ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating (2026): 4.97
IJAFS 2026; 8(4): 293-297
www.agriculturaljournals.com
Received: 22-01-2026
Accepted: 24-02-2026

Daman Preet Kour
Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology Jammu, Chatha, Jammu and Kashmir, India

Neeraj Gupta
Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology Jammu, Chatha, Jammu and Kashmir, India

Arashdeep Kour
Division of Microbiology, Sher-e-Kashmir University of Agricultural Sciences and Technology Jammu, Chatha, Jammu and Kashmir, India

Meghal Sharma
Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology Jammu, Chatha, Jammu and Kashmir, India

Corresponding Author:
Daman Preet Kour
Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology Jammu, Chatha, Jammu and Kashmir, India

Exploring the chemical characteristics of different pearl millet varieties

Daman Preet Kour, Neeraj Gupta, Arashdeep Kour and Meghal Sharma

DOI: https://www.doi.org/10.33545/2664844X.2026.v8.i4d.1322

Abstract
Pearl millet is a highly versatile and resilient cereal crop, widely cultivated in arid and semi-arid regions due to its ability to withstand harsh environmental conditions. This grain is a rich source of essential nutrients, including proteins, fibre, vitamins, and minerals, particularly iron, zinc, and phosphorus. Pearl millet exhibits significant genetic diversity, contributing to variations in its nutritional profile and agronomic traits. The present study was undertaken to investigate the chemical characteristics of five different varieties of pearl millet. The evaluation of five different varieties *viz;* Pusa composite (383), Pusa composite (701), Dhanshakti, MBC-2 and Local variety for chemical parameters crude fat, crude fibre, carbohydrates, calcium, iron, zinc and phosphorus content was carried out. The highest crude fat (5.96%), crude fibre (2.43%), calcium (42.13 mg/100 g), iron (8.16 mg/100 g), zinc (4.17 mg/ 100 g) and phosphorous content (333.82 mg/ 100 g) content were exhibited by Dhanshakti variety whereas the lowest were recorded in Local variety.

Keywords: Pearl millet, variety, dhanshakti, chemical

Introduction
Millets are a group of small-seeded cereal grains that have been cultivated for thousands of years and are renowned for their nutritional benefits and adaptability to diverse growing conditions. As climate-resilient crops, millets thrive in arid and semi-arid regions, making them an essential component of sustainable agriculture. For centuries, millet has been a valued crop in India and remains a staple diet for nearly one-third of the world's population. As a result, there is a global initiative to collect, introduce, evaluate, and utilize a wide variety of lesser-known, underexploited alternative crop plants to diversify agricultural systems (Saleh *et al.,* 2013) [18]. Pearl millet (*Pennisetum glaucum* L.) also known as bajra, is one of the major millet crops cultivated in India. It ranks as the fourth most important cereal in India, following rice, wheat, and sorghum (Kulkarni *et al.,* 2021) [10]. Recently, pearl millet has garnered significant interest from food scientists, technologists, and nutritionists due to its crucial role in national food security and its potential health benefits (Singh *et al.,* 2023) [20]. India is the world's largest producer of pearl millet. The traditional pearl millet-growing states in India include Gujarat, Rajasthan, and Haryana (Rajalakshmi *et al.,* 2021) [15]. Pearl millet is a rich source of micronutrients and nutraceutical components and is the most extensively cultivated millet (Priya *et al.,* 2023) [14]. Pearl millet is inherently a high-iron crop with a relatively high zinc content, surpassing that of rice and wheat. However, not all existing cultivars exhibit high levels of iron and zinc but the biofortified varieties of pearl millet have higher values of iron and zinc.

Pearl millet encompasses a diverse array of varieties, each uniquely adapted to specific agronomic and environmental conditions, making it an essential crop in arid and semi-arid regions. Biofortified varieties, developed through the cross-breeding of distinct inbred lines, exhibit superior grain and biomass yields and enhanced disease resistance (Mamta, 2015) [11]. Furthermore, high-nutrient varieties enriched with essential minerals such as iron and zinc address micronutrient deficiencies in diets where pearl millet serves as a staple. Collectively, all cultivated varieties contribute to the resilience, nutritional quality, and sustainability of pearl millet, underscoring its significance for food security. Each variety enhances the crop's overall versatility and importance, particularly in regions with challenging growing conditions (Rawat *et al.,* 2023) [17]. Therefore, the present study aims to evaluate various

Parameters of pearl millet varieties to improve food security, nutritional quality, and sustainable agricultural practices.

Materials and Methods

Pearl millet grains were obtained from the Advanced Centre for Rainfed Agriculture (ACRA), Dhiansar, SKUAST-Jammu and subsequently taken to the pilot plant of the Division of Post-Harvest Management at SKUAST-Jammu for further processing. Various pearl millet varieties, including Pusa Composite 383, Pusa Composite 701, Dhanshakti, MBC-2, and a Local variety, were obtained. The grains were manually cleaned to remove stones, straw, and other foreign particles. Subsequently, chemical analysis was conducted on these different cultivars of pearl millet. The varieties were evaluated for various chemical parameters *i.e.* crude fat, crude fibre, carbohydrates and minerals *viz;* calcium, iron, zinc and phosphorus, using the protocol given by (AOAC, 2012) [3]. The experiment was structured using a factorial Completely Randomized Design (CRD) and included three replications. The collected data was analyzed statistically according to the method described by using OPSTAT software (Gomez, 1984) [5].

Results and Discussion

Crude fat

The data depicted in Fig. 1 revealed that among the varieties of pearl millet, crude fat content of 5.96 per cent was significantly higher in Dhanshakti followed by MBC-2 (5.15 per cent), Pusa composite-701 (4.73 per cent) and Pusa Composite-383 (4.36 per cent), while Local variety possessed the lowest crude fat content of 4.08 per cent. Pearl millet is a significant source of fat, with 75 per cent of its fatty acids being unsaturated, and it also contains omega-3 and linolenic fatty acids. The variation among pearl millet varieties can be attributed to environmental conditions, agricultural practices, and genetic differences that affect their metabolic processes and nutrient allocation (Choudhary *et al.*, 2023) [4]. Similar findings were reported by Karkannavar *et al.* (2021) [7], who observed crude fat content ranging from 2.92 to 3.35 per cent in different cultivars of proso millet.

Crude fibre

The crude fibre content showed significant variation among different varieties of pearl millet. Dhanshakti exhibited the highest crude fibre content of 2.43 per cent, followed by MBC-2 (1.96 per cent) and Pusa Composite-701 (1.48 per cent). The lowest crude fibre content, 1.05 per cent, was found in the Local variety (Fig. 2). These findings are consistent with those of Shigihalli (2015) [19], who reported crude fibre content ranging from 3.16 to 3.31 per cent in various finger millet varieties. The variation in crude fibre content among pearl millet varieties may be attributed to their distinct genetic makeups, which can lead to differences in the composition of plant tissues with natural fibrous components. Additionally, variations in biochemical pathways that synthesize fibre components such as cellulose, hemicellulose, and lignin could contribute to these differences (Sushmita, 2016) [23].

Carbohydrates

The carbohydrate content of various pearl millet varieties ranged from 70.14 to 74.51 per cent (Fig. 3). The Local variety had the highest carbohydrate content of 74.51 per cent, followed by Pusa Composite-383 (73.59 per cent) and Pusa Composite-701 (72.84 per cent). In contrast, the Dhanshakti variety recorded the lowest carbohydrate content of 70.14 per cent. Sushmita (2016) [23] found carbohydrate content ranging from 56.74 to 61.75 per cent in various cultivars of little millet. The variation in carbohydrate content of different pearl millet cultivars might be due to the biochemical variations in the biochemical pathways involved in carbohydrate synthesis and storage can lead to differences in carbohydrate content. Also, the enzymatic activities and the efficiency of photosynthesis can vary among varieties, affecting carbohydrate accumulation (Khatak, 2010) [8]. Similarly, Shigihalli (2015) [19] reported carbohydrate content between 69.26 and 78.66 per cent in different finger millet varieties. Rajlaxmi *et al.* (2021) [15] also observed carbohydrate content ranging from 68.54 to 76.97 per cent in different sorghum varieties.

Calcium

The calcium content of various pearl millet varieties showed significant variation, ranging from 39.87 to 42.13 mg/100 g (Table 1). The highest calcium content was observed in Dhanshakti (42.13 mg/100 g), followed by MBC-2 (41.36 mg/100 g), Pusa Composite-701 (40.96 mg/100 g) and Pusa Composite-383 (40.45 mg/100 g). In contrast, Local variety had the lowest calcium content of 39.87 mg/100 g. The results are consistent with those of Jandu and Kavatra (2019) [6], who reported calcium content ranging from 49.91 to 54.71 mg per 100 g in various pearl millet varieties. Additionally, Sulaiman *et al.* (2020) [21] found calcium content values between 13.05 and 15.64 mg per 100 g in different sorghum millet cultivars.

Iron

The data in Table 1 indicated that the iron content in pearl millet varieties ranged from 6.57 to 8.16 mg/100 g. The Dhanshakti variety exhibited the highest iron content of 8.16 mg/100 g, followed by MBC-2 (7.68 mg/100 g), Pusa Composite-701 (7.39 mg/100 g) and Pusa Composite-383 (7.21 mg/100 g). However, Local variety recorded the lowest iron content of 6.57 mg/100 g. The variation in iron content among pearl millet varieties can be attributed to a combination of genetic, environmental, and agricultural factors which contribute to differences in iron levels across various varieties. Additionally, efforts to breed varieties with higher iron content and the implementation of good agricultural practices can enhance the nutritional value of pearl millet grains (Krishnan and Meera, 2018) [9]. These results align with the findings of Pawase *et al.* (2021) [12], who reported iron content ranging from 37.65 to 38.15 mg per 100 g in different pearl millet cultivars. Similar observations were made by Suma (2015) [22], who found iron content values between 5.01 and 6.04 mg per 100 g among various pearl millet varieties.

Zinc

The data presented in Table 1 showed significant variation in zinc content among pearl millet varieties. The Dhanshakti variety had the highest zinc content of 4.17 mg/100 g, followed by MBC-2 (3.45 mg/100 g), Pusa Composite-701 (3.26 mg/100 g) and Pusa Composite-383 (3.11 mg/100 g). However, Local variety recorded the lowest zinc content of 2.92 mg/100 g. Abdala *et al.* (2009) [1] and Velu *et al.*

(2008) [24] reported zinc content ranging from 5.3 to 7.12 mg per 100 g and 20.01 to 24.72 mg per 100 g respectively, in various pearl millet cultivars. Additionally, Rani (2017) [16] found zinc levels between 3.16 and 5.12 mg per 100 g in different pearl millet varieties.

Phosphorous

The data on phosphorous content indicated that the highest level was found in the Dhanshakti variety (333.82 mg/100 g), followed by MBC-2 (275.34 mg/100 g), Pusa Composite-701 (256.81 mg/100 g), and Pusa Composite-383 (238.45 mg/100 g). However, Local variety ACRA had the lowest phosphorous content of 203.49 mg/100 g (Table 1). The variation in phosphorus content among pearl millet varieties is likely due to a combination of genetic, environmental, and agricultural factors (Adeoti *et al.*, 2017) [2]. These findings align with those of Pontieri *et al.* (2022) [13], who reported phosphorous content ranging from 195.86 to 211.35 mg per 100 g in various sorghum millet varieties.

Table 1: Mineral content of different varieties of pearl millet

Variety	Calcium	Iron	Zinc	Phosphorus
Pusa Composite (383)	40.45	7.21	3.11	238.45
Pusa Composite (701)	40.96	7.39	3.26	256.81
Dhanshakti	42.13	8.16	4.17	333.82
MBC-2	41.36	7.68	3.45	275.34
Local Variety	39.87	6.57	2.92	203.49
Mean	40.95	7.40	3.39	261.58
CD (p=0.05)	0.06	0.04	0.03	0.09

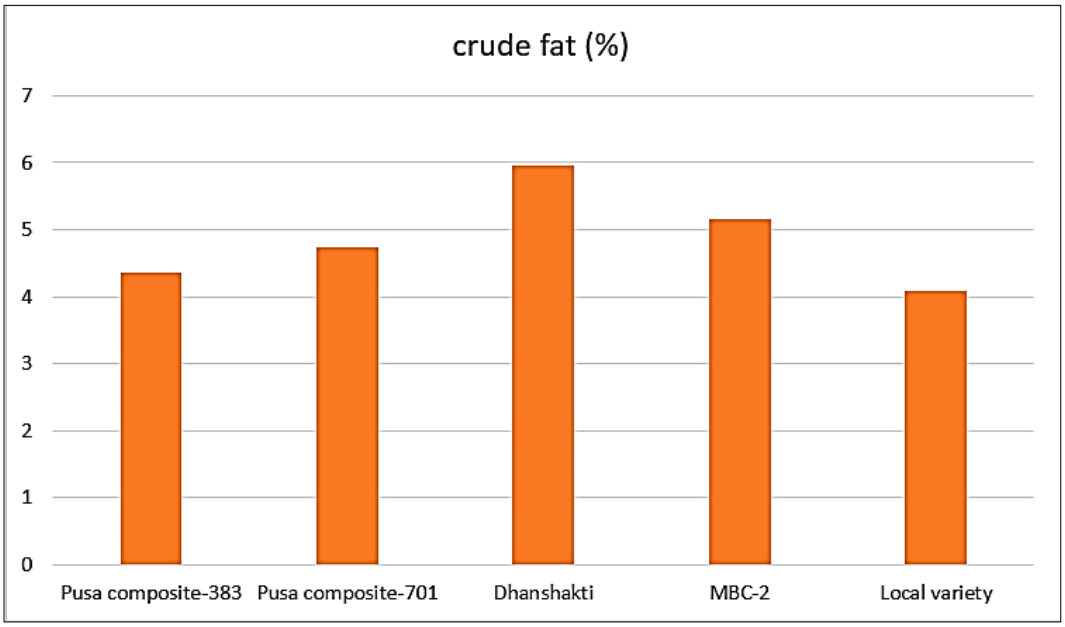

Fig 1: Effect of crude fat (%) on different varieties of pearl millet

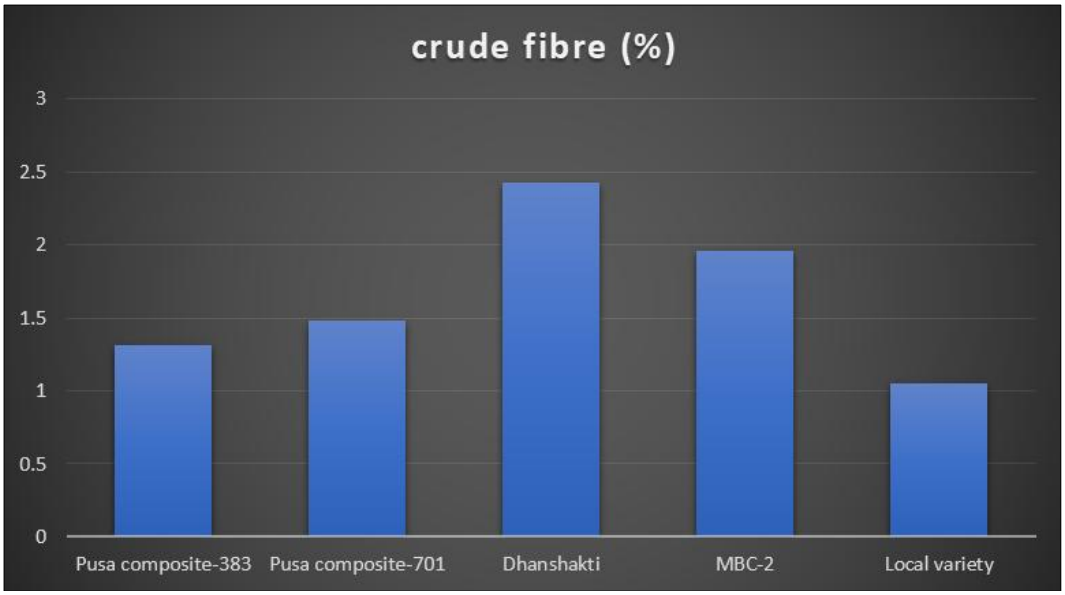

Fig 2: Effect of crude fibre (%) on different varieties of pearl millet

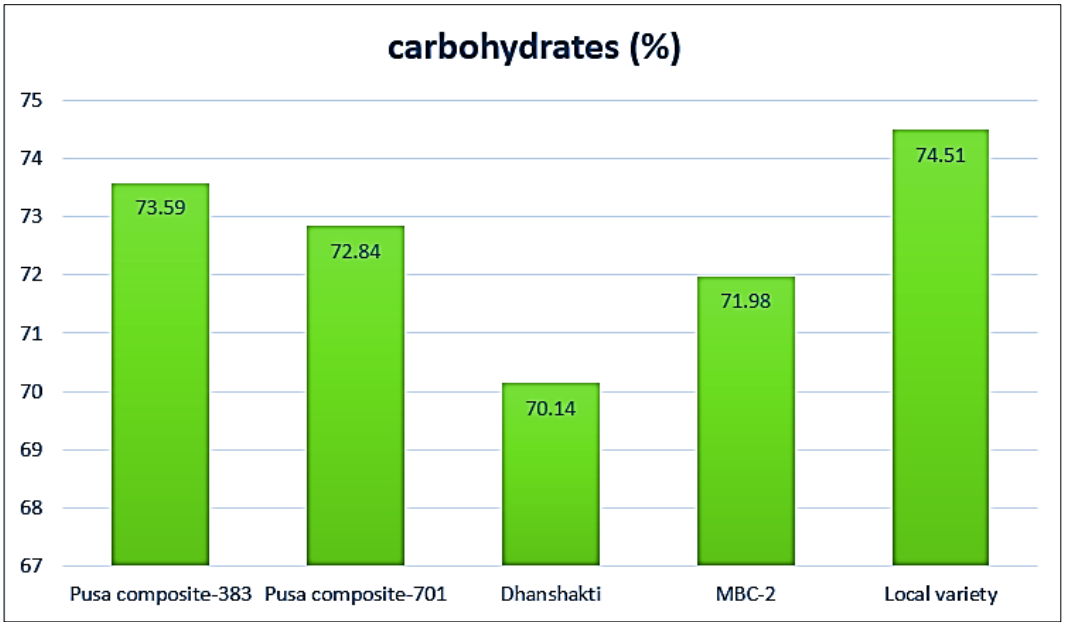

Fig 3: Effect of carbohydrates (%) on different varieties of pearl millet

Conclusion

The physico-chemical analysis revealed that the Dhanshakti variety of pearl millet has a high nutrient content. This study also showed that Dhanshakti is particularly rich in fat and fibre content, with higher availability of minerals as compared to other varieties. As a result, this variety holds considerable promise as a nutrient-dense ingredient for the formulation of various value-added food products within the food industry.

References

1. Abdalla AA, Ahmed UM, Ahmed AR, El Tinay AH, Ibrahim KA. Physicochemical characterization of traditionally extracted pearl millet starch (Jir). J Appl Sci Res. 2009;5(11):2016-27.
2. Adéoti K, Kouhoundé SH, Baba-Moussa F, Toukourou F. Nutritional value and physicochemical composition of pearl millet (Pennisetum glaucum) produced in Benin. J Micro Bio Food Sc. 2017;7(1):92-6.
3. AOAC. Official Methods of Analysis. 19th ed. Washington, DC: Association of Official Analytical Chemists; 2012.
4. Choudhary S, Rajpurohit BS, Kumawat S, Khandelwal V. Combining ability analysis for grain yield and quality characters in pearl millet [Cenchrus americanus (L.) Morrone]. Elect J Plant Breed. 2023;14(1):170-6.
5. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. New York: John Wiley and Sons; 1984.
6. Jandu R, Kawatra A. A comparative study on nutritional analysis of proximate composition and total mineral contents of different varieties of pearl millet. Int J Curr Microbiol App Sci. 2019;8(6):1868-72.
7. Karkannavar SJ, Shigihalli S, Nayak G, Bharati P. Physico-chemical and nutritional composition of proso millet varieties. Pharm Innovation J. 2021;10:136-40.
8. Khatak A. Evaluation, processing and utilization of pearl millet for preparation of value added RTE snacks [PhD thesis]. Hisar: CCS Haryana Agricultural University; 2010.
9. Krishnan R, Meera MS. Pearl millet minerals: effect of processing on bioaccessibility. J Food Sci Tech. 2018;55(9):3362-72.
10. Kulkarni DB, Sakhale BK, Chavan RF. Studies on development of low gluten cookies from pearl millet and wheat flour. Food Res. 2021;5(4):114-9.
11. Mamta. Development and nutritional evaluation of pearl millet (Pennisetum glaucum) based convenience foods [PhD thesis]. Hisar: I.C. College of Home Science, CCS Haryana Agricultural University; 2015.
12. Pawase PA, Chavan UD, Kotecha PM. Evaluation of functional properties of different pearl millet cultivars. Pharma Innovation J. 2021;10(6):1234-40.
13. Pontieri P, Troisi J, Calcagnile M, Bean SR, Tilley M, Aramouni F, Boffa A, Pepe G, Campiglia P, Del Giudice F, Chessa AL. Chemical composition, fatty acid and mineral content of food-grade white, red and black sorghum varieties grown in the mediterranean environment. Foods. 2022;11(3):436.
14. Priya P, Aneena ER, Thomachan S, Lakshmy PS, Prameela P. Optimization and evaluation of quality of the pearl millet nutri waffles. J Res ANGRAU. 2023;51(3):97-106.
15. Rajalakshmi G, Gnanalaksshmi KS, Baskaran D, Reiyaz MA. Proximate composition of sorghum grain and pearl millet. Int J Agric Sci Res. 2021;11(1):97-102.
16. Rani S. Nutritional evaluation and utilization of bio-fortified pearl millet in product development [MSc thesis]. Hisar: I.C. College of Home Science, CCS Haryana Agricultural University; 2017.
17. Rawat M, Varshney A, Rai M, Chikara A, Pohty AL, Joshi A, Binjola A, Singh CP, Rawat K, Rather MA, Gupta AK. A comprehensive review on nutraceutical potential of underutilized cereals and cereal-based products. J Agri Food Res. 2023;12:100619.
18. Saleh AS, Zhang Q, Chen J, Shen Q. Millet grains: nutritional quality, processing, and potential health benefits. Compr Rev Food Sci Food Saf. 2013;12(3):281-95.
19. Shigihalli S. Nutritional composition of white finger millet varieties and its value addition [MSc thesis].

Bengaluru: University of Agricultural Science GKVK; 2015.
20. Singh P, Gupta N, Bhat A, Sood M, Bandral JD. Quality evaluation and anti-nutritional factors of pearl millet blended cake. J Comm Mobil Sustain Develop. 2023;18(1):219-24.
21. Sulaiman SA, Igwegbe AO, Nassarawa SS. Proximate and mineral composition of some selected Sorghum varieties in Kano Metropolis. Am J Food Nutri. 2020;8(1):1-5.
22. Suma PF. Studies on the nutritional composition, functionality and utilization of pearl millet [PhD thesis]. Mysore: University of Mysore; 2015.
23. Susmita VP. A study on physico-chemical, cooking properties and development of yeast leavened products from selected varieties of little millet [MSc thesis]. Guntar: Acharya N G Rangna University; 2016.
24. Velu G, Rai KN, Sahrawat KL. Variability for grain iron and zinc content in a diverse range of pearl millet populations. J Crop Improv. 2008;35(2):186-91.