Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(3): 1871-1874
Received: 08-03-2020
Accepted: 10-04-2020

Hemamalini Ch
Agricultural Research Station, Vizianagaram Acharya NG. Ranga Agricultural University, Andhra Pradesh, India

Patro TSSK
Agricultural Research Station, Vizianagaram Acharya NG. Ranga Agricultural University, Andhra Pradesh, India

Anuradha N
Agricultural Research Station, Vizianagaram Acharya NG. Ranga Agricultural University, Andhra Pradesh, India

Triveni U
Agricultural Research Station, Vizianagaram Acharya NG. Ranga Agricultural University, Andhra Pradesh, India

Jogarao P
Agricultural Research Station, Vizianagaram Acharya NG. Ranga Agricultural University, Andhra Pradesh, India

Sandhya Rani Y
Agricultural Research Station, Vizianagaram Acharya NG. Ranga Agricultural University, Andhra Pradesh, India

Corresponding Author:
Hemamalini Ch
Agricultural Research Station, Vizianagaram Acharya NG. Ranga Agricultural University, Andhra Pradesh, India

Estimation of nutritive composition of seven small millets

Hemamalini Ch, Patro TSSK, Anuradha N, Triveni U, Jogarao P and Sandhya Rani Y

Abstract
Small millets are one of the underutilized groups of cereal grains. Millets are considered as rich source of energy, carbohydrate and protein as compared to other cereals but have more calcium, iron, dietary fibre and Vitamin E content. The presence of dietary fibre and phenolic compounds in small millets help in the prevention of many diseases such as diabetes, cardiovascular diseases and cataractogenesis. Different types of millets were analyzed for their nutritive values and the study resulted that Foxtail Millet is rich source of protein with a value of 14%, brown top Millet is rich source of fibre and zinc with values of 16.08% and 66.10mg respectively. Iron content is rich in Kodo millet with a value of 206.5mg and Calcium content is rich in Finger millet with a value of 3811.98mg.

Keywords: Small Millets, Proximate composition, Minerals, Energy, Fibre

Introduction
Small Millets are one of the oldest foods known to humans and possibly the first cereal grain to be used for domestic purposes. Millets are small-seeded grasses that are hardy and grow in dry zones as rain-fed crops, under marginal conditions of soil fertility and moisture (Himanshu *et al.*, 2018). Millets are one of the cereals asides the major wheat, rice and maize. They are grown mostly in marginal areas under agricultural conditions in which major cereals fail to give substantial yields.

Small Millets are important foods in many underdeveloped countries because of their ability to grow under adverse weather conditions like limited rainfall. In contrast, millet is the major source of energy and protein for millions of people in Africa (Issoufou *et al.*, 2013) [7]. Millet is a very important crop with following characteristics: millet is known to be a drought-resistant crop, resistance to pests and diseases, short growing season as compared to other major cereals. Millets are unique among the cereals because of their richness in calcium, dietary fibre, protein and polyphenols (Devi *et al*., 2011) [4].

Nutritional quality of food is the most important parameter for maintaining human health and complete physical wellbeing. Some of the agricultural foods are not using as human main food because of unawareness of people. Millets are one of them. Millets are being used as animal and bird feed. Millet has many nutritious and medical functions. These are underutilized and neglected crop because of little knowledge to people and some critical problems like lower cooking quality, taste and low bioavailability of millets. These problems can be solved and make them valuable as food for poor families to combat malnutrition and important source of income (Sarita and Ekta Singh, 2016) [13].

Small Millets are highly nutritious, non-glutinous and non-acid forming foods. Hence they are soothing and easy to digest. They are considered to be the least allergenic and most digestible grains available. Millets contain about 8 per cent protein and 4 per cent fat. They are rich source of vitamins and minerals. Millets are especially rich in calcium.

The dietary carbohydrate content of millets is also relatively high. Although a considerable portion of nutrients is concentrated in the seed coat, the bioavailability of nutrients present in the endosperm is higher than the seed coat nutrients. Anti-nutritional factors such as phytates and polyphenols are also present in millets but they are mostly confined to the seed coat and the milled millets are generally free from the anti-nutritional factors (Kumar, 2010) [9].

Materials and Methods
Different types of small millets which were grown predominantly in Agricultural Research Station, Vizianagaram were collected for nutritive analysis. The small millets underwent for nutritive analysis were namely Brown top millet (BTAVT6), Banyard millet (VMVC331),

Foxtail millet (SIA-3022), Proso millet (CO5), little millet (OLM-203), Kodo millet (CO3) and Finger millet (VR-847).
All different types of millets were harvested and then cleaned using degrader which is used for removing stones and aspirator which is used for removing sand and other dust particles. Then the cleaned grains were subjected in dehuller for removing husk from the grains, after dehulling rice was obtained from all different types of grains. Once the rice has been obtained from the grains, again the rice was subjected to aspirator to remove the remaining dust particles. After all these process the cleaned rice was obtained.
The cleaned rice varieties of different types of millets each of 200g quantity were packed in the polythene zip lock covers and were sent for nutritive analysis to Quality Control Laboratory, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad. The nutrients analyzed were ash, moisture, protein, fat, crude fibre, energy, iron, zinc and calcium for all different types of millets.

Estimation of Ash
The ash content of the samples was determined by using (AOAC, 2005) [1] method. The temperature of the muffle furnace was set to 600° C and empty crucibles were heated for 1 hour and then cooled in a dessicator and weighed (W1). Two g of defatted sample was weighed into the crucible and weight was noted (W2). The sample was kept on flame for charring and then incinerated at 600°C for 8 hours in muffle furnace. After complete ashing of the sample, crucibles were transferred into the dessicator, cooled and weighed (W3). Incineration was repeated until constant weight was obtained.

Calculation

$$\text{Ash \%} = \frac{weight\ of\ the\ ash}{weight\ of\ the\ sample\ taken} \times 100 = \frac{W3-W1}{W2-W1} \times 100$$

Weight of the sample taken = W2-Wl
Weight of the ash = W3-Wl

Estimation of Moisture
Moisture content of the samples was determined using procedure given by Association of Official Analytical Chemists (AOAC, 2005) [1]. Ten grams of food material was placed in known weight of dry petri dish with lid. Petri dishes were transferred to hot air oven at 100^0C to 105^0C till constant weight was obtained. It was followed by cooling in dessicator for 15 min and the final weight of sample was taken.

Calculation

$$\text{Moisture \%} = \frac{\text{Sample initial Wt (W1)} - \text{Final Wt (W2)}}{Initial\ Wt\ (W1)} \times 100$$

Estimation of Protein
Protein estimation of sample was carried out using Kjeldhal method (AOAC, 2005) [1]. The reagents required are conc. H_2SO_4, digestion mixture, mixed indicator, NaOH. The Kjeldhal method can conveniently be divided into three steps.
1. Digestion
2. Neutralization
3. Titration

0.1 g of sample was weighed into a kjeldhal flask and 0.2 g of the digestion mixture was added and digested in Kelplus – kjeldhal digester with 20 ml of concentrated H_2SO_4 until all the organic matter was oxidized and uniform greenish – blue digest was obtained. The digest was cooled, volume was made up to 100 ml with distilled water. An aliquot of 5 ml was taken for steam distillation in Kelpus distillation unit with excess of 40% NaOH solution (10 ml). The liberated ammonia was observed in 100 ml of 2% boric acid containing a few drops of mixed indicator. This was titrated against N/70 HCl. A simultaneous standard (Anhydrous ammonium sulphate) was done to estimate the amount of nitrogen taken up by N/70 HCl. From the nitrogen content of the sample, the protein content of different samples was calculated by multiplying with a factor of 6.25.

Calculation

$$\text{\% of nitrogen present in given sample} = \frac{\text{Sample titre value} - \text{Blank titre normality of HCl x 14 x 100}}{\text{Sample weight x 1000}}$$

Estimation of Fat
Fat was determined by Soxhlet method (AOAC, 2005) [1]. Two g of sample was accurately weighed into a dry thimble and extracted using petroleum ether (60-80° BP) in a flat bottomed flask and separated from the solvent by evaporating in oven. The flask was dried in an oven at 80^0C-100° C and cooled till constant weight was achieved. Fat content of the samples were expressed as g/100 g of sample. The amount of fat present in given food sample was calculated by the following formula.

Calculation
The amount of fat present in given food sample =

$$\text{\% fat/100g sample} = \frac{\text{Final wt of beaker} - \text{Empty weight of beaker}}{\text{Weight of sample}} \text{ X } 100$$

Estimation of Crude Fibre
The crude fiber content of the samples was determined by using (AOAC, 2005) [1] method. The sample was allowed to boil with 1.25% diluted H_2SO_4, washed with water, further boiled with 1.25% diluted sodium hydroxide and the remaining residue after digestion was taken as crude fiber. One g of moisture and fat free sample was weighed and were kept in the fibre bags. The glass spacer was kept into the bags. The bags were loaded in the sample carousel at the previewed positions (positions 1-12). The sample carousel was put into the glass container carefully. The glass container axial was placed on the previewed position of the hot plate. The programme was started in the Fibretherm (Gerhardt). After completion of the program, the fibre bags were removed. The residue was transferred to crucible and weighed (W1) and dried over night at 80^0C-100^0C in oven. Later it was Transferred to dessicator for cooling and weighed (W2). The crucible was heated in a muffle furnace at 600˚C for 2-3 hours. Then crucible was cooled in desiccators and weighed (W3).

Observations

Weight of the sample = (W1) g

Weight of the crucible + sample before heating at 600^0C = (W2) g

Weight of the crucible + sample after heating at 600^0C = (W3) g

Weight of crude fibre = (W2-W3) g

Calculation

$$\text{Crude fibre (g \%)} = \frac{100-(\text{moisture+fat})\text{X weight of the crude fiber}}{\text{weight of the sample taken(moisture and fat free) W1}}$$

Estimation of Energy

Energy was determined by multiplying the protein, fat and carbohydrate values with 4, 9 and 4 respectively and totaling them (Gopalan *et al*., 2004) [5].

Calculation

Energy (k.cal/ 100 g of rice) = (%protein*4) + (%CHO*4) + (% fat*9)

Estimation of Calcium

Calcium content of the samples were determined using titrimetric method (Siong *et al*., 1989) [14]. Chemicals required for estimating calcium were 0.01 $KMNO_4$, 0.01N Oxalic acid, 2N H_2SO_4, Standardize 0.01 $KMNO_4$, 0.1% Methyl red indicator, 20% ammonia, 10% acetic acid, 6% ammonium oxalate and Wang's wash.

5 ml of mineral solution was taken in a 15 ml centrifuge tube. 2ml of water and a drop of methyl red indicator was added. Ammonium hydroxide was added dropwise till the pink colour disappears and then acetic acid was added drop wise till faint pink colour appears. The solution was shaked well and 1ml of 6% ammonium oxalate was added. The solution was mixed thoroughly and allowed to stand for an hour. The tube was centrifuged and inverted on a blotting paper for 5 minutes. The precipitate was washed with 4ml of wang's wash solution thoroughly. The centrifuging process was repeated. The precipitate was dissolved in 2ml of 2N H_2SO_4. The solution was heated in a water bath up to 70-75˚C and titrated against 0.01N $KMnO_4$ (while the solution is still hot) till the end point (faint pink colour) appears.

Calculation

$$\text{Titer value x} = \frac{\text{Total volume of mineral solution}}{\text{Volume used for estimation}} \text{ x } \frac{100}{\text{wt.of the sample taken for ashing}} = \text{mg}/100$$

Estimation of Iron

Iron content of the samples were determined using α-α dipyridyl method. The reagents required are 2, 2 dipyridyl, Hydroxylamine hydrochloride, Acetate buffer and Iron standard solution.

0.2-1.0 ml (20-100mg) of standard iron solution was taken in five separate test tubes. 2ml and 4ml of mineral solution was taken in 2 separate test tubes. 1ml hydroxylamine hydrochloride was added and mixed thoroughly and 5ml of acetate buffer and 2ml dipyridyl was added into all the test tubes. The volume was made to 25ml by adding the required amount of double distilled water and mixed thoroughly. The absorbance was read at 510nm and graph was plotted with Concentration of iron on X-axis and OD values on Y-axis.

Calculation

Iron mg %=X × 50÷ 2× 100÷ 100÷sample weight

Results and Discussion

Small millets namely Brown top millet (BTAVT6), Banyard millet (VMBC331), Foxtail millet (SIA-3022), Proso millet (CO5), Little millet (OLM-203), Kodo millet (CO3) and Finger millet (VR-847) were analyzed for their nutritive values such as ash, moisture, protein, fat, crude fibre, energy, iron, zinc and calcium. The nutritive composition of millets were presented in Table 1.

Table 1: Nutritive Composition of Millets

Name of the Millet	Ash (%)	Moisture (%)	Protein (%)	Fat (%)	Crude Firbre (%)	Energy (kcal)	Iron (mg)	Zinc (mg)	Calcium (mg)
Brown top Millet (BTAVT6)	8.62	7.32	11.64	5.28	16.08	362.64	178.54	66.10	3266.27
Banyard Millet (VMVC331)	6.15	7.78	10.29	3.87	14.07	363.63	163.50	47.64	2661.68
Foxtail Millet (SIA-3022)	2.95	7.69	14.00	4.46	10.53	357.44	99.30	53.60	737.50
Proso Millet (CO5)	5.05	8.85	11.06	2.05	14.91	354.65	158.92	44.12	2649.14
Kodo Millet (CO3)	3.03	8.06	8.38	3.42	14.94	372.74	206.5	36.30	2724.76
Little Millet (OLM-203)	4.77	8.56	8.94	3.10	7.40	362.18	109.94	33.02	1894.66
Finger Millet (VR-847)	3.62	7.68	7.3	1.3	3.9	351.92	35.50	24.70	3811.98

The percentages of ash, moisture, protein, fat, energy, iron and calcium of brown top millet were 8.62, 7.32, 11.64, 5.28, 362.64kcal, 178.54mg and 3266.27mg respectively. Brown top Millet is the richest source of fibre and zinc with values of 16.08g/100g and 66.10mg/100g. Singh and Chauhan (2019) [13] studied that high fibre content makes the millet to have low glycemic index and hence a better option for diabetic patients. The resistant starch contributes towards dietary fibre, which acts as a prebiotic and hence enhances the health benefits of brown top millet.

Banyard millet had 6.15% of ash, 7.78% of moisture, 10.29% of protein, 3.87% of fat, 14.07% of fibre, 363.63 kcal of energy, 163.50mg of iron, 47.64mg of zinc and 2661.68mg of calcium. (Roopashree *et al.*, 2014) [11] in their study reported that banyard millet had 10.5% of protein, 3.6% of fat, 68.8% of carbohydrate and 398 kcal of energy.

Foxtail millet is highly nutritious and grains of foxtail millet have low glycemic index. The protein content of foxtail millet is higher among all millets with a value of 14g. Hariprasanna (2016) [6] reported that foxtail millet has a protein content of 12.3%. Results revealed that foxtail millet has an ash content of 2.95%, moisture of 7.69%, protein of 14%, fat of 4.46%, fibre of 10.53%, energy of 357.44kcal, iron of 99.30mg, zinc of 53.60mg and calcium of 737.50mg.

Proso millet showed a protein content of 12.5%, fat content of 3.1%, fibre content of 14.2% and phosphorous content of 206mg (Cedric *et al*., 2017) [2]. The results revealed that proso millet has 5.05% of ash, 8.85% of moisture, 11.06% of

protein, 2.05% of fat, 14.91% of fibre, 354.65 kcal of energy, 158.92mg of iron, 44.12mg of zinc and 2649.14mg of calcium. Among all millets proso millet showed a high moisture percent of 8.85.

Kodo millet has 3.03 percent of ash, 8.06 percent of moisture, 8.38 percent of protein, 3.42 percent of fat, 14.94 percent of crude fibre, 372.74 kcal of energy, 206.5mg of iron, 36.3mg of zinc and 2724.76mg of calcium. Deshpande *et al* (2015) reported that kodo millet contains 66.6g of carbohydrate, 353 Kcal of energy, 1.4 percent of fat and 190mg of iron. Among all the millets kodo millet has high iron content of 206.5mg and 372.74 kcal of energy.

The ash, moisture, protein, fat, crude fibre, energy, iron, zinc and calcium of little millet were 4.77%, 8.56%, 8.94%, 3.10%, 7.40%, 362.18 kcal, 109.94mg, 33.02mg and 3811.98mg respectively. Mallikarjun *et al*. (2013) [10] reported that little millet showed 4.74% of ash content, 5.78% of moisture content, 7.07% of protein content, 4.64% of fat content and 377 kcal of energy.

The study reported that finger millet is the richest source of calcium content with a value of 3811.98mg/100g when compared to other millets. Finger millet is good for infants, elderly and pregnant women due to its high calcium content. It is also very good for lactating women as it helps in producing sufficient breast milk (Kimeera and Sucharitha, 2019) [8]. Finger millet provides 351.92 kcal of energy, 35.50mg of iron and 24.70mg of zinc.

References

1. AOAC. Association of Official methods of Analytical Chemists. International.16th 432 edi., supplement 1998. AOAC Washington, Dc. USA, 2005, 25-28.
2. Cedric H, Janet B, Alpoim D, Girish M, Michael R, Kimberlee K *et al*. Proso Millet and Its Potential for Cultivation in the Pacific Northwest, U.S. A Review. Frontiers in Plant Science. 2017; 7(1):1-17.
3. Deshpande SS, Mohapatra D, Tripathi MK, Sadvatha RH. Kodo Millet – Nutritional Value and Utilization in Indian Foods. Journal of Grain Processing & Storage. 2015; 2(2):16-23.
4. Devi PB, Vijayabharathi R, Sathyabhama S, Malleshi NG, Pridarshini VB. Health Benefits of Finger Millet Polyphenols and Dietary Fibre: A Review. Journal of Food Science and Technology, 2011.
5. Gopalan C, Ramsastri BV, Balsubramanian. Nutritive value of Indian foods. National Institute of Nutrition, ICMR, Hyderabad, 2004, 47-69.
6. Hariprasanna K. Foxtail Millet-Nutritional Importance and Cultivation aspects. Indian Farming. 2016; 65(12):25-29.
7. Issoufou A, Mahamadou E, Gou W. Millets: Nutritional composition, some health benefits and processing – A Review. Journal of Food Agriculture. 2013; 25(7):501-508.
8. Kimeera A, Sucharitha KV. Millets-Review on Nutritional Profiles and Health Benefits. International Journal of Recent Scientific Research. 2019; 10(7):33943-33948.
9. Kumar Rekha S, Sinha LK. Evaluation of Quality Characteristics of Soy based Millet Biscuits. Advances in Applied Science Research. 2010; 1(3):187-196.
10. Mallikarjun Y, Hemalatha S, Meghana DR, Sharanappa T, Rama K. Evaluation of Little Millet (Panicum Sumatrense) Land Races for Cooking and Nutritional Composition. Current Research in Biological and Pharmaceutical Sciences. 2013; 2(1):7-11.
11. Roopashree U, Bharathi C, Rama N, Pushpa B, Sunanda I. Glycemic Index and Significance of Banyard Millet (Echinochloa Frumentacae) in type II diabetics. Journal of Food Science and Technology. 2014; 51(2):392-395.
12. Shahidi F, Chandrasekhara A. Millet grain phenolics and their role in diseases risk reduction and health promotion. Journal of Functional Foods. 2013; 5(2):570-581.
13. Singh S, Chauhan ES. Role of Underutilized Millets and their Neutraceuticals Importance in the New Era-A Review. International Journal of Scientific Research and Reviews. 2019; 8(2):2844-2857.
14. Siong TE, Wan Choo KS, Shahid SM. Determination of calcium in foods by the titrimetric methods. Division of Human Nutrition. 1989; 12(3):303-311.