Enzyme-digested chicken breast meat affects type IIb fiber diameter on the surface of tibialis anterior muscle in aged mice

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Objectives: With population ageing, extending healthy life expectancy is necessary to improve the quality of life for the elderly. Ageing is associated with the loss of skeletal muscle fibers and decrease in their size, especially of fast-twitch (type II) muscle. Maintaining skeletal muscle in the elderly is important to prevent sarcopenia. This study focused on the effect of enzyme-digested chicken breast meat (E-chicken) on skeletal muscle in aged mice.

Materials and Methods: Chicken breast meat was purchased from the market. After removal of skin, fat, and tendons, meat was ground and boiled at 100°C for 30 min, followed by cooling in iced water. After homogenization of the boiled meat, 500 g of meat was incubated with 100 mL of water or enzyme solution at 50°C for 8 h. The enzyme solution comprised 0.6% thermoaze PC10F and protease P Amano 3SD. Following inactivation by heating at 100°C for 30 min, the samples were freeze-dried. The control diet comprised 20 g of casein, 0.3 g of L-cysteine, 66.2 g of α-starch, 4 g of safflower oil, 5 g of cellulose, 1 g of vitamin mix, and 3.5 g of mineral mix per 100 g (276.6 kcal/100 g). Treatments included the addition of 0.5% of freeze-dried chicken or E-chicken to the control diet. After acclimatization, young C57BL/6J mice (male, 6 weeks old, n = 5) were fed a control diet for 35 days, and aged C57BL/6J mice (male, 61-62 weeks old) were fed the control (n = 10), chicken (n = 6), or E-chicken (n = 5) diets for 63 days. Grip strength was measured weekly in the four limbs. After sacrifice, the tibialis anterior (TA), extensor digitorum longus, soleus, gastrocnemius muscle, and quadriceps were collected and stored at -80°C before use. Sliced TA sections were subjected to hematoxylin-eosin staining and immunostaining with anti-myosin heavy chain antibody. All animal experiments were approved by the Institutional Animal Care and Use Committee of the University of Shizuoka.

Results and Discussion: During the experimental period, body weight of the aged mice reduced; however, skeletal muscle and body weight did not change after the experimental period in mice fed either the chicken or E-chicken diets. Regardless of diet, grip strength of the aged mice was significantly lower than that of the young mice. Ageing and diet did not alter the average cross-sec- tion area of total muscle fibers in TA, although ageing affected the histogram of the cross-section area of total muscle fiber in the deep layer of TA. Regarding muscle fiber type distribution, type IIb muscle fiber accounted for 70% of the surface layer of TA in both young and aged mice, and type IIx muscle fiber was the most common in the deep layer of TA. E-chicken reduced the propor- tion of small diameter fibers among type IIb fibers on the surface of TA in aged mice, which was similar to the fiber properties the muscle of young mice. Although the evaluation of the amount and timing of feed intake was unclear, the obtained results suggest that E-chicken suppresses the change in skeletal muscle fiber properties due to ageing.

Key words: Enzyme-digestion, Chicken breast meat, Ageing, Skeletal muscle, Type II fiber