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Sanju Chaudhary
Department of Foods & Nutrition, COHS, CCS Haryana Agricultural University Hisar, Haryana, India

Sangeeta C Sindhu
Department of Foods & Nutrition, COHS, CCS Haryana Agricultural University Hisar, Haryana, India

Neeta Kumari
Department of Foods & Nutrition, COHS, CCS Haryana Agricultural University Hisar, Haryana, India

Varsha Kumari
KVK, Vaishali, DRP Central Agricultural University, Bihar, India

Corresponding Author:
Sanju Chaudhary
Department of Foods & Nutrition, COHS, CCS Haryana Agricultural University Hisar, Haryana, India

Physico chemical and malting characteristics of pearl millet hybrids

Sanju Chaudhary, Sangeeta C Sindhu, Neeta Kumari and Varsha Kumari

Abstract
Present study reports physico chemical and malting characteristics of two pearl millet hybrids viz HHB 234 and WHC 901. Hybrid WHC 901 had significantly (P≤0.05) higher seed weight, seed density and swelling index whereas HHB 234 had significantly (P≤ 0.05) higher hydration capacity and hydration Index. Both under controlled conditions (27±2 °C) as well as at room temperature, per cent germination was higher for HHB 234. Consequently, malting loss was also higher for HHB 234.

Keywords: Peral millet hybrids, seed weight, swelling index, malting loss, per cent germination

Introduction
The COVID-19 pandemic and its impact on all 17 SDGs has shown that what began as a health crisis has quickly become a human and socio-economic crisis. While the crisis is hindering progress towards the SDGs, it also makes their achievement all the more urgent and necessary. (UN 2020) [11].

In this current scenario with escalating population and unrestricted use of natural resources, lots of underutilized crops are being explored and promoted for their potential to replace the staple crops of rice and wheat. Millets can be the answer in present scenario. Rightly termed as Nutri-cereals, millets are highly nutritive, rich in fibre and minerals as well as gluten-free. Recently, the UN General Assembly adopted by consensus, a resolution sponsored by India and supported by over 70 nations declaring 2023 as the International Year of Millets. This aims at raising awareness about the health benefits of the grain and their suitability for cultivation under changing climatic conditions.

Despite the fact that millets are highly nutritious, their consumption is still limited to the conventional and poor population due to lack of awareness towards its nutritional values. Presence of phytic acid and other phytochemicals that inhibit the digestion and absorption of protein and certain minerals, affects the exploitation of full nutritional potential of millets. However, simple domestic processing techniques like malting and fermentation can help improve the nutritional potential of millets (Sindhu *et al*., 2005; Kumari *et al*., 2018) [9, 6].

Pearl millet [*Pennisetum glaucum* (L.)] is grown widely in the arid and semi-arid tropical regions in Indian subcontinent. It is the third most widely cultivated food crop in India after rice and wheat. Over the years, changing food habits and inconvenience in food preparations has made pearl millet obsolete (Sindhu, 2011; Saini *et al*., 2021) [10, 8]. In an effort to bring pearl millet back to our food plate, enormous progress has been made in the genetic improvement of pearl millet in India during last several decades (Yadav & Rai, 2013; Berwal *et al*., 2017) [14, 2]. Present study reports the physicochemical and malting characteristics of two pearl millet hybrids widely popular in Haryana, India.

Materials & Methods
Procurement of varieties
Pearl millet hybrid HHB-234 and WHC 901/445 were procured in a single lot from the Bajra Section of the Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar.

Physico-chemical properties of grains
Pearl millet varieties were evaluated for Physico-chemical parameters (Seed weight, Seed density, Seed volume, Hydration capacity, Hydration index, Swelling capacity and Swelling index) by the methods described earlier by Williams *et al.* (1983) [13].

Malting

Malting was carried out by method described earlier by Chaudhary and Sindhu (2016)[3].

Malting loss was calculated as follows:

$$Metabolic\ loss = W_1\text{-}W_2 \quad (1)$$

W_1: Dry weight of initial sample

W_2: Dry weight of kilned malt

$$Vegetative\ loss = W_3/W_4 \times 100 \quad (2)$$

W_3: Weight of root and shoot

W_4: Weight of kilned derooted malt

Total malting loss was calculated as sum of Metabolic loss and Vegetative loss

Sensory evaluation

A modified sensory evaluation score sheet based on Six Point Hedonic Scale was used to gather data for sensory analysis by a panel of ten semi trained judges. The developed malt was evaluated for colour, aroma and texture with the following scores and description: Six (6) as liked very much; five (5) as liked moderately; four (4) as liked slightly; three (3) as disliked slightly; two (2) as disliked moderately and one (1) as disliked very much.

Results & Discussion

Physico-chemical properties

Thousand seed weight of pearl millet varieties HHB-234 and WHC 901 was 8.20 and 9.01 g, respectively (Table 1.) Significant ($P \leq 0.05$) difference in seed weight was observed among both pearl millet varieties. Seed density of Pearl millet varieties also varied significantly ($P \leq 0.05$) and it was 0.92 g/ml in HHB 234 and 0.94 g/ml in WHC 901 variety. Seed volume of both varieties HHB 234 and WHC 901 was 0.02 g/ml. Hydration capacity of HHB-234 was 0.01g/seed and WHC 901 was 0.005g/seed. Significant differences in hydration capacity were observed between the two varieties. Hydration index of both the varieties varied significantly ($P \leq 0.05$) and it was 1.22 g/seed in HHB 234 and 1.11 g/seed in WHC 901respectively.

Swelling capacity of both the varieties was similar (0.01ml/seed). Swelling index of HHB 234 was 0.75 ml/seed and WHC 901 was 0.79 ml/seed. Swelling index of WHC 901 was significantly ($P \leq 0.05$) higher than that of HHB 234.

It is important to understand the physico chemical characteristics as these are known to be correlated to cooking time which is a major criterion for acceptance of any new variety or hybrid (Williams *et al*., 2006) [12]. Seed weight and volume have also been found positively correlated to fat and carbohydrate content and negatively correlated to fiber content of seeds (Kaur *et al*., 2005) [5]. The water absorbing capacity of seeds depends on cell wall structure, composition of seed and compactness of the cells in the seed (Muller, 1967) [7]. The higher water absorption may indicate greater permeability of seed coat and softer cotyledons (Kaur *et al*., 2005) [5].

Per cent germination and malting loss

The percent germination of pearl millet variety HHB 234 at controlled temperature (27±2 °C) varied from 77 to 89 per cent for 24 and 72 hours whereas at shelf temperature (20±2 °C) it was 48 and 71 per cent respectively. In variety WHC 901, germination was 18 per cent at 24h, 31 per cent at 48h and 42 per cent at 72h at controlled temperature (27±2 °C). At shelf temperature, 8 per cent germination at 24h, 21 per cent at 48h and 31 per cent at 72h was recorded (Table 2).

Malting loss in variety HHB 234 was found to be 8.09 per cent at 24h, 8.37 per cent at 48h and 9.7 per cent at 72h respectively at controlled temperature (27±2 °C) whereas at shelf temperature (20±2 °C), malting loss was found to be 7.23 per cent at 24h, 7.51 per cent at 48h and 7.84 per cent at 72h. In WHC 901 malting loss at controlled temperature was 7.10 percent at 24h, 7.92 per cent at 48h and 9.10 per cent at 72 hours whereas at shelf temperature, 6.98 per cent at 24h, 7.11 per cent at 48 h and 7.89 per cent at 72h (Table 2).

Sensory evaluation

When pearl millet flour was malted at controlled temperature (27±2 °C), no significant differences were observed in color, texture and overall acceptability when evaluated organoleptically using six-point hedonic scale by judges. The aroma of HHB 234 malted at 24 and 48 hours had significantly ($P \leq 0.05$) higher scores as compared to WHC 901 (Table 3).

When pearl millet flour was malted at room temperature, no significant differences were observed in colour, aroma and texture when evaluated organoleptically using six-point hedonic scales by judges. The overall acceptability of HHB 234 malted at 48 hours was significantly ($P \leq 0.05$) higher as compared to its 24/72 hr counterparts (Table 4).

Malting is an important process that helps in the mobilization of seed reserves and elaboration of the activity of α- and ß-amylase and protease, thereby making these more digestible. It is important to understand the malting characteristics of any new variety/hybrid as it affects their utilization in further product development. Malting conditions with lower malting loss and acceptable colour and aroma need to be standardized for better utilization of pearl millet in development of value-added nutritious products with higher digestibility and bioavailability of nutrients. Badau *et al*. (2006) [1] studied malting properties in ten pearl millet cultivars and reported that metabolic loss (malting loss), vegetative loss (seedling yield) and total malting loss increased significantly ($P < 0.05$) with an increase in germination time and varied widely among cultivars. This information can serve as a guide for selection of suitable pearl millet cultivars for malting (Embashu and Nantanga, 2019) [4].

Table 1: Physico-chemical properties of different varieties of pearl millet

Variety	Seed Weight (g/1000 seeds)	Seed density (g/ml)	Seed volume (g/ml)	Hydration capacity (g/seed)	Hydration Index	Swelling Capacity (ml/seed)	Swelling Index
HHB 234	8.20±0.32	0.92±0.01	0.02±0.00	0.010±0.01	1.22±0.01	0.01±0.01	0.75±0.02
WHC 901	9.01±0.07	0.94±0.01	0.02±0.00	0.005±0.01	1.11±0.01	0.01±0.00	0.79±0.02
t (cal)	2.46*	1.23*	NS	1.95*	1.55*	NS	1.57*

Values are mean ± SE of three independent determinations, NS – Non-significant

*Significant at 5% level of significance

Table 2: Per cent germination and malting loss of selected pearl millet varieties (on dry matter basis)

		HHB 234		WHC 901	
Temperature	**Time**	**Germination (%)**	**Malting loss**	**Germination (%)**	**Malting loss**
Controlled (27±2° C)	24 h	77	8.09	18	7.10
	48 h	83	8.37	31	7.92
	72 h	89	9.7	42	9.10
Room temp.*	24 h	48	7.23	8	6.98
	48 h	59	7.51	21	7.11
	72 h	71	7.84	31	7.89
*The prevailing temperature at the time of study ranged from 18-22°C					

Table 3: Organoleptic acceptability of malted pearl millet varieties [Controlled conditions (27±2°C)]

Variety	Time period	Color	Aroma	Texture	Overall acceptability
HHB 234	24 h	44.50±0.1515	4.70±0.15	4.60±0.15	4.60±0.09
	48 h	4.70±0.15	4.70±0.22	4.60±0.16	4.66±0.06
	72 h	4.60±0.16	4.30±0.22	4.30±0.15	4.40±0.06
WHC 901	24 h	4.70±0.15	4.00±0.16	4.50±0.17	4.40±0.21
	48 h	4.60±0.15	3.90±0.15	4.60±0.25	4.37±0.27
	72 h	4.60±0.15	3.90±0.15	4.30±0.25	4.27±0.23
CD(P≤0.05)		NS	0.40	NS	NS
Values are mean ± SE of ten independent determinations NS: Non-significant					

Table 4: Organoleptic acceptability of malted pearl millet varieties (Room temperature*)

Variety	Time period	Color	Aroma	Texture	Overall acceptability
HHB 234	24 h	44.30±0.1515	4.10±0.15	4.30±0.15	4.23±0.07
	48 h	4.60±0.15	4.20±0.22	4.60±0.16	4.46±0.01
	72 h	4.35±0.16	3.90±0.22	4.30±0.16	4.18±0.02
WHC 901	24 h	4.60±0.15	3.90±0.26	4.50±0.17	4.33±0.21
	48 h	4.50±0.15	4.10±0.35	4.50±0.15	4.36±0.27
	72 h	4.50±0.15	4.20±0.35	4.30±0.15	4.33±0.23
CD(P≤0.05)		**NS**	**NS**	**NS**	**0.22**
Values are mean ± SE of ten independent determinations NS: Non-significant *The prevailing temperature at the time of study ranged from 18-22°C					

Conclusions

There is no doubting that inclusion of millets in our food plate is imperative for food security. Pearl millet hybrids can successfully be subjected to malting to produce malt of acceptable color and aroma. This characteristic can be useful in higher demand of crop for brewing or development of value added traditional and novel food products.

References

1. Badau MH, Nkama I, Jideani IA. Steep-out moisture, malting loss, and diastatic power of pearl millet and sorghum as affected by germination time and cultivar. International Journal of Food Properties 2006;9(2):261-272. https://doi.org/10.1080/10942910600596233
2. Berwal MK, Chugh LK, Goyal P, Kumar R, Devvart. Protein, micronutrient, antioxidant potential and phytate content of Pearl Millet hybrids and composites adopted for cultivation by Farmers of Haryana, India. International Journal of Current Microbiology and Applied Sciences 2017;6(3):376-386.
3. Chaudhary S, Sindhu SC. Sensory and nutritional evaluation of developed malted pearl millet cake. Annals of Agri Bio Research 2016;21(2):198-201.
4. Embashu W, Nantanga KK. Malts: Quality and phenolic content of pearl millet and sorghum varieties for brewing nonalcoholic beverages and opaque beers. Cereal Chemistry 2019;96(4):765-774.
5. Kaur M, Singh N, Sodhi NS. Physicochemical, cooking, textural and roasting characteristics of chickpea (*Cicer arietinum* L.) cultivars. Journal of Food Engineering 2005;69(4):511-517.
6. Kumari V, Sindhu SC, Singh J. Digestibility of indigenously developed sorghum based composite flours. International Journal of Chemical Studies 2018;6(2):3376-3379.
7. Muller FM. Cooking quality of pulses. Journal of the Science of Food and Agriculture 1967;18(7):292-295.
8. Saini S, Saxena S, Samtiya M, Puniya M, Dhewa T. Potential of underutilized millets as Nutri-cereal: an overview. Journal of Food Science and Technology 2021, 1-13.
9. Sindhu SC, Khetarpaul N, Sindhu A. Effect of probiotic fermentation on carbohydrate and mineral profile of an indigenously developed food blend. Acta alimentaria 2005;34(1):41-47.
10. Sindhu SC. Emerging consumption pattern in rural sector in India. *In* (*Eds.*) Chamola SD, Bharti A. Agriculture and Rural Development in India Some Emerging Issues. 2011, 83-99. Global Vision Publishing House, India.
11. UN. Decade of Action – United Nations Sustainable Development 2020.
12. Williams PC, Nakoul H, Singh KB. Relationship between cooking time and some physical characteristics in chickpeas (Cicer arietinum L.). Journal of the Science of Food and Agriculture 2006;34(5):492-496.
13. Williams PC, Nakoul H, Singh KB. Relationship between cooking time and some physical characteristics in chickpeas (*Cicer arietinum* L.). Journal of the Science of Food and Agriculture 1983;34(5):492-496.
14. Yadav OP, Rai KN. Genetic improvement of pearl millet in India. Agricultural Research 2013;2(4):275-292.