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(5): 1480-1483
Received: 18-06-2020
Accepted: 25-07-2020

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Effect of processing on the Physico-chemical properties of Browntop millet (*Brachiaria ramosa*)

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Abstract
The Physico-chemical composition of Browntop millet grains was analysed after subjecting to various processing conditions like soaking, germination, fermentation, roasting and autoclaving. Grain length of control whole and dehulled Browntop millet (BTM) was 3.11±0.06mm and 1.79±0.00mm and width was 1.83±0.01mm and 1.56±0.005mm respectively. The seed weight and 1000 seed mass of whole and dehulled processed BTM was found to be in the range of 0.18±0.01g to 0.35±0.00g and 1.93±0.00g to 3.66±0.00g respectively. There was a slight decrease in seed weight and 1000 seed mass after processing of Browntop millet. Seed volume of control whole and dehulled BTM was found to be 3.00±0.00ml and 2.00±0.00ml respectively. Bulk density of control whole and dehulled BTM was found to be 0.67±0.00g/ml and 0.91±0.00g/ml and true density was found to be 5.50±0.50 kg/m^3 and 5.00±0.00 kg/m^3 respectively. Porosity of control whole and dehulled BTM was found to be 87.78±1.11% and 81.82±0.00% respectively.

Keywords: Browntop millet, Physico-chemical properties, processing, dehulled

Introduction
Millet refers to a collective group of small-seeded annual grasses that are grown as grain crops, in dry areas of temperate, subtropical and tropical regions. Millets grow under difficult ecological conditions and tolerate poor soils and a certain degree of drought better than any other cereal crop (Sade, 2009) [11]. Millets represented in the prehistoric world can be placed in to one of nine common genera., *Brachiaria, Digitaria, Echinochloa, Eleusine, Panicum, Paspalum, Pennisetum, Setaria, Sorghum*. The most prominent and well-known millets are the large or great millets of Africa, i.e., Sorghum and Pennisetum. The rest of the millets are often referred to as the small, or minor millets (Weber and Fuller, 2007) [15].
Browntop millet (*Urochloa ramosa*), a minor millet is an annual/ perennial warm-season grass which is used in forage/pasture management systems that originated in Southeast Asia (Sheahan, 2014) [12]. It is cultivated in Africa, Western Asia, Arabia, China and Australia (Clayton, 2006) [3]. The Browntop millet is called "Korale" in Kannada and "Karlakki" in Mandya region and "Andukorralu" in Telangana and AP. It is specially grown in rainfed tracts of Tumakuru, Chitra Durga and Chikkaballapura districts of Karnataka state. The crop is popular in this region in terms of cultivation and consumption. The nutritional composition of Browntop millet is on par with the other millets and is reported to be a good source of zinc, iron and fibre. Color of the millet is also appealing and well accepted when compared to other minor millets (Roopa *et al.*, 2016) [10]. Millet grains, before consumption are usually processed by commonly used traditional processing techniques such as decorticating, malting, fermentation, roasting, flaking, and grinding to improve their edible, nutritional, and sensory properties (Ahmed *et al.*, 2013) [1]. An understanding of suitable processing, salubrious alternatives, are key factors in determining the usage of Browntop millet for domestic consumption or product development with optimum nutrients. There are very few studies conducted on the effect of processing on the physico-chemical properties on Browntop millet. Hence, there is a need to explore the potentiality and utility of the grain in daily diet by demonstrating the suitability of best processing methods with optimal physico-chemical properties for consumption.

Materials and Methods
The whole and dehulled Browntop millet grains were subjected to five treatments such as soaking, germination, fermentation, roasting and autoclaving. Each treatment was replicated 2 times. Methods of processing is explained below:

Germination (Sade, 2009) [11]: 400g of Browntop millet grains were soaked overnight in distilled water at room temperature. The seeds were placed in muslin cloth and tied into pouch with intermittent watering at regular intervals for 48hrs for the seeds to germinate. The sprouted seeds were then completely dried at 60 °C in a tray drier.

Fermentation (Sade, 2009) [11]: 400g of Browntop millet grains were fermented naturally by steeping in distilled water for 72 hours after which they were rinsed with clean water and dried in an oven at 55-60 °C for 10hrs.

Soaking (Pawar and Machewad, 2005) [8]: 400g of Browntop millet grains were soaked for 18 hours in distilled water at room temperature. After completing the soaking process, the grains were rinsed with clean water and dried in tray drier at 60 °C.

Roasting (Sade, 2009): 400g of millet grains were roasted in a pan using an induction stove at 160 °C for 15 min with constant stirring to avoid charring of the grains.

Autoclaving (Cabrejas *et al.*, 2004) [2]: 400g of brown top millet grains were autoclaved using vertical autoclave at 15 lb pressure at 121°C for 20min in distilled water (1:10, w/v) until they became soft when felt between the fingers and dried at 60 °C using tray drier.
All the processed samples were estimated for the following parameters:

Seed Length and Width: Length and Width of the whole and dehulled processed BTM were measured using digital Vernier calipers**.** Grains were measured in triplicates and recorded in mm.

Seed weight (Mohsenin, 1980) [6]: Hundred Browntop millet grains were counted in triplicates and then weights were recorded in grams to nearest one decimal point.

Seed volume (Mohsenin, 1980) [6]: Thousand Browntop millet grains were counted and transferred to a 50ml measuring cylinder and 25ml of demineralized water was added to it. Seed volume (ml/seed) was calculated as below.

Seed Volume = Total volume – 25

1000 Seed mass (Singh *et al.*, 2010) [13]: Thousand Browntop millet grains were counted in triplicates and then weights were recorded using electronic balance with least count 0.001g.

Bulk density (Ramashia *et al.*, 2017) [9]: Ten grams of the Browntop millet grain was placed in a 25ml graduated cylinder and packed by gentle tapping of the cylinder on a bench top, ten times, from a height of 5-8cm. The final volume of the grain was expressed as bulk density.

$$\text{Bulk density} = \frac{\text{weight of the grain}}{\text{volume of grain after tapping}}$$

True density (Ramashia *et al.*, 2017) [9]: 30ml of toluene was placed in a 50 ml measuring cylinder and 5g of sample was added into it. The raise in toluene level was recorded as true density.

Porosity (Singh *et al.*, 2009) [13]: Porosity of Browntop millet grains was calculated using bulk density and true density value that was found earlier, by using the following formula

$$\text{Porosity} = \left[1 - \frac{BD}{TD}\right] \times 100$$

Statistical analysis: The generated data was subjected to Analysis of Variance (ANOVA) using SPSS version 23 (SPSS, IBM, Chicago USA) and means were separated using the Duncan multiple range test. Significant differences among different treatments was accepted at 95% confidence interval ($p< 0.05$).

Results and Discussion

The mean results of physicochemical composition of whole and processed Browntop millet (BTM) are given in the Table 1. The findings of physicochemical composition revealed that length of control whole and dehulled Browntop millet (BTM) was 3.11±0.06mm and 1.79±0.00mm and width was 1.83±0.01mm and 1.56±0.005mm respectively. The results of length and width of the whole and dehulled processed BTM were measured using Vernier digital calipers and were found to be in the range of 1.79±0.00mm to 3.19±0.11mm and 1.46±0.00mm to 1.93±0.03mm respectively. Length values were significantly higher ($p< 0.05$) for whole BTM (control and processed), while dehulled BTM (whole and processed) were not significantly different. Width values were significantly higher ($p< 0.05$) in whole BTM (control and processed), while the width values varied significantly among the whole and dehulled (control and processed) samples. Similar results were obtained by (Hamdani *et al*., 2014., Ramashia *et al.*, 2018 and Jain and Bal, 1997) [4, 9, 5] for length, width and thickness in hulled barley, finger millet and bajra. The mean length and breadth of Browntop millet were found to be 2.2mm and 1.9mm by Roopa (2015) [10].
The seed weight and 1000 seed mass of whole and dehulled processed BTM was found to be in the range of 0.18±0.01g to 0.35±0.00g and 1.93±0.00g to 3.66±0.00g respectively. Seed weight of control whole and dehulled BTM was found to be 0.34±0.01g and 0.21±0.01g respectively. 1000 seed mass of control whole and dehulled BTM was found to be 3.66±0.00g and 2.20±0.00g respectively. There was a slight decrease in seed weight and 1000 seed mass after processing of Browntop millet. Similar results by Verma *et al.* (2015) [14] revealed that the thousand kernel weight of foxtail millet, barnyard millet and rice was observed to be 2.5g, 3.0g and 18.3 g, respectively.
Seed volume of control whole and dehulled BTM was found to be 3.00±0.00ml and 2.00±0.00ml respectively. The seed volume of whole and dehulled processed BTM was found to be in the range of 1.00±0.00ml to 4.00±0.00ml. There was no significant difference found between the treatments of whole and dehulled BTM. The grain volume of barnyard millet was observed to be 4.01ml and 2.96ml for foxtail millet. Grain volumes change significantly and most often, regularly at varying moisture contents (Nazni and Devi, 2016) [7].
The bulk density, true density and porosity of whole and dehulled processed BTM (Figure 1) was found to be in the range of 0.33±0.10g/ml to 0.91±0.00g/ml, 3.50±0.50kg/m^3 to 5.50±0.50 kg/m^3 and 73.48±3.79% to 93.86±0.76% respectively. Bulk density of control whole and dehulled BTM was found to be 0.67±0.00g/ml and 0.91±0.00g/ml respectively. It was observed that germination and roasting lead to significant ($p< 0.05$) reduction in the bulk density of all the BTM samples compared to other treatments.

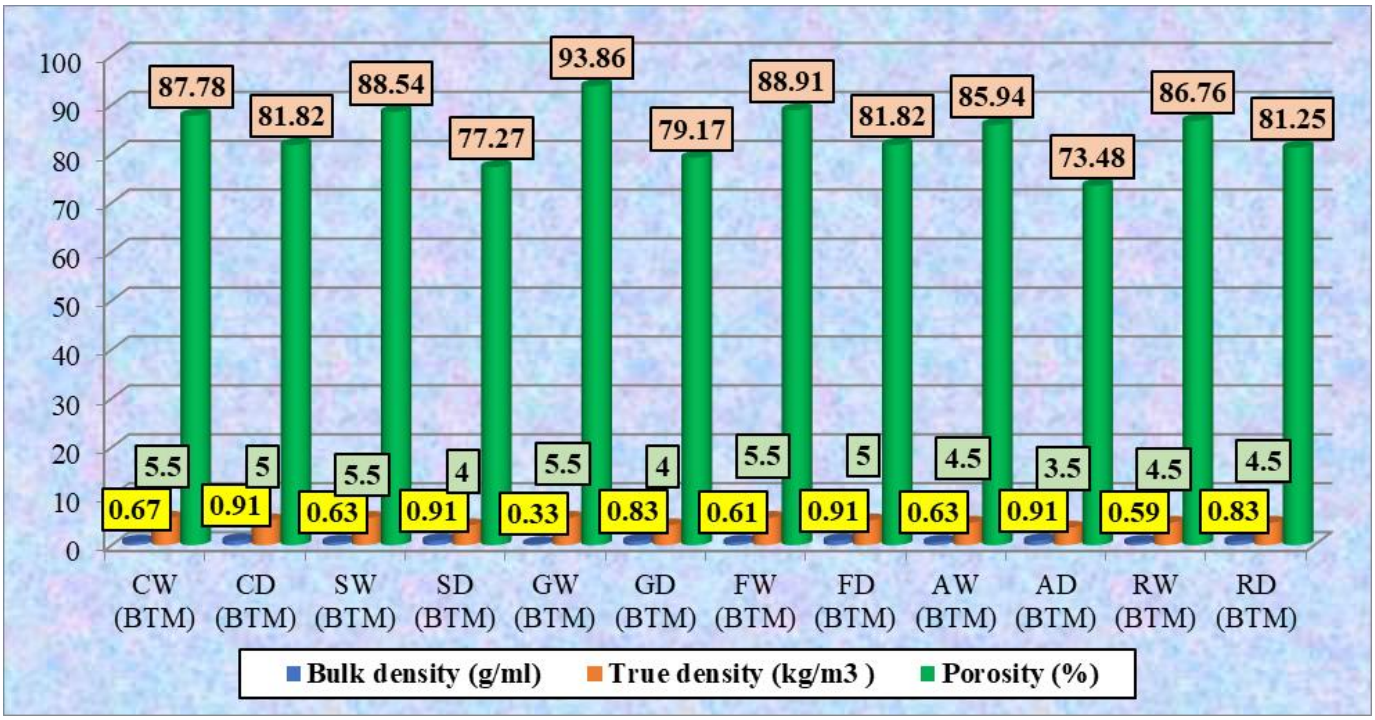

Fig 1: Bulk density(g/ml), true density(kg/m^3), porosity (%) of whole and processed Browntop millet grains. BTM - Browntop Millet, CW - Control Whole, CD - Control Dehulled, SW - Soaked Whole, GW - Germinated Whole, GD - Germinated Dehulled, FW - Fermented Whole, FD - Fermented Dehulled, AW - Autoclaved Whole, AD - Autoclaved Dehulled, RW - Roasted Whole, RD - Roasted Dehulled.

Table 1: Physico-chemical composition of Whole and Processed Browntop Millet

Treatment	Length (mm)	Width (mm)	Seed weight (g)	1000 seed mass (g)	Seed volume (ml)	Bulk density (g/ml)	True density (kg/m^3)	Porosity (%)
Control (Whole BTM)	3.11±0.06^{d}	1.83±0.01^{g}	0.34±0.01^{f}	3.66±0.00^{h}	3.00±0.00^{c}	0.67±0.00^{ef}	5.50±0.50^{e}	87.78±1.11^{gh}
Control (Dehulled BTM)	1.79±0.00^{a}	1.56±0.01^{bc}	0.21±0.01^{cd}	2.20±0.00^{d}	2.00±0.00^{b}	0.91±0.00^{gh}	5.00±0.00^{d}	81.82±0.00^{e}
Soaked (Whole BTM)	3.12±0.05^{d}	1.74±0.10^{d}	0.33±0.10^{ef}	3.45±0.00^{g}	4.00±0.00^{d}	0.63±0.00^{ce}	5.50±0.50^{e}	88.54±1.04^{ij}
Soaked (Dehulled BTM)	1.83±0.01^{ad}	1.55±0.01^{bc}	0.19±0.00^{b}	1.95±0.00^{ac}	2.00±0.00^{b}	0.91±0.00^{gh}	4.00±0.00^{b}	77.27±0.00^{b}
Germinated (Whole BTM)	2.86±0.01^{b}	1.78±0.03^{e}	0.31±0.00^{d}	3.23±0.001^{e}	4.00±0.00^{d}	0.33±0.10^{a}	5.50±0.50^{e}	93.86±0.76^{kl}
Germinated (Dehulled BTM)	1.83±0.04^{ad}	1.46±0.00^{a}	0.18±0.01^{a}	1.93±0.00^{ab}	2.00±0.00^{b}	0.83±0.00^{fg}	4.00±0.00^{b}	79.17±0.01^{c}
Fermented (Whole BTM)	3.05±0.02^{cd}	1.81±0.06^{f}	0.33±0.00^{e}	3.38±0.00^{fa}	4.00±0.00^{d}	0.61±0.20^{cd}	5.50±0.50^{e}	88.91±0.67^{jk}
Fermented (Dehulled BTM)	1.82±0.01^{ac}	1.52±0.03^{b}	0.18±0.00^{a}	1.90±0.00^{a}	1.00±0.00^{a}	0.91±0.00^{gh}	5.00±0.00^{d}	81.82±0.00^{e}
Autoclaved (Whole BTM)	3.01±0.03^{c}	1.78±0.00^{e}	0.34±0.05^{f}	3.48±0.00^{g}	4.00±0.00^{d}	0.63±0.00^{ce}	4.50±0.50^{c}	85.94±1.56^{f}
Autoclaved (Dehulled BTM)	1.86±0.02^{ae}	1.50±0.05^{b}	0.19±0.01^{bc}	2.02±0.00^{b}	2.00±0.00^{b}	0.91±0.00^{gh}	3.50±0.50^{a}	73.48±3.79^{a}
Roasted (Whole BTM)	3.19±0.11^{e}	1.93±0.03^{h}	0.35±0.00^{g}	3.33±0.00^{f}	4.00±0.00^{d}	0.59±0.00^{b}	4.50±0.50^{c}	86.76±1.47^{g}
Roasted (Dehulled BTM)	1.81±0.00^{ab}	1.59±0.03^{c}	0.20±0.00^{c}	2.13±0.01^{c}	2.00±0.00^{b}	0.83±0.00^{fg}	4.50±0.50^{c}	81.25±2.08^{d}
Mean	2.44	1.67	0.264	2.72	2.83	0.73	4.75	83.88
S.E of mean	0.13	0.03	0.01	0.14	0.00	0.03	0.16	1.18
CD	0.14	0.13	0.01	0.00	0.00	0.02	1.26	4.59
CV	2.61%	3.55%	2.31%	0.08%	0.00%	1.25%	12.16%	2.51%

True density of control whole and dehulled BTM was found to be 5.50±0.50 kg/m^3 and 5.00±0.00 kg/m^3 respectively. It was observed that there was a significant (p< 0.05) decrease in the true density of dehulled soaked, germinated, autoclaved and roasted BTM grains compared to other treatments. Porosity of control whole and dehulled BTM was found to be 87.78±1.11% and 81.82±0.00% respectively. The results indicate that porosity of the dehulled samples was significantly (p< 0.05) lower that the whole BTM grains. A study conducted by Nazna and Devi (2016) [7] reported that the Bulk density of germinated millet flours of barnyard and foxtail millets decreased significantly compared to raw millet flour. The decrease in bulk density of the germinated millet flour was due to low porosity or air spacing in the flour, therefore less autooxidation occurs and this is an advantage in respect to spoilage, packing and transportation as goods in relation to weight.

Conclusion

It can be concluded that processing (soaking, germination, fermentation, autoclaving and roasting) of browntop millet resulted in slight decrease in seed weight and 1000 seed mass. There was no significant difference found between the treatments of whole and dehulled BTM. The physicochemical properties of Browntop millet was on par with the other millets, indicating that the dehulled and processed Browntop millet flours can be efficiently used in processing and formulating various healthy food products as is done with other minor millets.

Acknowledgment

We thank honourable vice chancellor of Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad for his encouragement.

References

1. Ahmed S, Saleh M, Qing Z, Jing C, Shen Q. Millet Grains: Nutritional Quality, Processing and Potential Health Benefits. Comprehensive Reviews in Food Science and Food Safety. 2013; 12:281-295.
2. Cabrejas MAM, Sanfiz B, Vidal A, Molla E, Esteban R, Andreu FJL. Effect of Fermentation and Autoclaving on Dietary Fibre Fractions and Anti-Nutritional Factors of Beans (*Phaseolus vulgaris* L.). Journal of Agricultural and Food Chemistry. 2004; 52:261-266.
3. Clayton WD, Vorontsova MS, Harman KT, Williamson H. Grass Base–the online world grass flora, 2006. http://www.kew.org/data/grassesdb.html.
4. Hamdani A, Rather SA, Shah A, Gani A, Wani SM, Masoodi FA, Gani A. Physical properties of barley and oats cultivars grown in high altitude Himalayan regions of India. Journal of Food Measurement and Characterization. 2014; 8(4):296-304.
5. Jain RK, Bal S. Properties of pearl millet. Journal of Agricultural Engineering and Research. 1997; 66:85-91.
6. Mohsenin NN. Thermal Properties of Food and Agricultural Materials. 1980; 55:732-733.
7. Nazni P, Devi SR. Effect of processing on the characteristic's changes in barnyard and foxtail millet. Journal of Food Processing and Technology. 2016;7(3):1-9.
8. Pawar VD, Machewad GM. Processing of foxtail millet for improved nutrient availability. Journal of food processing and preservation. 2006; 30(3):269-279.
9. Ramashia SE, Gwata ET, Meddows-Taylor S, Anyasi TA, Jideani AIO. Some physical and functional properties of finger millet (*Eleusine coracana*) obtained in sub-Saharan Africa. Food Research International. 2018; 104:110-118.
10. Roopa OM, Jamuna KV, Brunda SM, Darshan GB. Development and Sensory Evaluation of Ready-To-Cook Idli Mix from Browntop Millet (*Panicum ramosa*). International Journal of Science, Environment and Technology. 2016; 5(2):816-821.
11. Sade FO. Proximate, Antinutritional Factors and Functional Properties of Processed Pearl Millet (*Pennisetum glaucum*). Journal of Food Technology. 2009; 7(3):92-97.
12. Sheahan CM. Plant guide for brown top millet (*Urochloa ramosa*). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center, Cape May, NJ, 2014.
13. Singh KP, Mishra HN, Saha S. Moisture Dependent Properties of Barnyard Millet Grain and Kernel. Journal of Food Engineering. 2010; 96:598-606.
14. Verma S, Srivastava S, Tiwari N. Comparative study on nutritional and sensory quality of barnyard and foxtail millet food products with traditional rice products. Journal of Food Science and Technology. 2015; 52(8):5147-5155.
15. Weber SA, Fuller DQ. Millets and their role in early agriculture. Pragdhara. 2008; 18(69):1-32.