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RESEARCH ARTICLE

BPT2848 (IET28692): A Black Rice with High Protein Content

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Abstract

Rice serves as a dietary staple for nearly half of the global population, making it a crucial source of nutrition. Enhancing the protein content of rice can significantly contribute to alleviating protein-energy malnutrition, which affects over one-third of the world's children. BPT 2848 (IET 28692), a newly developed black rice variety derived from the cross between RP Bio 226*1 and IRGC 48493 through pedigree breeding, stands out for its high protein content of 10.5% in polished rice, a notable improvement over conventional white rice (6–7%). Evaluated across nine locations in seven states during the IVT-Biofortification trial, BPT 2848 consistently exhibited superior protein levels, exceeding 10% at five locations, with the highest content observed at Cuttack (13.33%) and Jeypore (13.17%). Additionally, BPT 2848 demonstrated high total phenol content (123.31 mg/100 g), flavonoid content (784.54 mg/100 g), and antioxidant activity (86.63 mg/100 g), contributing to its potential health benefits. Unlike traditional glutinous black rice, BPT 2848 possesses intermediate amylose content and an alkali spreading value, resulting in a soft and flaky texture upon cooking. With a medium slender grain, a test weight of 13.5 to 14.0g, and a mean grain yield of 4415 kg/ha, BPT 2848 combines nutritional superiority with agronomic viability. This high-protein, bioactive compound-rich black rice presents an appealing option for promoting dietary protein intake and enhancing nutritional security.

Keywords: Black rice, high protein content, nutritional security and anti-oxidant activity

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Introduction

With roughly half of the world's population relying on rice (*Oryza* spp. L.) as a staple food, the grain supplies the majority of dietary nutrients to billions of people (Khanin *et al*., 2017). Although rice contains less protein content than wheat or corn, it has superior biological value; therefore, the impact of improving the protein content in rice would be enormous in combating protein-energy malnutrition, which is prevalent in more than one-third of the world's child population. Plant-based foods have become the most popular and trending choice for people across all levels of the social ladder, instead of relying on medication for protein (Shuvobrata *et al*., 2022). While white rice, commonly consumed across many cultures, contains around 6 to 7% protein, recent innovations in rice breeding have led to the development of varieties with higher protein content. One such variety, BPT 2848, black rice, stands out with a protein content of approximately 10.5% in polished white rice. This increase in protein makes black rice a noteworthy option for those seeking to enhance their protein intake through plant-based sources.

Materials and Methods

BPT 2848 (IET 28692) is a black rice variety developed through a pedigree breeding method. It is a derivative of the cross between

RP Bio 226*1 and IRGC 48493, bred at the Agricultural Research Station, Bapatla. The breeding process involved continuous selection across generations to stabilize the desired traits, particularly high protein content and agronomic performance. BPT 2848 was evaluated as part of the IVT-Biofortification trial conducted during the *kharif* season across nine locations in seven states of India. The trial aimed to assess yield performance, grain quality, and nutritional parameters. A total of 38 entries were tested, including four check varieties — IR 64 and BPT 5204 as yield checks, and DRR Dhan 45 and Chittimuthyalu as micronutrient checks. Grain yield (kg/ha), quality traits, and nutritional parameters were recorded. The polished rice samples from all entries were analyzed for protein content, zinc content, and iron content at ICAR-NRRI, Cuttack. The analysis followed standard biochemical methods to ensure accuracy and reliability.

Results

The polished rice of all the entries was analyzed for nutritional parameters, *viz.*, zinc content, Fe content, and protein content at ICAR-NRRI, Cuttack during *kharif*, 2019. Among all the entries tested, BPT 2848 showed the highest overall mean protein content (10.5%) in polished rice**.** The two micronutrient checks *viz.*, DRR Dhan 45 and Chitimuthyalu recorded 6.43 and 8.30% mean protein content on an overall basis respectively. IET 28692 recorded more than 10.0% protein content in polished rice at 5 locations *viz.*, Jeypore (13.17%), Cuttack (13.33%), Sirsi (10.52%), Aduthurai (12.28%) and Coimbatore (10.36%), out of 9 testing locations (Fig 1).

BPT 2848 (IET 28692) possesses a medium slender grain with a test weight of 13.5 to 14.0 g. BPT 2848 matures in 125 to 130 days duration during the *kharif* season and recorded a mean grain yield of 4415 kg/ha when tested at 20 locations in the IVT-Biofortification trial. Proteins are important modulators of glucose homeostasis by increasing gluconeogenesis and preventing insulin resistance (Ke *et al.,* 2018); hence, genotypes possessing a high protein content digest slowly and aid in the slow release of blood glucose. It also recorded high total phenol content (123.31 mg/100 g), high flavonoid content (784.54 mg/100 g) and high antioxidant activity (86.63 mg/100 g) which plays a major role in free radical balance (Table 1). Similar results were also reported by (Yuehan *et al.*, 2018) that the free TPC of whole-grain red and black rice had significantly higher values than that of white rice. Unlike other glutinous black rice varieties, BPT 2848 possesses an intermediate amylose content and alkali spreading value; hence, it cooks soft and flaky. Hence, the black pericarp-colored rice genotype, BPT 2848, possessing a medium slender grain with desirable cooking quality (soft and flaky texture of cooked rice) can be included in the daily diet because of its high bioactive compounds, which have potential nutraceutical benefits to health.

Discussion

The development of BPT 2848, a high-protein black rice variety, holds promising implications for improving nutritional security, particularly in regions facing protein-energy malnutrition. Its significantly higher protein content,

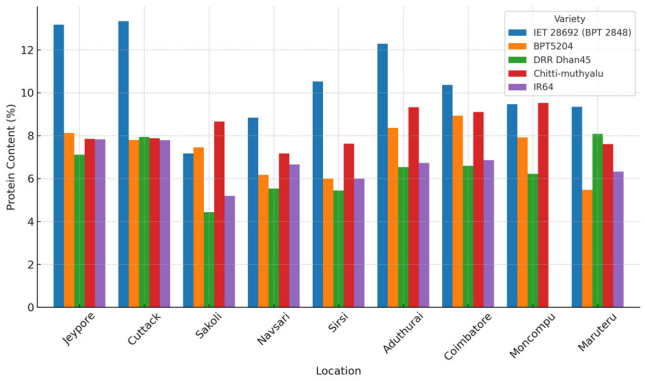

Fig. 1: Protein content (%) in polished rice samples of BPT 2848 (IET 28692) in initial variety trial- biofortification (IVT-Biofort) analyzed at different locations during *Kharif,* 2019

Table 1: Physico-chemical, nutritional and biochemical quality characteristics of BPT2848

S.No	*Quality parameter*	*BPT2848*	*S.No*	*Quality parameter*	*BPT 2848*
1	Kernel length (mm)	5.63	11	Protein content (%) in polished rice	10.5
2	Kernel breadth (mm)	1.96	12	Crude fiber (%)	1.21
3	Length/ breadth ratio	2.88	13	Carbohydrate (%)	73. 17
4	Grain type	Medium slender	14	Energy (Kcal.)	358
5	Volume expansion Ratio	3.73	15	Fe content (ppm)	12.30
6	Water uptake(ml)	417	16	Zn content (ppm)	18.00
7	Alkali spreading value	4.33	17	Total Antioxidant activity in unpolished rice (mgAAE/100 g)	86.63
8	Gel consistency (mm)	78.0	18	Total anthocyanin content in unpolished rice (mg C3g/100 g)	24.99
9	Amylose content (%)	22.48	19	Total phenol content in unpolished rice (mg GAE/100 g)	123.31
10	Protein content (%) in unpolished rice	13.2	20	Flavonoid content in unpolished rice (mg GAE/100 g)	784.54

combined with essential bioactive compounds like phenols, flavonoids, and antioxidants, makes it an ideal candidate for promoting better health and preventing lifestyle diseases such as diabetes and obesity. Future breeding programs can leverage BPT 2848 as a donor parent to introduce high protein content and antioxidant traits into other elite rice varieties, enhancing both nutritional and agronomic performance. Additionally, its desirable cooking quality soft and flaky texture increases its market acceptance, encouraging consumers to incorporate it into daily diets. Expanding cultivation of this variety in diverse agro-climatic regions could ensure stable yields and consistent nutritional quality across varying environments. Moreover, exploring its potential in value-added products like rice-based snacks, health foods and fortified rice formulations can create new market opportunities. Long-term studies on its health impacts, particularly in glucose regulation and antioxidant benefits, could further establish BPT 2848 as a functional food. Integrating this variety into biofortification strategies and government nutrition programs could significantly contribute to addressing global malnutrition challenges. Finally, with rising consumer preference for plant-based protein sources, BPT 2848 has the potential to position itself as a sustainable, nutrient-rich alternative to animal-based proteins.

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