PE9.16 Studies on thermic effect of mutton 106.00

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Abstract—The purpose of this study is to investigate the thermic effect of mutton and to identify the components that induce thermogenesis and the pathway of mutton induced-thermogenesis. After ingestion of experimental diets containing fractionized mutton, the body temperatures of groups of rats fed diets containing lean mutton, especially purified mutton protein, were higher than those of rats fed other diets. There was hardly any L-carnitine in purified mutton protein. The results suggested that the thermic effect of mutton is attributed not to L-carnitine but to lean mutton proteins or digested peptides. It is thought that elevation of body temperature by thermogenesis induced by the ingestion of lean mutton is due to the facilitation of lipid metabolism, not to sympathetic nerve stimulation.

Index Terms—body temperature, diet-induced thermogenesis, L-carnitine, lipid metabolism, mutton.

I. INTRODUCTION

Thermic effect of food is well known. Energy is expended by our body when we consume (bite, chew, and swallow) and process (digest, transport, metabolize and store) food. Many foods have been classified in Chinese medicine according to their thermic effect. Meats have also been classified and it has been empirically believed that mutton has a higher thermic effect than the thermic effects of other meats. The results of our preliminary study showed that body temperature was elevated by ingestion of mutton. Mutton is rich in L-carnitine which is one of key components of lipid metabolism [1-3]. However, it is unclear if L-carnitine contributes to the thermic effect of mutton. Therefore, the aim of this study was to elucidate components contributing the thermic effect of mutton and the mechanism by which body temperature is elevated.

II. MATERIALS AND METHODS

Mutton (leg) was purchased from a domestic market. The fractionation of mutton was performed as follows. First, minced mutton was freeze-dried (FDM). Next, defatted mutton (DFM) was prepared from FDM with hexane, and then purified mutton protein (PMP) was prepared from DFM with distilled water and ethanol [4]. Mutton tallow (MT) was extracted from adipose tissue of mutton with hexane. Five-week-old male Wistar rats were obtained from Japan Laboratory Animals Inc. (Tokyo, Japan). The animals were housed individually with a 12-h light-dark cycle (lights on from 1000 to 2200) in an isolated room at a controlled temperature (22-24°C) and humidity (40-60%). Before starting the experiment, all animals were acclimated to a control diet (C) for one week. Experimental diets based on AIN93-G (C, M, T, LE and PP) were prepared by using FDM, DFM, PMP and MT as shown in Table 1. After fasting for 18 h, the experimental diets were given to animals for 2 h. The body temperature of each animal under anesthesia was measured in a room at a controlled temperature (33°C) after 1 h of feeding and then blood was collected. The contents of adrenalin and noradrenalin in plasma and the contents of glucose, triglyceride, non-esterified fatty acid and ketene body (3-hydroxybutyric acid) in serum were measured. The experimental plan of this study was approved by the Laboratory Animal Care Committee of Hokkaido University.

III. RESULTS AND DISCUSSION

After ingestion of the experimental diets containing fractionized mutton, the body temperature of each of the animals fed diets was measured (Fig. 1). The body temperatures of three groups of animals fed diets containg lean mutton (M, LE and PP groups) were higher than those of animals fed C and T diets. Mutton contains more L-carnitine than other meats [1, 2]. L-carnitine is a key component of lipid metabolism[1, 3]. However, there was hardly any L-carnitine in PMP (data not shown). These results indicated that L-carnitine did not contribute to the thermic effect. It was thought that lean proteins of mutton or digested peptides have a thermic effect. In sugar metabolism parameters in serum, no difference was observed among the groups (data not shown). However, the lipid metabolism in the three groups of animals fed diets containing lean mutton (M, LE and PP group) was tended to be facilitated as compared with that in

the groups of animals fed C and T diets (Fig 2.). Next, we measured the contents of adrenalin and noradrenalin in plasma. The contents of adrenalin and noradrenalin were not so high in any of the groups. The contents of adrenalin and noradrenalin in the groups of animals that ingested lean mutton tended to be higher than those of the groups of animals that did not ingest lean mutton. These results suggested that, unlike capsaicin and gingerol [5], the thermic effect of mutton is not due to sympathetic nerve stimulation.

IV. CONCLUSION

Ingestion of lean mutton, especially lean proteins of mutton, induced an elevation of body temperature. L-carnitine did not appear to contribute to the thermic effect of mutton. The thermic effect of mutton is thought to be due to facilitation of lipid metabolism, not to sympathetic nerve stimulation.

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