

Study on the immunostimulatory effect of fermented meat products with psychrotrophic lactic acid bacteria

Mayu Hattori ^{1,3}, Kanako Gabe ², Akari Otani ², Yuri Ito ³, Mao Nagasawa ³, Toshiya Hayashi ³

¹ Faculty of Health and Human Life, Nagoya Bunri University, ² Faculty of Agriculture, Meijo University, ³ Graduate School of Agriculture, Meijo University, Japan

Objective: It has been suggested that a decline immune system can lead to the development of various immune-related diseases. In particular, elderly people and children are likely to have a higher risk of them than healthy adults due to the insufficient immune function. Furthermore, COVID-19, caused by SARS CoV- 2 infection, is currently causing a pandemic, which is having a negative impact on the medical field and socioeconomic activities. A promising approach to solve these problems is to enhance the human immune system through the daily diet.

In recent years, the use of foods with immunomodulatory effects has become widespread, as they are believed to help the prevention of diseases and maintenance and promotion of our health. Among them, fermented milk products are attracting attention as food with immunostimulating effects. In fact, there are numerous reports such as stimulating cytokine production and a series of immune responses by activating various immune cells. On the other hand, research on the bioregulatory function of fermented meat products, one of the same fermented livestock products, has lagged due to the negative image of the fat and the additives used in processing in terms of health, and there are few reports on immune function.

However, fermented meat products are considered to be useful foods for improving biological regulatory functions. This is because they contain vitamin B₁ and zinc from pork, which have bioactive functions, and bacteria and metabolites from lactic acid bacteria. In addition, bioactive peptides decomposed from skeletal muscle proteins by lactobacilli are expected. Therefore, fermented meat products are expected to become food that promotes the improvement of immune functions.

Based on the above, the present study evaluated the immunostimulatory effects of fermented meat products to contribute to one's health through the development of meat products that can maintain and enhance immune functions in daily intake.

Materials and Methods: Salting agent and *Lactobacillus sakei* D-1001, a lactic acid bacteria, as a lactic acid bacteria starter were added to the pork thigh and fermented for 5 days under low temperature to produce fermented meat products.

The fermented meat products were heat sterilized at 75°C and enzymatically treated with pepsin to simulate digestion in the human body, and the water-soluble components were extracted and lyophilized as the experimental sample for the present study.

Cultured macrophage-like cells (RAW264) were used to evaluate immunostimulating effects. RAW264 cells were incubated with water-soluble components of pepsin-digested fermented meat products for 24 hours. Cytokine (TNF- α) assay, nitric oxide assay, phagocytosis assay, and cell morphology observation by scanning electron microscopy (SEM) were performed to evaluate the immunostimulatory activity.

Results and Discussion: In macrophages added a water-soluble component of fermented meat products, mRNA expression of TNF- α was significantly increased, which is widely involved in the biological defense reaction through inflammation. In addition, the present result demonstrated that the water-soluble component of fermented meat products promotes the production of nitric oxide, which is an important one of protective factor against infection during infection. It was also found that the phagocytosis ability, which is considered to be important in the early stages of infection defense, was also activated. Furthermore, observation of cell morphology by SEM revealed that the cytoskeleton was flattened and changed into activated macrophages. Therefore, the present study suggested that the water-soluble components of fermented meat products have immunostimulatory effects by activating macrophages.

Conclusion: The present study demonstrated that the water-soluble component of fermented meat products promotes the activation of macrophages. Fermented meat products can be expected to contribute to one's health as foods with immunostimulatory activity.

Key words: Fermented meat products, Immunostimulation, Macrophages