

Development of drinkable meat and evaluation of its nutritional function

Shinichi Takenoyama ¹, Minami Yamauchi ¹, Kumiko Kawakita ¹, Toyoo Nakamura ², Michio Muguruma ¹

¹ Minami Kyushu University, ² Marunaka Food, Japan

Objectives: Sarcopenia is now widely recognized as an age-related loss of skeletal muscle mass and physical function (muscle strength or physical performance) that occurs with advancing age (Bloom, et al., 2018). A high-quality diet in older adults is associated with a reduced risk of common age-related diseases and greater longevity. Appropriate protein (amino acid) intake and exercise are important for the prevention of sarcopenia and frailty in the elderly. Meat contains several high-quality proteins and is essential for human health and longevity. The purpose of this study was to produce meat products with high-quality protein that can be easily consumed at one's convenience.

Materials and Methods: Domestic chicken breast meat was used as the experimental material. The hydrolysates of chicken breast meat were prepared by digestion with a food-grade enzyme, Protamex (endotype protease; Novozymes). Distilled water was added to the chicken breast meat and homogenized. The enzyme was added to the homogenate, and the meat homogenate was heated at 50 °C for 90 min with stirring. After inactivating the enzyme by heating at 100 °C for 2 min, the cooled hydrolysate was filtered through a gauze. The filtrate was centrifuged (7,000 rpm for 15 min), and the supernatant fraction was used as a meat drink. The meat drink was spray dried to prepare meat powder, and meat pellets were prepared from this powder. The degree of protein degradation by enzymatic treatment was analyzed using SDS-PAGE and gel filtration HPLC. The DPPH radical-scavenging activity, ACE-inhibitory activity, and free amino acid content of each sample were measured. Factorial analysis was performed using ANOVA, followed by Tukey's test. Data are expressed as mean ± SEM.

Results and Discussion: SDS-PAGE analysis revealed that hydrolyzing chicken with Protamex for 30 min decomposes myosin heavy chains (MW 230,000), α -actinin (MW 100,000), and actin (MW 42,000) into low-molecular-weight peptides (MW 7,000 or less). HPLC analysis was performed to measure the molecular weight distribution of the chicken hydrolysate in the dissolved state. After 30 min of Protamex treatment, peaks at MW 6,800 and 3,800 and broad peaks up to 240 were observed. After 90 min, the molecular weight was further reduced, and a small peak appeared at 1,700. These results indicated that the peaks contained a large number of peptides composed of approximately 2-60 amino acid residues. The chicken hydrolysate (CM hydrolysate) showed approximately 3.7-fold higher antioxidant activity than the control group, Chicken Meat (CM). In addition, the spray-dried product (CM hydrolyzed powder) and the tablet (CM hydrolyzed pellet) also maintained high antioxidant activity of approximately 4.2 and

3.35 fold, respectively, than the control group. Compared to the control group, all hydrolysates showed high ACE-inhibitory activity. Coversyl (perindopril erbumine) is an effective drug for the treatment of hypertension. Therefore, we compared the ACE-inhibitory activity of hydrolyzed chicken tablets (CM hydrolyzed pellet) with that of carnosine and coversyl. We found that the titer of the tablet was approximately 4-fold higher than that of carnosine and approximately half that of coversyl. The hydrolysate contained high concentrations of essential amino acids, branched-chain amino acids, and the imidazole dipeptides, carnosine and anserine. The carnosine to anserine ratio was approximately 1:3. Imidazole dipeptides, which have excellent absorbability and functionality, improve muscle fatigue, delay brain aging, and prevent dementia. To this end, functional protein-based drinks, powders, and tablets were derived from meat.

Conclusions: Hydrolysates of chicken breast meat showed high DPPH radical-scavenging activity and ACE-inhibitory activity. In addition, the hydrolysates contain essential amino acids and functional peptides such as BCAA and imidazole dipeptides and, therefore, have potential applications as functional foods. With the development of functional peptide beverages, powders, and tablets with excellent digestibility and absorbability, high-quality meat proteins are now easily available to the elderly, toddlers, under-nourished people, those with masticatory and swallowing disorders, and athletes.

References:

Bloom, C. Shand, C. Cooper, S. Robinson and J. Baird. Diet Quality and Sarcopenia in Older Adults: A Systematic Review. *Nutrients*, 10, 308 (2018)

Key words: Chicken hydrolysate, Functional peptide, Elderly people, Sarcopenia, Sports nutrition