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COMPARATIVE NUTRITIONAL, HEALTH, AND PHARMACOLOGICAL EVALUATION OF BARNYARD MILLET AND WHITE RICE: ESTABLISHING BARNYARD MILLET AS A SUPERIOR DIETARY ALTERNATIVE

Priyanshu Jaiswal[1*], Prashant Gangwar[2], Ms. Neelam Painuly[3]

[1]Scholar, [2]Scholar, [3]Associate Professor,

School of Pharmacy and Research Dev Bhoomi Uttarakhand University, Dehradun, India.

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***Corresponding Author**

Priyanshu Jaiswal

Scholar, School of Pharmacy and Research Dev Bhoomi Uttarakhand University, Dehradun, India.

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ABSTRACT

A lot of people around the world, especially in Asia, eat white rice (Oryza sativa) as a main food. It possesses a high glycemic index and is easily digestible, contributing significantly to the glycemic load of your diet. Consuming polished white rice frequently has been associated with an increased risk of metabolic disorders, including type 2 diabetes, obesity, and heart disease. Due to these health concerns, an increasing number of individuals are seeking out healthier cereal alternatives. Barnyard millet *(Echinochloa frumentacea*), also known as Sawa rice or Jhangora, is a type of millet that is eaten in many parts of India and Asia. It is known for having a better nutritional profile than other types of millet. Barnyard millet is a whole grain that boasts a high content of dietary fiber, resistant starch, essential proteins, and minerals such as iron and zinc, along with bioactive compounds including phenolics and antioxidants. But white rice is not. This review examines the nutritional content, health advantages, and potential medical applications of barnyard millet and white rice. Studies indicate that barnyard millet possesses a significantly lower glycemic index, along with higher levels of fiber and micronutrients. These traits could help a person control their blood sugar, break down fats, and keep their heart healthy overall. Additionally, individuals with celiac disease can consume it without concern, as it is gluten-free. In general, barnyard millet

is a better choice than white rice when it comes to nutrition and metabolism for encouraging healthier eating habits.

KEYWORDS: Rice, barnyard millet, nutritional properties, health benefits, pharmacological properties.

1. INTRODUCTION

Oryza sativa belongs to the Poaceae family. It serves as a fundamental food source for numerous individuals, particularly in Asian nations, and is considered a significant factor in dietary glycemic load.[1],[2] The USA 24-2025 report indicates that India and China collectively accounted for 27% of the total rice production worldwide. Millions of individuals globally rely on it for sustenance.[3],[4] The disadvantages of this include a high glycemic index, a quick source of carbohydrates, and the risk of developing diabetes and heart problems[5] The circumstances surrounding oryza sativa are prompting individuals to seek alternative options. Echinochloa frumentacea belongs to the Poaceae family and serves as a significant minor millet, commonly consumed as a staple food across various regions in Asia, particularly in India. In Uttarakhand, India, it is referred to as sawa rice, while in English, it is known as barnyard millet.[6] Barnyard millet and other grains are known to be important sources of nutrition for millions of people around the world, especially in areas with hot and dry climates [8] Barnyard millet is a whole grain, opposite to polished rice, and it possesses a low glycemic index. This characteristic indicates that it contributes less to the glycemic load of your diet. Foods with a high glycemic index, like white rice, are fast carbohydrates that can cause blood sugar levels to rise quickly after eating. This raises the risk of obesity, type 2 diabetes, and heart disease.[1],[2] On the other hand, Barnyard millet (Sawa rice) has slowly digestible carbs, a lot of fiber, resistant starch, and important micronutrients that help keep blood sugar levels stable and improve metabolic health.[4] Because of these health and functional benefits, barnyard millet is becoming more popular as a healthier alternative to white rice, especially for people with diabetes, heart disease, and metabolic disorders caused by lifestyle choices.[7],[10]

Fig. 1: Barnyard Millet

Fig. 2: White Rice.

2. NUTRITIONAL DIFFERENCES OF SAWA RICE AND WHITE RICE

To prepare white rice, the bran and germ layers are removed from whole rice grains. In contrast, sawa rice is considered whole grain, retaining both the bran and germ, which are rich in fiber and phytochemicals. As a result, white rice contains fewer antioxidants, B vitamins, minerals, fats, fiber, and a small amount of protein. White rice contains 11.78% moisture, whereas barnyard millet has a moisture content of 10.27%. The crude protein content in rice is precisely 7.01%. This quantity of protein is slightly below the average crude protein content found in barnyard millet, which stands at 7.58%. Barnyard millet contains a higher protein content than rice, making it beneficial for high-protein diets. It contains the highest levels of iron and fiber found in any food. Gamma amino butyric acid (GABA; beta-glucan and GABA) is another significant component found in these grains. These substances act as antioxidants, contributing to the reduction of blood lipid levels.[14] Barnyard millet serves as an alternative to rice for individuals with diabetes. Jhangora contains significantly higher levels of crude protein, crude fat, and crude fiber compared to rice, with values of 9.39, 2.0, and 6.3 percent, respectively. Barnyard millet contained higher levels of total dietary fiber (11.4%), resistant starch (12.81%), tannin (67.8%), and total antioxidant activity (59.23%) compared to rice, a widely consumed cereal. Jhangora contains a significant amount of iron, ranging from approximately 15.6 to 18.6 mg per 100 grams, which is considerably higher than that found in other millets and staple cereals.[12] The high ratio of carbohydrates to crude fiber helps keep blood sugar levels stable by slowing down the release of sugars into the blood. In studies involving rats, the resistant starch found in barnyard millet has demonstrated the ability to reduce blood glucose levels, serum cholesterol, and triglycerides. Millets possess a significantly lower average glycemic index (GI) of approximately 52.7, in contrast to milled rice, which has an average GI of around 71.7. This indicates that millets release glucose into the bloodstream at a slower rate.

Table 1: Nutritional value of Sawa rice and white rice per 100g [7],[8],[15],[17],[18],[19],[20],[21],[22],[23],[24],[25],[26],[27],[28],[29],[30],[31],[32],[33],[34],[35],[36]

S. No.	Nutrition	Sawa rice	White rice
1.	Carbohydrate	51.5-77.08 %	73-88.87%
2.	Crude fiber	5.41-18.0%	0.6-1.0%
3.	Crude fat	1.5-6.3%	1.6-2.8%
4.	Protein	6.7-12.7%	7.1-8.3%
5.	Calorific value	327-398 kcal	363-385 kcal
6.	Dietary fiber	6.0-15%	1.58%
7.	Moisture content	8.66-8.74%	11.78%
8.	Minerals	2.1-4.4%	0.6%
9.	Crude ash	2.0-5.4%	1.0-1.5%
10.	Iron	5.0-22.98mg	0.7-5.4 mg
11.	Zinc	0.4-5.9mg	1.5-2.2 mg
12.	Phosphorus	280mg	60 mg

3. HEALTH BENEFITS AND PHARMACOLOGICAL ACTIVITIES OF SAWA RICE

Barnyard millet can assist in addressing various health and dietary issues, including obesity, diabetes, heart disease, malnutrition, skin disorders, cancer, and celiac disease. Due to its high content of slowly digestible carbohydrates, it gradually releases glucose into the bloodstream, aiding in the maintenance of stable blood sugar levels. In contrast, the consumption of white rice has been associated with an increased risk of Type 2 Diabetes Mellitus.[37],[38] Barnyard millet serves as an alternative to rice for individuals with diabetes. Jhangora contains 9.39% crude protein, 2.0% crude fat, and 6.3% crude fiber, along with essential micronutrients such as iron (Fe) and zinc (Zn), which are associated with various health advantages. These nutritional levels significantly surpass those found in rice. Barnyard millet contained higher levels of total dietary fiber (11.4%), resistant starch (12.81%), tannin (67.8%), and total antioxidant activity (59.23%) compared to rice, a common staple cereal,[12] White rice has a higher glycemic index (GI) because it converts starch into simpler sugars, leading to a rapid increase in blood sugar levels. This occurs partly due to the milling process, which eliminates the bran that holds the majority of the fiber. But white rice generally has less minerals because most of the bran, which is high in minerals, is taken out from it.[39] Barnyard millet is a great source of fiber. It has anti-mutagenic, anti-inflammatory, and antioxidant properties. It also helps keep blood pressure and blood sugar levels in check, which is good for metabolic health.[40] Barnyard millet is rich in starch and low in sugar, making it an excellent food choice for individuals with diabetes.[7],[17] Diabetics can prevent

spikes in glucose levels by replacing white rice with barnyard millet. We discovered a significant connection between the consumption of large amounts of white rice and various risk factors for cardiovascular diseases, including type 2 diabetes and metabolic syndrome.[41] Conversely, a high intake of refined rice has also been associated with metabolic syndrome, type 2 diabetes, and cardiovascular diseases. In contrast, regularly consuming barnyard millet meal has been associated with a reduced glycemic index (GI) in individuals with type 2 diabetes. Rodents that consumed a diet consisting of native and treated starch from barnyard millet exhibited reduced levels of blood glucose, serum cholesterol, and triglycerides compared to those that were fed rice and other lesser millets.[17] Barnyard millet serves as an excellent alternative to rice for individuals with gluten sensitivities. The barnyard millet is gluten-free, similar to all other types of millet, making it suitable for individuals who are unable to consume gluten, such as those with celiac disease. Millet serves as an alternative to both rice and wheat. Barnyard millet is low in calories and serves as an excellent source of protein that is easily digestible. Millets are recognized for their high content of phenolic acids, tannins, and phytate, all of which are classified as "antinutrients." But these antinutrients lower the chance of getting colon and breast cancer in animals.[42] Barnyard millet has antioxidants that come from its phytochemicals. These may help to prevent cells from oxidative damage and lower inflammation rate, which is good for overall health and well-being.[43] Flavonoids, anthocyanins, tannins, and phenolic acid are all phenolic compounds found in millet. They act as antioxidants and are very important for boosting the immune system. They may also help fight oxidative stress and inflammation, which can improve overall health and well-being.[44]

4. CONCLUSION

This review shows that there are clear differences in the nutrition, health, and pharmacology of white rice (Oryza sativa) and barnyard millet (Echinochloa frumentacea). Barnyard millet is a better dietary choice because of its high nutritional value. White rice remains a fundamental food source globally; however, the polishing process increases its glycemic index while reducing its fiber content and micronutrient levels. This alteration is associated with metabolic disorders such as type 2 diabetes, obesity, and heart disease. Conversely, barnyard millet is a whole grain that retains its bran and germ layers. This indicates that it is rich in dietary fiber, resistant starch, essential minerals, and bioactive phytochemicals. The research indicate that barnyard millet has a slightly lower glycemic index, which releases glucose more slowly, hence improves lipid metabolism, and has a strong antioxidant, anti-

inflammatory, and antidiabetic effects. It is also good for people with celiac disease and gluten intolerance because it doesn't contain any amount gluten. So, switching out white rice for barnyard millet on a regular basis may help with blood sugar control, lower the risk of heart disease and diabetes, and overall nutritional security. In conclusion, promoting barnyard millet as an alternative to white rice that can play a crucial role in reducing lifestyle related metabolic disorders and improving public health. Future research should focus on comprehensive clinical trials, the refinement of processing methods, and increased consumer awareness to promote wider dietary incorporation.

REFERENCES

1. Malabadi, R. B., Kolkar, K. P., &Chalannavar, R. K. (2022). *White, and brown rice-nutritional value and health benefits: Arsenic toxicity in rice plants*. International Journal of Innovation Scientific Research and Review, 4(7): 3065–3082.
2. Awika, J. M. (2011). Major cereal grains production and use around the world. In *Advances in cereal science: implications to food processing and health promotion* (pp. 1-13). American Chemical Society.
3. Saha, S. (2025). *Net and percentage change in area & production of rice in major states in India*. International Journal for Multidisciplinary Research (IJFMR)., 7(3): May-June 2025; E-ISSN: 2582-2160.
4. Kabdal, B., Kushwaha, A., Dutta, A., Kumar, S., Sharma, U. C. L., &Shahi, N. C. Comparative study of physical and nutritional characteristics of rice and barnyard millet: Assessing barnyard millet as an alternative to rice.
5. Eduru, A., Kamboj, A., Reddy, P. M., & Pal, B. (2021). Nutritional and health benefits of millets, present status and future prospects: A review. *The Pharma Innovation Journal*, *10*(5): 859-868.
6. Nithiyanantham, S., Kalaiselvi, P., Mahomoodally, M. F., Zengin, G., Abirami, A., & Srinivasan, G. (2019). Nutritional and functional roles of millets—A review. *Journal of food biochemistry*, *43*(7): e12859.
7. Bhatt, D., Rasane, P., Singh, J., Kaur, S., Fairos, M., Kaur, J., ... & Sharma, N. (2023). Nutritional advantages of barnyard millet and opportunities for its processing as value-added foods. Journal of Food Science and Technology, 60(11): 2748-2760.
8. Bhatt, D., Fairos, M., &Mazumdar, A. (2022). Millets: nutritional composition, production and significance: a review. *J Pharm Innov.*, *11*: 1577-82.

9. Manimekalai, M., Dhasarathan, M., Karthikeyan, A., Murukarthick, J., Renganathan, V. G., Thangaraj, K., ... &Senthil, N. (2018). Genetic diversity in the barnyard millet (Echinocholafrumentacea) germplasms revealed by morphological traits and simple sequence repeat markers. *Current Plant Biology.*, *14*: 71-78.
10. Karakannavar, S. J., Nayak, G., &Hilli, J. S. (2021). Effect of different levels of polishing on physico-chemical characteristics of barnyard millet (Echinochloafrumentacea). *Pharm Innov J.*, *10*: 50-54.
11. Khalua, R. K., Tewari, S., &Mondal, R. (2019). *Nutritional comparison between brown rice and white rice*. The Pharma Innovation Journal, 8(6): 997–998.
12. Pandey, S., Joshi, N., Kumar, M., Nautiyal, P., Papnai, G., &Bhaskar, R. (2021). Nutritional profile & health benefits of Jhangora: a mini review. *Pharm Innov.*, *10*: 379.
13. Amadou, I., Gounga, M. E., & Le, G. W. (2013). Millets, nutritional composition, some health benefits and processing. *Emir J Food Agric.*, *25*(7): 501-508.
14. Gahalawat, P., Lamba, N., & Chaudhary, P. (2024). Nutritional and health benefits of millets: a review article. *Journal of Indian System of Medicine*, *12*(1): 4-11.
15. Renganathan, V. G., Vanniarajan, C., Karthikeyan, A., &Ramalingam, J. (2020). Barnyard millet for food and nutritional security: current status and future research direction. *Frontiers in genetics*, *11*: 500.
16. Anitha, S., Kane-Potaka, J., Tsusaka, T. W., Botha, R., Rajendran, A., Givens, D. I., ... & Bhandari, R. K. (2021). A systematic review and meta-analysis of the potential of millets for managing and reducing the risk of developing diabetes mellitus. *Frontiers in nutrition*, *8*: 687428.
17. Maurya, N. K., Singh, J., Gupta, E., Kumari, N., Yadav, L., &Maurya, P. (2023). Barnyard Millet's Health and Nutritional Significance. *International Journal of Agricultural Invention*, *8*(2): 156-160.
18. Kaur, H., & Sharma, S. (2020). An overview of Barnyard millet (Echinochloafrumentacea). *J PharmacognPhytochem*, *9*(4): 819-822.
19. Saleh, A. S., Zhang, Q., Chen, J., & Shen, Q. (2013). Millet grains: nutritional quality, processing, and potential health benefits. *Comprehensive reviews in food science and food safety*, *12*(3): 281-295.
20. Prasanna, J., & Girish, C. (2020). An overview on echinochloafrumantacea millets.
21. Jacob, J., Krishnan, V., Antony, C., Bhavyasri, M., Aruna, C., Mishra, K., ... &Visarada, K. B. (2024). The nutrition and therapeutic potential of millets: an updated narrative review. *Frontiers in nutrition*, *11*: 1346869.

22. Maitra, S., Panda, P., Panda, S. K., Behera, D., Shankar, T., & Nanda, S. P. (2020). Relevance of barnyard millet (Echinochloa frumentacea L.) cultivation and agronomic management for production sustainability. *Int J Bioinform Biol Sci.*, *8*: 27-32.
23. Roopashree Ugare, R. U., Bharati Chimmad, B. C., Rama Naik, R. N., Pushpa Bharati, P. B., & Sunanda Itagi, S. I. (2014). Glycemic index and significance of barnyard millet (Echinochloafrumentacae) in type II diabetics.
24. Bhinda, M. S., Joshi, D. C., Parihar, M., Meena, R. P., Joshi, P., Gupta, A., ... & Sood, S. (2023). Genetics, breeding, and genomics of Indian barnyard millet (Echinochloa frumentacea): status and perspectives. In *Neglected and Underutilized Crops* (pp. 115-135). Academic Press.
25. Chandra, S., Saklani, S., Semwal, R. B., & Semwal, D. K. (2019). Estimation of nutritional and mineral contents of eleusine coracana and echinochloa frumentacea–two edible wild crops of india. *Current Nutrition & Food Science*, *15*(4): 363-366.
26. Krati, B. R., Bhardwaj, A., & Singh, A. (2025). A Comprehensive Review on Indian Barnyard Millet (Echinochloa frumentacea). *International Journal of Pharmaceutical Technology and Biotechnology*, *12*(1): 01-07.
27. Sharma, V. K., Bhatt, P., & Malik, M. 7. CHEMICAL COMPOSITION OF JHINGORA (INDIAN BARNYARD MILLET) VARIETIES CULTIVATED IN UTTARAKHAND AND THEIR USES.
28. Rajeswari, N., & Priyadharshini, V. P. (2021). Evaluation of Nutritional and Nutraceutical Content of Polished and Unpolished Barnyard Millet-An Analytical Study. *Current Research in Nutrition & Food Science*, *9*(3).
29. Singh, R., Singh, R., Singh, P. K., & Singh, O. (2023). Climate smart foods: nutritional composition and health benefits of millets. *Int. J. Environ. Clim. Change*, *13*(11): 1112-1122.
30. Choudhary, R., Chodhary, M., Rana, B. B., & Narwal, K. (2023). BARNYARD MILLET (Echinochloa species).
31. Verma, D. K., & Shukla, K. (2011). Nutritional value of rice and their importance. *Journal of Indian Farmers Digest.*, *44*(1): 21-35.
32. Mohan, V., Anjana, R. M., Gayathri, R., Ramya Bai, M., Lakshmipriya, N., Ruchi, V., ... & Sudha, V. (2016). Glycemic index of a novel high-fiber white rice variety developed in India—A randomized control trial study. *Diabetes technology & therapeutics*, *18*(3): 164-170.

33. Saleh, A. S., Wang, P., Wang, N., Yang, L., & Xiao, Z. (2019). Brown rice versus white rice: Nutritional quality, potential health benefits, development of food products, and preservation technologies. *Comprehensive reviews in food science and food safety*, *18*(4): 1070-1096.
34. Gahalawat, P., Lamba, N., & Chaudhary, P. (2024). Nutritional and health benefits of millets: a review article. *Journal of Indian System of Medicine*, *12*(1): 4-11.
35. Thakur, A., Painuly, N., Vardhan, B. V., Hangloo, K., & Chandra, S. (2025). Reducing free radical potential of Echinochloa frumentacea: A millet from Uttarakhand Himalayas. International Journal of Environmental Sciences, 11(16s): 128–137.
36. Gowda, N. N., Siliveru, K., Prasad, P. V., Bhatt, Y., Netravati, B. P., &Gurikar, C. (2022). Modern processing of Indian millets: a perspective on changes in nutritional properties. *Foods*, *11*(4): 499.
37. Mhaske, P. S., Nathan, B., Nallusamy, S., Raman, R., Sampathkumar, V., Kathirvel, P., Ravikumar, C. N., Sathyaseelan, C., & Divya, S. (2025). Exploring the anti-diabetic potential of barnyard millet: Insights from virtual screening, MD simulation and MM-PBSA. Journal of Biomolecular Structure and Dynamics, 1–15. https://doi.org/10.1080/07391102.2025.2478466.
38. Yu, J., Balaji, B., Tinajero, M., Jarvis, S., Khan, T., Vasudevan, S., ... & Malik, V. S. (2022). White rice, brown rice and the risk of type 2 diabetes: A systematic review and meta-analysis. *BMJ open*, *12*(9): e065426.
39. Ahmed, Z. (2025). A review on the impact of cooking methods and rice varieties on nutritional value. IPS Journal of Nutrition and Food Science, 4(3): 555–560. https://doi.org/10.54117/5vaksr64.
40. Jaiswal, K., Tannu, Dubey, S. K., & Behar, N.(2025). *Evaluation of phytochemicals and antioxidant potential in millets*. *International Journal of Pharmaceutical Sciences and Research, 16*(9): 2600–2607. https://doi.org/10.13040/IJPSR.0975-8232.16(9).2600-07.
41. Izadi, V., &Azadbakht, L. (2015). Is there any association between rice consumption and some of the cardiovascular diseases risk factors? A systematic review. *ARYA atherosclerosis*, *11*(Suppl 1): 109.
42. Rana, S., Agnihotri, V., & Bhandari, N. S. (2023). Nutritional characteristics of horsegram (Macrotyloma uniflorum) and its value-added food products: A review. *IJFMR-International Journal for Multidisciplinary Research*, *5*(2): 1-17.

43. Chandrkar, L., Sahu, T., & Shahi, S. (2024). *A systematic review of barnyard millet*. African Journal of Biological Sciences, 6(9): 2673–2680. https://doi.org/10.33472/AFJBS.6.9.2024.2673-2680.
44. Ofosu, F. K., Elahi, F., Daliri, E. B.-M., Chelliah, R., Ham, H. J., Kim, J.-H., Han, S.-I., Hur, J. H., & Oh, D.-H. (2020). *Phenolic profile, antioxidant, and antidiabetic potential exerted by millet grain varieties.*Antioxidants, 9(3): *254*. https://doi.org/10.3390/antiox9030254.