



# Proximate composition and phytochemical analysis of little millet (*panicum sumatrense*)

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## Abstract

Little millet (*Panicum sumatrense*) is the minor crops cultivated in India especially it has grown in various regions of Karnataka. Little millet contains several nutraceutical components owing the health benefits against many diseases. Proximate analysis of little millet, was evaluated providing the data that will guide the utilization of grains in food application and used as a nutraceuticals. The proximate analysis of the little millet recorded the moisture content of 6.8%, crude protein 8.87%, crude fibre 7.6%, crude fat 4.76%, crude ash 1.21% and nitrogen free extract (carbohydrates) 70.7%. polyphenol content of methanol, acid methanol, acid methanol heated, aqueous and aqueous heated in little millet was found to be 2.5, 0.9, 0.7, 1.5 and 2.4 mg GAE/g. Tannin content was found to be 0.09% and also estimated the presence of major mineral elements like sodium, potassium, phosphorus, calcium and magnesium were estimated to 11, 262, 252, 22, 129mg/100g dry little millet. The above information may lead to understanding of a balanced basic diet, which may supply all the essential nutrients and minerals in suitable concentration to prevent or manage the metabolic diseases.

**Keywords:** Little millet; proximate analysis; metabolic diseases; polyphenol; mineral

## Introduction

Millets are the small seeded cereals used as a food in the various regions of the world for consumption. Minor millets indicating utilization potential and variability including potential benefits in modern diets. Ignorance of balanced nutrition facts and the life style appears to be a common factor that governs the increased risk of anaemia, Diabetes Mellitus, obesity and cardiovascular disorders. Based on their consumption millets occupy sixth place in the world. Most of the millets are grown in different regions of the world from east to west. Millets have several health benefits as they are the major source of carbohydrates, fibers, protein, minerals, and several other phytochemicals compared to rice or wheat (Hadimani and Malleshi 1993 and Jayaraj *et al*, 1980). Millet are the staple foods in the developing countries and also millet has resistance to pest and diseases compared to cereals (Devi *et al*, 2011). Hence, millets are now gaining attention from developing countries as well as from developed countries (Li *et al*, 2008). Millets can grow in adverse condition due to their sustainability (Ushakumari *et al.*, 2004).

Little millets (*Panicum sumatrense*) are hardy and can grow in adverse condition over various parts of India. They have high nutritional value especially the presence of vitamins (Usha *et al*, 2011). It grown throughout India to a limited extent up to altitudes of 2100 m and it has a similar in habit to the proso millet (FAO, 1995). It can be used as a food by making any recipe as similar as rice. Due to their nutritive value are so rich that any other cereal (Chandrasekara and Shahidi 2011a). Hence millets are the solution for the malnutrition and other health conditions affects the majority of the Indian population.

## Materials and methods

### Collection of samples

Little millet (*Panicum sumatrense*), was obtained from the super market of Tumkur and Kolar, Karnataka, India. The sample was grinded to fine powder and the millet flour powder was sieved by 0.6 mm sieve and stored in dry place for further analysis.

### Chemicals and reagents

Methanol HPLC grade was obtained from Ranbaxy Chemicals. Folin-Ciocalteu's phenol reagent was procured from Qualigens, India. All other chemicals like mineral acids and inorganic chemicals were purchased from SD fine Chemicals.

### 1. Proximate composition analysis of little millet

Proximate composition of a food grain is the relative proportion of moisture, dry matter, crude protein, crude fat, crude fiber, crude ash and carbohydrate, where in carbohydrate content were calculated by difference method. The analysis may be done the percent composition of different constituents were determined with respect to 100 moisture free sample.

### Estimation of moisture content

The moisture content of the sample was estimated by AOAC Method 930.15, 1990. 5g of flour of sample (W) was transferred to pre-weighed, clean and dry aluminium moisture cups (W1) and recorded the weight (W2). The samples containing aluminium moisture cups were transferred to hot air oven at 105<sup>0</sup> C for 3 h and transfer to dessicator to cool. After drying transfer the dish to the dessicator to cool. Reweigh the dish and its dried sample (W3). Using the below formula moisture content of the sample was calculated.

Initial weight of the sample- final weight of the sample

Moisture content - -----X100

Initial weight of the sample

Moisture = 100 - % Dry matter.

### Estimation of crude protein

Protein content of the sample was determined by the Kjeldahl method as modified by AOAC method 981.10. 0.5g of the Sample was digested by heating with concentrated H<sub>2</sub>SO<sub>4</sub> in a digestion block using (K<sub>2</sub>SO<sub>4</sub> and CuSO<sub>4</sub>) catalyst. After digestion, samples were distilled with 10M NaOH. Boric acid (4%) was used to trap ammonia from the distillation and the distillate was titrated with 0.2 NaOH using mixed indicator (Methyl red and bromocresol green in alcohol, 0.1%). Percent nitrogen was used to estimate percent protein concentration by means of a nitrogen-to-protein conversion factor 6.25. The blank reagent was also titrated similarly.

% Protein= (Vol. Acid – Vol. Blank) X 1.4007 X 0.2 N X6.25/g sample.

### Estimation of crude fat

The crude fat in the sample was estimated by described in AOAC Method 920.39, 1990. 5g flour sample (w) was subjected to drying (AOAC Method 934.01, 1990) and the dried sample was transferred to clean and dry extraction thimble, which was packed with glass wool to permit the free flow of solvent. A pre-weighed clean and dry heating flask (w1) was filled with petroleum ether fat was extracted at a condensation rate of 5 to 6 drops per second for 8 hours. After the extraction of fat, the ether was removed by vacuum evaporator and the residual ether was dried in oven at 100°C for 30 min. The flask was then cooled in vacuum desiccator for 2 hr. and recorded the weight (w2).

Percent crude fat was calculated as  $[(w2-w1)/ (w1-w)] \times 100$ .

### Estimation crude fibre

The estimation of crude fibre in little millet was performed by AOAC Method 978.10, 1990. A 2g of the defatted sample was hydrolysed by boiling with 150 ml of 0.25 N H<sub>2</sub>SO<sub>4</sub> for 30 min. The suspension was filtered, washed with hot distilled water and the residue obtained was hydrolysed by boiling with 150 ml of 0.313 N NaOH for 30min. The residue was washed with hot water and acetone. The crucible containing sample was dried in oven for 3 hr at 103°C and the weight recorded (w1). The sample was then ignited in a Muffle furnace at 600°C for 3 hr and was held in an oven at 103°C for 1 hr and weight recorded (w2).

Percent crude fibre was calculated as  $[(w1-w2)/ (w)] \times 100$ .

### Estimation of ash

The crude ash in the powdered sample was estimated by AOAC Method 942.05. About 3g of sample was added into cleaned porcelain crucible weight was recorded. The sample was dried in a hot air oven at 100°C for 5h (AOAC Method 934.01) and further ignited in a muffle furnace for 3 h at 600°C. Cool the crucible in desiccators and weigh. At the end of the process the ash content will be in whitish grey colour

% Crude ash =  $(W2-W)/ (W1-W) \times 100$

### Determination of nitrogen free extract

Nitrogen Free Extract (NFE) or soluble carbohydrates of sample was determined by difference method

$$\%NFE = 100 - (\% \text{ moisture} + \% \text{ crude protein} + \% \text{ crude fat} + \% \text{ crude ash} + \% \text{ crude fibre}).$$

### 2. Extraction and determination of polyphenols using standard gallic acid curve

Extraction of polyphenols from little millet was performed by the method as suggested by Chethan and Malleshi (2007a).

1. Methanol extracts-1g of the millet extracted in methanol (10ml) for 72 hours at 30 °C in rotary shaker. The extracts were filtered and the filtrate centrifuged for 15 min and 10000 rpm at 4°C.
2. Acid-methanol extract- 1g of sample was extracted in methanol (10ml) for 72 hours at 30 °C in rotary shaker, the extracts were filtered and the residue dried. The dried residue was then extracted with 10ml of acidified methanol (1% HCL in methanol) for 2 h in a rotary shaker shaking at 80 rpm at 30 °C. The extract was cleared by filtration and centrifugation as shown above and was dried.
3. Acid methanol extract (heated) - It was done as shown above but, the sample was heated for 10 min in a boiling water bath prior to extraction.
4. Aqueous extracts- 1g of sample was extracted in water (10ml) for 24 hours in rotary shaker at 30°C, The extracts were filtered and the filtrate centrifuged for 15 min and 10000 rpm at 4°C
5. Aqueous extracts (heated) - 1g of the sample was extracted in 10 ml of distilled water by boiling for 2 hours. The extracts were filtered and centrifuged for 15 min and 10000 rpm at 4°C.

The 0.2ml of the extract were made up to 1ml with the methanol and then added 0.5ml Folin-Ciocalteu reagent and allowed to stand for 20 minutes and then added 2% sodium carbonate. The absorbance was recorded after 30 minutes at 760 nm spectrometrically. The concentration of phenols were expressed in milligram of Gallic Acid Equivalents (GAE) per 100 g of sample. A standard gallic acid curve was constructed. 100mg of Gallic acid was dissolved in 100ml of methanol to get 100µg/ml standard solution.

### 3. Analysis of Tannins

Extraction of Tannin content from little millet sample was determined by Vanillin HCL method as described by Price, Van Scoyoc and Butler (1978). 5g of samples were extracted with methanol. Extract was treated with 3ml of 0.1M FeCl<sub>3</sub> in 0.1N HCl and 3M of K<sub>3</sub>Fe(CN)<sub>6</sub>. Absorbance of the colour developed was read at 720nm

### 4. Analysis of mineral content in little millet

Mineral content in little millet was estimated by standard AOAC-968.08 method (1990). For evaluation of minerals, 1gm each grain samples were powdered and transferred to a silica crucible. The crucible was then placed into a muffle furnace and heated at 600°C for 3 h. The crucible was removed, allowed to cool and the ash formed was weighed. A weighed quantity of ash was dissolved in dilute HCl and subjected to mineral analysis in an Atomic absorption spectrometer. The mineral content was expressed as mg/100 g sample.

## Results and discussion

The results on the proximate composition of little millet (*Panicum sumatrense*) is prescribed in the table 1. The moisture content of little millet (*Panicum sumatrense*) was found to be 6.8%. Our results matches with Kamatar *et al*, 2013. Previous investigation reported the moisture content in the little millet by Hulse *et al*, 1980; Ravindra *et al*, 2008 as 9.7%, 11.38% and Thilagavathi *et al*, 2015 as 11.83% respectively. Lowest the moisture content, higher shall be shelling percentage and length of shelf life of grains. Little millet had the lowest moisture content. The crude protein in the little millet was estimated to be 8.87%. our results fall within the range of earlier literature reported by Thilagavathi *et al*, 2015 as 8.66%; 8.42% reported by Srilekha *et al*, 2019; Kamatar *et al*, 2013 as 7.09%, Kavita *et al*, 2015 as 7.45% , Hulse *et al*, 1980 and Kundgol *et al*, 2014 as 9.7% and 7.57% respectively.

The fibre is the one of the major component. The crude fibre in little millet was found to be 7.6%. Our results on the crude fibre in the little millet are matches well with Hulse *et al*, 1980 as 7.6%. The literature showed that Thilagavathi *et al*, 2015 reported as 7.73%; Kamatar *et al*, 2013 as 4.70%, Thilagavathi *et al*, 2015 as 4.92%, Roopa *et al*, 2013 as 4.97% and Ravindra *et al*, 2008 as 5.09%.

Our investigation on the ash content in the little millet was found to be 1.21%. Our results on the ash content in little millet matches with the studies reported as 1.10% by Geervani and Eggum, 1989. Ravindra *et al*, 2008 as 1.95%. Little millet has higher mineral content due to their higher ash content of 2.9% than the other millets such as finger (2.7%) and barnyard (2.1%) (REVATHI *et al*, 2016). Higher ash content in the food samples indicates higher mineral content (Hymavathi *et al*, 2020). Carbohydrate is an important fuel nutrient. Millets in general are reported to contain lower carbohydrate content than the staple cereals (Gopalan *et al*, 1971). In the present investigation, the nutritional computation revealed carbohydrate content of little millet to be 70.76%. According to the earlier study on the carbohydrate content in two genotype of little millet was recorded as 69.50% and 70.47% respectively by Roopa *et al*, 2013. The carbohydrate content in the two varieties of little millet showed 80.98% and 81.09% respectively (Gupta *et al*, 2014).

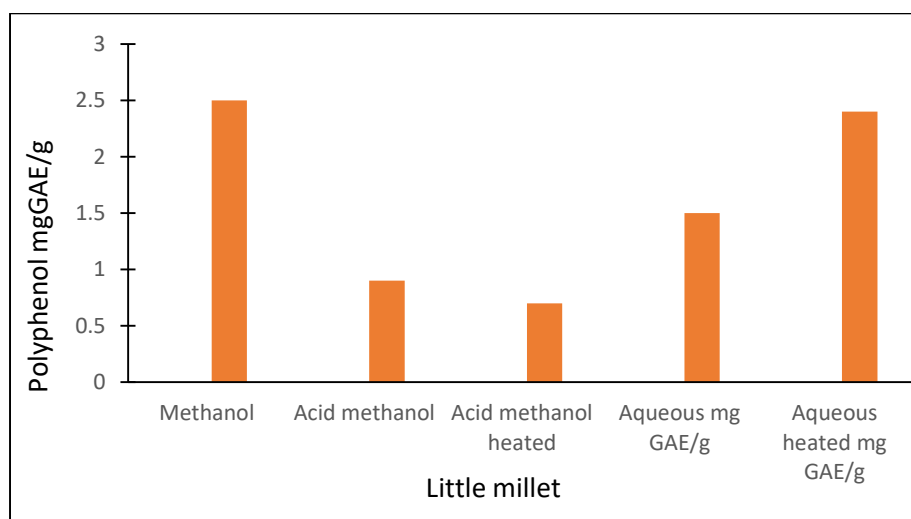
Our investigation showed the polyphenol content present in methanol extracts, acid methanol extracts, aqueous extracts, acid methanol heated and aqueous heated was found to be 2.5, 0.9, 1.5, 0.7 and 2.4 mg/g GAE respectively (Figure 1). Thilagavathi *et al*, 2015 reported the little millet flour contain highest polyphenol content of 3.73mg/g than kodo (3.68mg/g). Goudar *et al*, 2022 reported the free phenolic fraction and bound phenolic fraction of little millet contains the total phenol content of 1.33 and 2.78 mg/g GAE. The 10 different bound little millet landraces polyphenol content ranged from 1.13 to 1.45 mg/g (Kundgol, *et al*, 2013). According to the literature by Chandrasekara *et al*, 2012 the little millet whole grain, dehulled grain, cooked grains and hulls of little millet showed 7.19%, 2.04, 1.95 and 15.9% respectively. We have also estimated the tannin content in little millet was found to be 0.09mg/g (Table 2). Thilagavathi *et al*, 2015 reported the tannin content in little millet was 0.18mg TAE/g). Goudar *et al*, 2022 also reported the little millet contains 0.15mg/g of tannin content. The difference in the tannin content depends on the variety and colour of the millet grains. Minerals are the important constituents of food even they are present in small amounts. The mineral content (Table 3). Suggest that the little millet seed is a rich source of minerals. The seeds are rich source of K, P, Ca, Mg, and Fe and good source of Zn, Cu, Mn, Mo and Ti. Our investigation on mineral content of Ca, Fe, Zn

matches with Patil *et al*, 2015. Our value of Na, Ca and P showed the higher values than the other investigation reported as by Dey *et al*, 2022. Karuppasamy, 2019 reported the Ca content in five varieties of little millet showed lesser than our values. Mounika *et al*. 2022 reported the little millet contains the Fe, Ca, P and K as 9.3, 17, 220 and 216 mg which fall in the range of our investigation. Goudar *et al*. 2023 reported the mineral content of little millet like Zn, Ca, Mn and Cu of 3.61, 17.17, 0.32 and 0.38 mg which is accordance with our values.

**Table 1.** Proximate composition of little millet

Component	g/100 g
Moisture	6.8
Crude protein	8.87
Crude fibre	7.6
Crude fat	4.76
Ash	1.21
Carbohydrate	70.76

**Figure 1.** Total polyphenols contents in methanol, acid methanol, acid methanol heated, aqueous and aqueous heated extract of little millet



**Table 2.** Tannin content in little millet

Little millet	0.09%
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**Table 3.** Mineral content in little millet

Mineral	Little millet
Na	11
K	262
P	252
Ca	22
Mg	129
Fe	8.6
Zn	3.2
Cu	1.2
Mn	1.8
Mo	2.1
Cr	0.12
Cd	0.08
Ti	3.2
Si	0.08
Se	0.08
Pd	0.04
Al	0.16
V	0.08

### Conclusion

Millet can serve as a staple diet for nearly one- third of world's population. Millet can be grown in varied environmental conditions. The proximate analysis, mineral and phytochemical analysis of the little millet gave an idea for its chemical composition which as a significant amount of protein and fiber and had low fat content. The presence of huge amount of nutrient components in this millet might be helpful for the production of various nutraceuticals.

### Future scope

Due to the presence of nutrients and phytochemicals in the little millet it could be used to prepare diet food as an individual or in blending with other food and also it helps in the regulation of inhibitory enzyme involve in the glucose metabolism to manage the diabetic mellitus.

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