total carbohydrates (%)	79.6 ± 1.8	74.4 ± 0.50
Total Protein (%)	7.0 ± 0.3	10.4 ±0.42
Ash (%)	1.5 ± 0.03	2.10 ± 0.01
Crude Fibre (%)	0.2 ± 0.01	1.3 ± 0.02

*Each value represents the average of three determinations

Results given in above Table 1 indicated that the mean value for moisture, fat, carbohydrate, protein, ash and crude fibre content of raw rice found as 11.3%, 0.4%, 79.6%, 7.0%, 1.5%, and 0.2% respectively (Verma and Shukla, 2011) [1] and of raw sorghum found as 10.1%, 1.8%, 74.4%, 10.4%, 2.10%, 1.3% respectively. Results reported are in close agreement with these findings of (Onoja *et al.*, 2014; Singh *et al.*, 2015) [17, 18].

Chemical properties of ragi and green gram

Data pertaining to various chemical properties like moisture,

fat, carbohydrates, protein, ash, and crude fiber were investigated and results obtained are depicted in Table 2.

Table 2: Chemical composition of ragi and green gram

Chemical Parameters	Ragi	Green Gram
Moisture (%)	13.2 ± 0.7	9.96 ± 0.07
Total Fat (%)	1.2 ± 0.1	1.73 ± 0.05
Total carbohydrates	70.8 ± 2.0	57.54 ± 0.9
Total Protein (%)	8.1 ± 0.04	22.74 ± 0.3
Ash	2.9 ± 0.01	3.98 ± 0.02
Crude Fibre	4.0 ± 0.05	3.97 ± 0.01

*Each value represents the average of three determinations

Results given in above Table 2 indicated that the mean value for moisture, fat, carbohydrate, protein, ash and crude fibre content of raw ragi found as 13.2%, 1.2%, 70.8%, 8.1%, 2.9%, and 4.0% respectively (Gopalan *et al*., 1976; Shobana *et al*., 2013)[19,20] and of raw green gram found as 9.96%, 2.16%, 57.54%, 22.74%, 3.98%, 3.97% respectively. Results reported are in close agreement with these findings of (Kamboj and Nanda., 2017; Tiwari *et al*., 2017; Tilekar *et al*., 2019) [21, 22, 15].

Mineral analysis of rice, sorghum, ragi and green gram

Data pertaining to various chemical properties like calcium, phosphorus, potassium, magnesium, iron, sodium, manganese and zinc were investigated and results obtained are depicted in table 3

Table 3: Mineral composition of rice, sorghum, ragi and green gram

Mineral	Rice (mg/100g)	Sorghum (mg/100g)	Ragi (mg/100g)	Green gram (mg/100g)
Calcium (Ca)	22	39	351	85
Phosphorus (P)	90	532	278	391
Potassium (K)	6	566	411	341
Magnesium (Mg)	-	208	136	57
Iron (Fe)	0.8	4.14	3.88	9.53
Sodium (Na)	-	32	10	9
Manganese (Mn)	-	1.70	5.92	1.5
Zinc (Zn)	-	1.52	2.2	-

*Each value represents the average of three determinations

Results given in above Table 3 indicated that rice is poor source of minerals compared to other 3 materials. It only contains phosphorous and calcium in trace amounts and results are in close accordance with findings of (Verma and Shukla, 2011) [1].

Sorghum is found as richest source of phosphorous, potassium, magnesium and sodium in amounts 532mg/100g, 566mg/100g, 208mg/100g and 32mg/100g respectively compared to other 3 materials. Sorghum also found as fair source of other minerals. These results were in close agreement with (Chavan *et al*., 2009) [23].

Ragi contains all the minerals in good amounts and proved as richest source of calcium and manganese as 351mg/100gm, 5.92mg/100g respectively compared to other 3 samples. Ragi is also a very good source of minerals like phosphorous and potassium in amounts 278mg/100g, and 411mg/100g respectively. Results are in close accordance with findings of (Gopalan *et al.*, 2004; 1999) [24, 25].

Green gram is richest source of iron among all as 9.53mg/100g among all. Fair amounts of phosphorus and potassium are also present. Results are in close agreement with (El-Adawy, 1996) [26].

Conclusion

Overall it can be concluded that the importance of studying chemical properties is considered as the basic data in their use in various food products according to nutritional value as base ingredients, for fortification or to modify carbohydrates, protein, fibre and mineral content of food. In present investigation chemical properties of rice, sorghum, ragi and green gram were studied.

References

1. Verma D, Shukla K. Nutritional value of rice and their importance. Indian Farmer's Digest 2011, 44(1).
2. Awika JM, Rooney LW. Sorghum phytochemicals and their potential aspects on human health. Phytochemistry 2004;65:1199-1221.
3. Salunkhe DK, Kadam SS, Chavan JK. Nutrition quality of proteins in grain sorghum. Qualitas Plantarum 1977; 27:187-205.
4. Hulse JH. Polyphenols in cereals and legumes. proceeding of a symposium held during the 36th annual meeting of the institute of food technologists, St. louis, Missouri 1979, 10-3.
5. Gopalan C, Sastry BV, Balsubramanyam SC. Nutritive value of Indian foods. National Institute of Nutrition. I.C.M.R., Hyderabad 2000.
6. Patil PB, Sajjanar GM, Biradar BD, Patil HB, Devarnavadagi SB. Technology of hurda production by microwave oven. Journal of Dairying, Foods and Home Sciences 2010;29:232-236.
7. Takhellambam RD, Chimmand BV, Prakasam JN. Ready-to-cook millet flakes based on minor millets for modern consumer. Journal of Food Science and Technology 2016;53(2):1312-1318.
8. Jideani IA, Takeda Y, Hizukuri S. Structures and physiochemical properties of Acha (*Digitaria exilis*), iburu (*D. iburua*) and Tamba (*Eleusine coracana*). Cereal Chemistry 1996;73(6):77-685.
9. Gull A, Kmalesh P, Kumar P. Optimisation and functionality of millet supplemented pasta. Food Science and Technology 2015;35(4):626-632.
10. Saleh SM, Zhang Q, Chen J, Shen Q. Millet grains, nutritional quality, processing and potential health benefifits. Comprehensive Reviews in Food Science and Technology 2013;12:281-295.
11. Siwela M, Taylor JNR, de Milliano WAJ, Doudu KG. Influence of phenolics in fifinger millet on grains and malt fungal load, and malt quality. *Food Chemistry*. 2010;121:443-449.
12. Amadou I, Mahamadou EG, Le GW. Millets, Nutritional composition, some health benefits and processing - A Review. Food Science and Technology. 2013;25(7):501-508.
13. Jideani IA, Jideani VA. Developments on the cereal grains *Digitaria exilis* (acha) and *Digitaria iburua* (iburu). Journal of Food Science and Technology. 2011;48(3):251-259.
14. Jideani IA. *Digitaria exilis* (acha/fonio), *Digitaria iburua* (iburu/fonio) and *Eleusine coracana* (tamba/fifinger millet) - Non-conventional cereal grains with potentials. Scientific Review and Essays 2012;7(45):3834-3843.
15. Tilekar RD, Oswal M, Ayenampudi SB, Rangarajan J. Effect of soaking time on sprouting and rheological properties of green gram. International Journal of Pure Applied Bioscience 2019;7(3):181-188.

16. AOAC. Official Methods of Analysis of A.O.A.C International.18th Edition 2005.
17. Onoja US, Akubo PI, Gernar DI, Chinmma CE. Evaluation of complementary food formulated from local staples and fortified with calcium, iron and zinc. Journal of Nutrition and Food Sciences 2014;4(1):3-6.
18. Singh E, Jain KP, Sharma S. Effect of different household processing on nutritional and antinutritional factors in *Vigna aconitifolia* and *Sorghum bicolour* (L.) Moench seeds and their product development. Journal of Medical Nutrition and Nutraceuticals 2015;4(1):95-100.
19. Gopalan C, Ramasastri BV, Balasubramanian SC. Nutritive value of Indian foods Hyderabad, India: National institute of nutrition. Indian Council for Medical Research 1976.
20. Shobana S, Krishnaswamy K, Sudha V, Malleshi NG, Anjana RM, Palaniappan L *et al*. Finger millet (Ragi, *Eleusine coracana* L.): a review of its nutritional properties, processing, and plausible health benefits. *Advanced Food Nutrition Res*earch 2013;69:1-39.
21. Kamboj R, Nanda V. Proximate composition, nutritional profile and health benefits of legumes – A review. Agricultural Research Communication Centre 2017.
22. Tiwari AK, Shivhare AK, Vinay K. Mung bean production technology. Ministry of Agriculture and farmers Welfare, Department of Agriculture cooperation and farmer's welfare, Directorate of pulses development, Bhopal (Madhya Pradesh) 2017.
23. Chavan UD, Patil JV, Shinde MS. Nutritional and roti quality of sorghum genotypes. Indonesian Journal of Agricultural Science 2009;10(2):80-88.
24. Gopalan C, Ramashastri BV, Balasubramanium SC. Nutritive value of Indian foods. Hyderabad: National institute of nutrition (NIN), Indian council of medical Research 2004, 59-67.
25. Gopalan C, Sastri R, Subramaniam B. Nutritive values of Indian foods. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research 1999.
26. El-Adawy TA. Chemical, nutritional and functional properties of mung bean protein isolate and concentrate. Menufifiya Journal of Agricultural Research, 1996;21(3):657-672.