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BRRI DHAN31 GENERATE ELEVATED LEVEL OF BIOACTIVE COMPONENT, γ-AMINOBUTYRIC ACID (GABA) AT PRE-GERMINATED BROWN RICE CONDITION.

Biochemistry

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ABSTRACT

Being rich in nutritional value and food functionality, pre-germinated brown rice has added advantage over polished milled rice or brown rice considering physiological, clinical and nutritional aspects. A total of ten rice varieties of brown rice including both traditional rice such as Ghungshe, Kajalsail, Monteshor, Moulata, Sadamota and high-yielding variety such as BR22, BR23, BRRI dhan31, BRRI dhan40, BRRI dhan41 were analyzed for the presence of important amino acids such as GABA, Glutamic acid, Methionine, Lysine, Histidine and Arginine. Our data revealed that BRRI dhan31 possess the most elevated content of GABA among ten rice varieties. Since GABA has nutritionally potential to mediate recovery to many disorders such as Diabetics, Hypertension, Alzheimer's disease so dietary administration of BRRI dhan31 at pre-germinated brown rice condition might be supportive to get a better healthy lifestyle.

KEYWORDS:

BRRI dhan31, Gamma amino butyric acid, Pre germinated brown rice,

Introduction

Pre-germinated brown Rice (PGBR) alias germinated brown rice (GBR) or sprouted brown rice (SBR) enhances the bio-availability of nutrients by neutralizing phytic acid during germination process. Consumption of unsprouted grains can lead to poor absorption to nutrients in the grain. The incompletely digested proteins can irritate the intestines, leading to inflammation and allergic reactions.Neut ralizing the phytic acid, releasing the proteins, vitamins, and enzymes allow these important nutrients to be absorbed during digestion. Brown rice (BR) can be soaked in water at 30°C for specified hours for germination to get PGBR. Soaking for 3 h and sprouting for 21 h has been found to be optimum for getting the highest GABA content in PGBR, which is the main reason behind the popularity of PGBR (Swati, 2011). During the process of germination, nutrients in the brown rice (BR) change drastically. It is reported that, not only existing nutrients are increased but new components are also released from the inner part of rice change due to germination (Kayahara, 2001; Kayahara at. el., 2001). The nutrients which have increased significantly include GABA, lysine, vitamin E, dietary fiber, niacin, magnesium, vitamin B1, and vitamin B6 (Kayahara at. el., 2000) . BR contains more nutritional components than 0ordinary white rice. PGBR has been reported to exhibit many physiological effects, including anti-hyperlipidemia, anti-hypertension, and the reduction in the risk of some chronic diseases, such as cancer, diabetes, cardiovascular disease, and Alzheimer's disease (Wu F., 2013). Therefore, it is likely that PGBR will become a popular health food in Bangladesh. As the protein supply for ever increasing world population becomes limiting, the need for accurate data on the amino acids of major foods, such as rice becomes more critical. In this experiment we investigated the potentiality of our both Bangladeshi HYV and local rice varieties of Bangladesh for the preparation of PGBR as well as estimation of some selective amino acids, such as GABA, Glutamic acid, Methionine, Lysine, Histidine and Arginine in these tested rice varieties. Our present study might widen the scopes of developing of new food from rice and rice by-products based on the available content of beneficial amino acids specially GABA.

Materials and methods: Grains of ten Bangladeshi rice varieties including 5 traditional like Ghungshe, Kajalsail, Monteshor, Moulata, Sadamota and 5 BRRI HYV like BR22, BR23, BRRI dhan31, BRRI dhan40, BRRI dhan41 were subjected to determine the protein content (AOAC, 1995), apparent amylose content (Juliano, 1971) and amino acid content (Moore S, 1963) of Glutamic acid, GABA, Methionine, Histidine, Lysine and Arginine at both PBR and PGBR condition. The SPSS, version 20 was applied for statistical analysis of the experimental data. Analysis of variance (ANOVA) followed by Duncan's multiple range test (DMRT) was applied on changing fold data of amino acid content parameters from PBR to PGBR condition at Table 4. The level of significance was set at $p < 0.05$.

Results and discussion

In protein analysis, it is clearly revealed that protein content increased in PGBR compare to PBR in all tested varieties ranges from 13.73 % to 46.86 % (Table1). Ghungshe, BRRI dhan41 and BR23 showed maximum increased in protein content in PGBR stage compare to PBR. In Amylose content assay, all tested varieties showed decreasing AAC in PGBR compare to PBR and PMR (Table 2). In Amino acid analysis (Table 3), we found that in estimation of glutamic acid content, BR23 has the lowest content of 1.40 mg 100^{-1}g at PGBR and all tested varieties has a decreasing trends from PBR towards PGBR except BRRI dhan41 (Table 3). In GABA estimation, BRRI dhan31 has the highest content of 12.00 mg 100^{-1}g at PGBR among all varieties and it showed an increasing trend from PBR towards PGBR for all varieties (Table 3). In case of Histidide estimation, Ghungshe has the lowest content of 0.60 mg 100^{-1}g and BRRI dhan 31 has the highest content of 2.34 mg 100^{-1}g. All the varieties showed increasing trend from PBR towards PGBR except Ghungshe and Kajalsail (Table 3). In estimation of Methionine, Ghungshe has the lowest content of 0.9 mg 100^{-1}g and BR22 has the highest content of 2.43 mg 100^{-1}g among all varieties. All varieties showed increasing trends from PBR toward PGBR except Kajalsail, Montesshor and BRRI dhan40 (Table 3).

Table 1. Protein Content of Traditional and HYV of Rice Varieties.

Varieties	Protein (N X 5.95) Content (g 100g-1)				
	PMR	PBR(%)	PGBR(%)		
		Content	Increased	Content	Increased
Ghungshe	7.75	9.00	16.13	11.38	46.84
Kajalsail	8.32	9.18	10.34	10.5	26.20
Monteshor	8.29	9.74	17.49	9.87	19.06
Moulata	8.57	9.23	7.70	10.36	20.89
Sadamota	8.30	9.38	13.01	9.44	13.73
BR22	8.56	9.13	6.66	9.96	16.36
BR23	7.50	8.76	16.80	10.51	40.13
BRRI dhan31	8.34	8.85	6.12	10.47	25.54

BRRI dhan40	8.19	9.11	11.23	10.01	22.22
BRRI dhan41	7.32	8.77	19.81	10.75	46.86
PMR; Parboiled Milled Rice, PBR; Parboiled Brown Rice, PGBR; Pre-Germinated Brown Rice.					

Table 2. Amylose Content (g 100-1g) of Traditional and HYV of Rice Varieties.

Varieties	PMR	PBR	PGBR
Ghungshe	23.05	22.6	21.32
Kajalsail	25.65	24.41	23.46
Monteshor	22.33	20.94	23.46
Moulata	25.34	24.42	21.9
Sadamota	25.56	23.68	22.7
BR22	26.24	25.16	23.07
BR23	27.86	25.47	22.5
BRRI dhan31	26.97	26.22	23.5
BRRI dhan40	26.67	25.62	22.49
BRRI dhan41	27.12	26.07	23.46
PMR; Parboiled Milled Rice, PBR; Parboiled Brown Rice, PGBR; Pre-Germinated Brown Rice			

Table 3. Amino Acid (Glutamic Acid, GABA, Histidine Meth ionine, Lysine, Arginine) Content of Traditional and HYV Rice Varieties in PBR and PGBR Stage.

Amino Acid Content of Traditional and HYV Rice Varieties in PBR and PGBR (mg 100g-1) Stage.												
Rice	Glutamic Acid		GABA		Histidine		Maethionine		Lysine		Arginine	
Varieties	PBR	PGBR	PBR	PGBR	PBR	PGBR	PBR	PGBR	PBR	PGBR	PBR	PGBR
Ghungshe	8.40	3.70	0.36	7.46	1.03	0.60	0.60	0.90	1.20	1.00	1.20	1.52
Kajalsail	7.40	2.50	0.80	7.60	1.44	1.33	1.05	0.11	1.50	1.30	1.11	1.31
Monteshor	11.50	4.60	1.66	8.43	0.84	1.40	1.50	0.90	1.30	2.01	1.81	1.21
Moulata	6.90	4.70	0.60	9.46	1.03	1.91	0.09	1.37	0.80	1.60	2.13	3.25
Sadamota	8.10	4.60	2.60	8.33	0.64	2.01	0.42	0.67	0.90	2.30	2.20	4.02
BR22	2.80	1.60	0.76	9.66	0.93	1.91	1.11	2.43	0.61	1.20	1.00	0.09
BR23	6.00	1.40	1.56	11.10	0.70	1.54	0.63	1.68	0.60	0.51	2.01	0.30
BRRI dhan31	9.30	3.10	0.85	12.00	0.70	2.34	0.49	1.22	1.30	0.50	1.91	0.71
BRRI dhan40	7.50	2.00	1.00	10.60	0.80	1.40	1.13	0.91	1.01	0.42	0.50	0.31
BRRI dhan41	4.70	4.90	1.53	7.53	0.80	1.64	0.60	2.16	1.00	3.40	1.50	1.80

Table 4: Changing Folds of Amino Acid Content in Traditional and HYV of Rice Varieties From PBR To PGBR.

Variety	Glutamic Acid	GABA	Methionine	Histidine	Lysine	Arginine
Ghungshe	0.44d	22.51^{a}	1.53d^{e}	0.58^{c}	0.82^{d}	1.27^{bc}
Kajalsail	0.33^{e}	0.99d^{e}	0.10^{f}	0.90^{c}	0.89^{d}	1.17^{bc}
Monteshor	0.40^{de}	5.09^{f}	0.60e^{f}	1.68^{b}	1.55^{c}	1.02^{c}
Moulata	0.68^{b}	16.11^{b}	14.11^{a}	1.8^{b}	2.11b^{c}	1.52^{ab}
Sadamota	0.56^{c}	3.21^{f}	1.80^{cd}	3.10^{a}	2.56^{b}	1.82^{a}
BR22	0.57^{c}	12.61bcd	2.22^{cd}	2.10^{b}	2.01b^{c}	0.09^{c}
BR23	0.23^{g}	7.091ef	2.70^{c}	2.10^{b}	0.86^{d}	0.14^{c}
BRRI dhan31	0.33^{ef}	14.27bc	2.49^{cd}	3.40^{a}	0.38^{d}	0.37^{de}
BRRI dhan40	0.26^{g}	10.65^{cde}	0.81^{ef}	1.70^{b}	0.41^{d}	0.60^{d}
BRRI dhan41	1.04^{a}	4.91^{f}	3.72^{b}	2.00^{b}	3.51^{a}	1.19^{bc}
Duncan's Multiple Range Test; Within Column Means Followed By Same Letter(S) Did Not Differ Significantly At P<0.05.						

In case of Lysine estimation, BRRI dhan40 has the lowest content of 0.42 mg 100^{-1}g and BRRI dhan41 has the highest content of 3.40 mg 100^{-1}g among all varieties at PGBR (Table 3). Finally, in Arginine estimation, BR22 has the lowest content of 0.09 mg 100^{-1}g and Sadamota has the highest content of 4.02 mg 100^{-1}g among all varieties at PGBR condition (Table 3). In analyzing of changing folds of amino acid content from PBR to PGBR, Ghungshe has increased the maximum folds of 22.51 for GABA, Moulata has 14.11 folds for Methionine, BRRI dhan31 has 3.40 folds for Histidine, BRRI dhan41 has 3.51 folds for Lysine and Sadamota has 1.82 folds for Arginine, compare to other traditional and HYV rice varieties (Table 4).

PGBR could be acceptable to consumers and food industry as a promising foodstuff that contains more nutritional proteins, amino acid and bio-functional components than ordinary rice products for malnourished children and aged population who have been suffering from different chronic disease. PGBR and rice bread may be cited as two promising rice based products that hold much more nutrition over milled rice and ordinary brown rice. Improve food security in food shortage regions can be attained by consumption of PGBR. PGBR can be a dietary food for health improvement. The reason behind the popularity of PGBR among health-conscious consumers and bio-techno-scientists is the significant increase in GABA and its extensive bio-functional properties to maintain a good human health. PGBR has potential to become innovative rice by preserving all nutrients in the rice grain for human consumption in order to create the highest value from rice. The PGBR technology can be transferred for empowerment of rural people, by transforming them into a successful entrepreneur by starting their own food (PGBR) processing units and to contribute in the national development of health and nutritional security and improvement in the living standards in Bangladesh. In our experiment, we concluded that Ghungshe, seems the most suitable rice varieties among the tested varieties in order to possess highest protein and BRRI dhan31 has the highest GABA content of 12.00 mg 100^{-1}g (Table 3) at PGBR stage.

These findings can be important information to our rice based agro food industries in Bangladesh. Lathyrism is due to absolute methionine deficiency. It is apparent that the low nutritive value of lentil protein is due to methionine deficiency instead of cystine deficiency and the better quality of rice protein is due to the higher methionine content. In this case, BR22 which has the highest content of methionine 2.43 mg 100^{-1}g among all varieties could be beneficial for rice consumer who have tendency of lathyrism related disorders. Histidine is utilized by our body to develop and maintain healthy tissues. It is especially important in the myelin sheath that coat nervous cells to ensure the transmission of messages from our brain to organs throughout our body. Adequate Histidine levels are essential to good mental and physical health. Histidine may be implicated in the treatment of mental disorders; sexual dysfunction and play a role in protecting the body from radiation damage and prevent the onset of AIDS (Erica, 2015). This is due to its ability to naturally detoxify the body and produce both red and white blood cells. Histidine, similar to other amino acids, is found primarily in high-protein foods. Meat, poultry, fish, dairy and some grain products including rice, wheat and rye are therefore histidine-containing foods. Histidine reduces the weight of stool and the frequency of stool output in cholera (Rabbani, 2005) and could be a useful and safe adjunct treatment that will increase the success rate of ORS (oral rice saline) and antibiotic therapy in cholera. Since BRRI dhan31 has the highest Histidine content of 2.34 mg 100^{-1}g (Table 3) among all varieties, it could be a good carbohydrate source for Histidine-supplemented rice based oral rehydration solution for Bangladesh.

Conclusion

Our research findings reveals that pregerminated brown rice (BRRI dhan31) generates elevated level of bio-active component, γ-aminobutyric acid (GABA) and in conclusion we are hopeful that GABA enriched rice could widen the scopes of developing of a new rice based value added nutritional food products in Bangladesh in coming future.

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