

Effects of Jukoku koji on protein digestion in rats

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Abstract

The mixed grain koji "Jukoku Koji" is produced by fermentation with either white koji mold (*Aspergillus kawachii*), black koji mold (*Aspergillus awamori*) or yellow koji mold (*Aspergillus oryzae*) of a mixture of 9 types of grains (white rice, *Hordeum vulgare*, red rice, brown rice, *Setaria italica*, *Panicum miliaceum*, black rice, *Sorghum bicolor*, Japanese barnyard millet). In this study, the effect of "Jukoku Koji" on protein digestion was investigated in rats using the portal vein catheter placement method.

First, "Jukoku Koji" and a casein solution were incubated at 37°C and the released amino acids were quantified by HPLC with OPA pre-column derivatization. The results showed that the concentration of amino acids (leucine, valine, histidine, methionine, phenylalanine and tyrosine) increased over time. Furthermore, when "Jukoku Koji" was administered to rats received a continuous intragastric infusion of casein solution, portal vein blood concentrations of free amino acids (leucine, isoleucine, valine, methionine, phenylalanine, alanine, asparagine, glutamine, glutamic acid, tyrosine and serine) were significantly greater than the control group (casein administered group). The results suggest that "Jukoku Koji" promotes protein digestion in rats.

Keywords : Jukoku koji, protein, digestion, rats

I Introduction

"Jukoku koji" is a mixture of nine grains (white rice, barley, red rice, brown rice, foxtail millet, proso millet, black rice, sorghum, and Japanese barnyard millet) that was converted to koji with *Aspergillus kawachii*, *Aspergillus awamori*, and *Aspergillus oryzae* separately by each koji mold and subsequently dried. *Aspergillus kawachii* is used in *shochu* brewing in southern Kyushu and is a cultured koji mold that underwent divergent selection after being isolated from the medium-acidic *Aspergillus awamori* as an albino mutant strain¹⁾. *Aspergillus awamori* is used in *awamori* brewing in Okinawa²⁾ and is known to prevent the proliferation of germs during fermentation by producing high levels of citric acid. *Aspergillus oryzae* is used in manufacturing brewed seasonings such as soy sauce and miso, and generates amino acids, or the "umami" component, by breaking down protein in the raw material³⁾. Jukoku koji, produced using these koji

molds, is considered to contain various enzymes that break down starch and protein. In particular, the proteases that break down protein may be beneficial for elderly individuals with decreased digestive and absorptive functions and for athletes who require protein supplementation, indicating the potential usefulness of Jukoku koji at hospitals, welfare facilities, and sports-related institutions.

In this study, we therefore investigated the effects of Jukoku koji on the digestion of protein using a rat portal vein catheterization model.

II Experimental Methods

1. Experimental materials

Jukoku koji was manufactured by Biogenic Co., Ltd. Component analysis of Jukoku koji was conducted at Japan Food Research Laboratories.