

The effects of cultivar in the bioconversion of glutamate to γ -aminobutyric acid using Korean hull-less barley bran

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[Introduction]

γ -Aminobutyric acid (GABA) is a non-protein amino acid that is synthesized from glutamate by glutamate decarboxylase (GAD). In this reaction, a pyridoxal 5'-phosphate-dependent enzyme catalyzes the irreversible α -decarboxylation of L-glutamate to GABA. GABA has recently attracted research attention. However, as GABA cannot pass the blood-brain barrier and enter the central nervous system, GABA levels in the brain are not increased by oral administration alone. Thus, it is necessary to supply sufficient GABA from outside sources such as food, necessitating the development of functional foods rich in GABA.

[Materials and Methods]

Barley bran was prepared from whole barley grains harvested in 2016 at the National Institute of Crop Science, Rural Development Administration, Korea. Generally, barley is categorized into two types on the basis of the amylose content of the starch. 18 hull-less barley cultivars (200 g) were pearled to 23% of their original weight using a Satake Test Mill (M05; Satake, Tokyo, Japan). Barley bran (0.25–2 g) and 10 mL of distilled water containing 1–10 mM monosodium glutamate were mixed thoroughly. The reaction temperature was varied from 20°C to 60°C, and the reaction time from 0 h to 24 h. The enzymatic conversion reaction was stopped by heat inactivation at 80°C for 20 min.

[Results and Discussions]

The GABA concentration in the reaction solution decreased as the reaction temperature increased, although it slightly increased at 60°C. The glutamic acid increased as the reaction temperature increased up to 50°C. The optimal reaction temperature of GABA production was 20°C. The concentration of GABA exponentially increased up to 9 h, and then decreased. The glutamic acid concentration decreased until 6 h, and slightly increased thereafter. When 25 mg of barley bran was used, 1.1 mM GABA was produced. As the initial concentration of barley bran increased, the concentration of GABA produced increased. However, when 150 mg and 200 mg of bran were used, the GABA concentration was 10.9 mM and 10.4 mM, respectively, showing no significant change. The GABA concentration increased as the initial concentration of sodium glutamate increased; however, the amount of residual glutamic acid also increased. GABA was produced using bran of 18 Korean hull-less barley cultivars and the GABA concentration differed depending on the cultivar.

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