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PORK HYDROLYSATE STIMULATES ALCOHOL METABOLISM IN RATS AND MAN

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Backgrounds and Objectives:

The liver is sometimes injured by drinking too much alcoholic beverage [1]. It is well known that eating meat or meat products with alcoholic liquors alleviates the drunkenness and relieves hangover. Yang *et al.* [2] reported that the pork-administered rats metabolized alcohol faster than did the vegetable protein-administered rats. Our previous study showed that the rats administered pork peptide became fond of drinking dilute ethanol instead of tap water. Such phenomena partly seem to depend on favorable amino-acid composition of pork and/or the pork peptide.

The present paper describes stimulation of alcoholic metabolism in laboratory animals and man by pork-peptide administration.

Materials and Methods:

Preparation of pork peptide: Pork peptide (abbr. PP) was prepared by digesting lean pork with papain as described previously [3].

Alcohol metabolism in PP-administered rats: Male Wistar ST rats (Japan SLC, Inc.) were raised on a commercial diet (F2, Funabashi Farm, Inc.) for 7 days and then with one of three different nitrogen source-containing diets (15 g/day), soy protein concentrate (Fuji Oil, Co., Ltd.), pork and PP. During the 65-day test period, the rats were raised with or without oral administration of ethanol powder (Sato Foods Industries, Co., Ltd.) or an ethanol solution (2.55-g ethanol/rat/day). After the test period, the livers were immediately excised and homogenized with chilled 3 mM Tris-HCl, pH 7.4, containing 0.25M sucrose and 0.1 mM EDTA. The cytosol and mitochondria fractions of the livers were prepared by differential centrifugation and subjected to determination of activities of alcohol dehydrogenase (abbr. ADH) and aldehyde dehydrogenase (abbr. ALDH) with commercially available assay kits.

Alcohol metabolism in man administered a PP-containing beverage: The study was carried out with the informed consent. Eight healthy volunteers (three persons scarcely- and five persons highly-tolerant to ethanol) were asked to drink 150 ml of a beverage containing 1.33 mg PP/ml and then (30 min. later) shochu, a popular Japanese distilled liquor, equivalent to 0.24 g ethanol/kg body weight. Ethanol concentrations of the volunteers' exhalation were periodically determined by a gas analyzer (UR-140 DB, Komyo Rikagakukogyo, K.K.).

Results:

Alcohol metabolism in the PP-administered rats: No significantly different growths were observed among all the diet groups. However, activities of the enzymes relating to alcoholic metabolism, ADH and low- and high-k_m ALDH, were different among the groups. Namely, activity of low-k_m ALDH of the PP- raised rats with administration of alcohol was significantly high (Fig. 1). With activities of ADH and high-k_m ALDH, the same phenomena were observed.

Alcohol metabolism in man administered the PP-containing beverage: Since ethanol concentration of exhalation parallels that in the blood stream at a ratio of 1:2,000 [4], the present study used the noninvasive former method.

The PP-containing beverage prevented accumulation of alcohol in and stimulated alcohol clearance from the volunteers' bodies (Fig. 2). With the volunteers scarcely tolerant to alcohol, such a tendency was apparent: maximal ethanol concentration of the negative control group was 0.136, but that of the test group 0.060 mg/l.

Discussion:

Such findings as stimulated activities of ADH and ALDH in PP-administered rats, prevention of alcohol accumulation in the volunteers' bodies and stimulation of alcohol clearance from the bodies may partly relate to PP's amino-acid composition. PP contains abundant threonine, lysine and such hydrophobic amino acids as alanine, leucine and proline. Yang *et al.* [5] observed that activities of ADH and ALDH were stimulated in the rats by administration of proline or threonine. Dorato *et al.* [6] reported that oral administration of lysine inhibited absorption of ethanol from the small intestine. Iimuro *et al.* [7] suggested that oral administration of glycine activated alcohol metabolism in the gastric mucosa. Further studies are undertaken to clarify the mechanism(s).

Literature:

1) Lieber, C. S., *Bailliere's Clin. Gastroenterol.* 7, 581-608, 1993.
2) Yang, S. C., Ito, M., Morimatsu, F., Budijanto, Y., Furukawa, Y., and Kimura, S., *J. Nutr. Sci. Vitaminol.* **39**, 1, 55-61, 1993.
3) Morimatsu, F., Ito, M., Budijanto, S., Watanabe, I., Furukawa, Y., and Kimura, S., *J. Nutr. Sci. Vitaminol.* **42**, 145-153, 1996.
4) Harger, R. N., Forney, R. B. and Barnes, H. B., *J. Lab. Clin. Med.* **36,** 306, 1950.
5) Yang, S. C., Ito, M., Morimatsu, F., Budijanto, Y., Furukawa, Y., and Kimura, S., *J. Clin. Biochem. Nutri.* **10**, 151-159, 1994.
6) Dorato, M. A., Lynch, V. D. and Ward, C. O., J. *Pham. Sci.* **66**, 35-39, 1997.
7) Iimuro, Y., Bradford, B. U., Forman, D. T. and Thurman, R. G., *Gastroenterology*, **110**, 1536-1542, 1996.

Remark:

Depending upon the above-described findings, "PEPCOHOL™", a soft drink formulated with PP, has been developed and marketed in Japan.

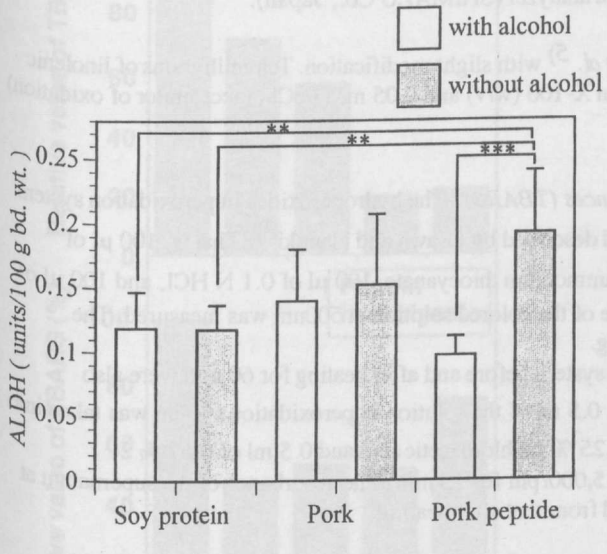

Fig.1 The activities of low-*km* aldehyde dehydrogenase of rats raised with soy protein, pork or pork peptide
(Mean ± S.D., ** ; $p < 0.01$, *** ; $p < 0.001$)

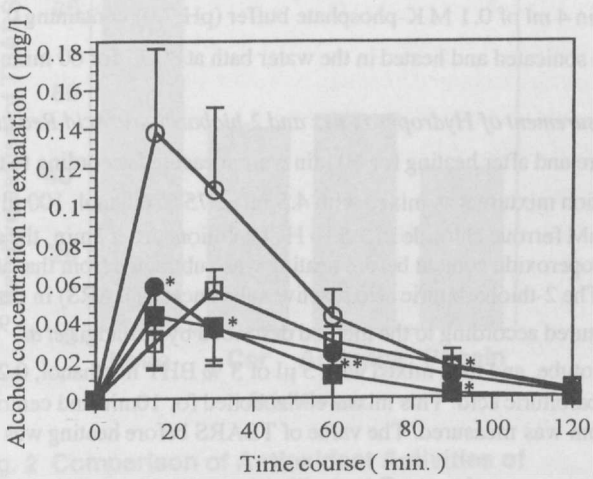

Fig. 2 Accumulation and clearance of alcohol in and from the volunteers administered the pork peptide-containing beverage
○ ; scarcely tolerant group administered control drink,
□ ; highly tolerant group administered control drink,
● ; scarcely tolerant group administered experimental drink,
■ ; highly tolerant group administered experimental drink
(Mean ± S.D., * ; $p < 0.05$, ** ; $p < 0.01$)