Physicochemical properties of wooden breast-extracted myosin and rheological properties of its heatinduced gel

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Objectives: Recently, many broilers called "Wooden breast" have been observed in the poultry industry. In the muscle tissue of the wooden breast, the muscle shows active degeneration and regeneration of muscle fibers, and infiltration of immune cells with in- creased deposition of adipose and connective tissue, and development of abnormal stiffness have been observed (Sihvo et al., 2014). Minced chicken meat is an important raw material for various processed meat products in the food processing industry. One of the possible uses of the wooden breast with poor appearance is as a raw material for processed products. There have been many reports on the heat processing properties of breast meat that affected wooden breasts (Brambila et al., 2017). In all previous studies, it was found that wooden breasts had low processing properties, such as binding and water holding capacities. However, the reason for the low processing characteristics has not been clarified. It has been shown that salt-soluble proteins such as myosin and actin in muscle are related to the processing characteristics of meat. In this study, we extracted myosin from chicken meat-affected wooden breast, investigated its physicochemical properties, and examined the relationship between the structure and rheological properties of the heated gel of myosin obtained from the wooden breast.

Materials and Methods: 1. Preparation of chicken breast muscle myosin Individual pectoralis major muscles in 46-day-old broilers were collected from a commercial Japanese poultry slaughterhouse. Three wooden breast samples and three normal breast samples were collected within two hours postmortem in the deboning line. All breast muscle samples were transported to the laboratory within six-hour of slaughter. The muscles were stored at −80°C until used. Chicken breast muscle myosin was prepared from washed myofibrils using a modified method (Yamamoto & Moos, 1983). 2. Thermal treatment of chicken breast myosin and its physicochemical properties. Myosin (0.5 or 1 mg/ml) solutions were treated at 40°C 80°C for 10 min, then the solutions were cooled in an ice bath until use. *The turbidity*, *hydrophobicity*, and *sulfhydryl groups were measured for the* physicochemical proper- ties *of wooden breast myosin.* 3. Rheological properties of myosin heat-induced gel and model sausage. The protein concentration of the myosin solution was adjusted to 5.5 mg/ml using 20-mM Bis-Tris (pH 6.0) containing 0.5-M NaCl. The model sausages were made from the ground meat of each sample. Those samples were heated at 70°C for 30 min, and immediately cooled. A spherical plunger was penetrated into the myosin gel and model sausage using a creep meter. Apparent elasticities of the gel and the model sausage were calculated from the load versus indentation curve based on Hertz's theory.

Results and Discussion: The protein composition of each myosin solution obtained from wooden breast and normal breast was con- firmed by SDS-PAGE. Myosin extracted from the wooden breast was extracted with relatively high purity. Therefore, all subse- quent experiments were performed using these myosin solutions. Turbidity, representing the protein aggregation reaction due to thermal denaturation, was not significantly different around 30°C 40°C, where the aggregation reaction between myosin heads oc- curs. Wooden breastextracted myosin showed higher turbidity around 50°C, up to 80°C. The surface hydrophobicity of normal breast myosin decreased around 60°C, while that of myosin removed from wooden breast increased. The free SH groups increased with increasing heating temperature in both cases, and myosin obtained from wooden breast always showed higher values. The me- chanical properties of the heat-induced gel of wooden breast-extracted myosin and a model sausage made from wooden breast- minced meat were compared with those of normal breast one. The mechanical properties (apparent elasticity) of heat-induced myo- sin gels and normal ones were 4.2 ± 0.38 and 8.6 ± 0.44 Pa (mean ± standard deviation), respectively, indicating the evidence of elasticity of myosin extracted from the wooden breast was about half as stiff as normal ($p < 0.05$). Moreover, the apparent elasticity of the model sausage was 60 ± 17 and 170 ± 22 kPa for wooden breast and normal breast meat, respectively, and, similar to the heat-induced myosin gel, the stiffness was significantly lower for wooden breast ($p < 0.05$). The microstructure of the heat-induced myosin gel of myosin extracted from the wooden breast was a coarse structure with many gaps and aggregates connected to the fi- bers. Therefore, we conclude that the molecular structure of myosin extracted from WB is unstable, which coarsens the structure of its heated gel and affects the mechanical properties of the gel.

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