

Skeletal muscle adaptations and biomechanical properties of tendons in response to jump exercise in rabbits

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Abstract :

Pen housing has been proposed in rabbits as an alternative to standard-sized cages. Rabbits reared in pens show greater physical activity. This study investigated whether jump exercise could modify body composition, muscle biochemical and histological characteristics, and some meat quality traits, including the biomechanical properties of tendons. Male weaned rabbits of similar BW (793 ± 11 g) were either reared in giant collective cages and had to jump over obstacles to get food and water for 35 consecutive days (EXE), or confined in small isolated cages (SEDN). Rabbits were weighed weekly to determine ADG ($n = 79$ EXE; $n = 46$ SEDN) and ADFI ($n = 9$ cages in EXE; $n = 46$ cages in SEDN). At approximately 10 wk of age, rabbits were slaughtered in 2 series. After overnight chilling, carcasses in the first series ($n = 30$ EXE; $n = 27$ SEDN) were divided into fore, intermediate, and hind parts. Color and ultimate pH were recorded in the biceps femoris (BF) and LM. The Achilles tendon and patellar ligament were dissected from the legs and cooked. Muscles [semimembranosus proprius, semimembranosus accessorius (SMA), and BF] were harvested from the legs in a subset of animals from the second series ($n = 10$ in EXE; $n = 9$ in SEDN). Both ADG and ADFI were slightly reduced ($P < 0.10$) in EXE rabbits compared with SEDN rabbits. Exercised rabbits showed a greater ($P = 0.01$) proportion of hind parts than SEDN rabbits. Enzyme activities of 3-hydroxyacyl-CoA dehydrogenase and citrate synthase, which play key roles in fatty acid oxidation and the terminal oxidative degradation of nutrients, respectively, were increased in the semimembranosus proprius, SMA (except citrate synthase), and BF muscles of EXE rabbits compared with SEDN rabbits. Only SMA exhibited a decreased ($P = 0.05$) activity of the glycolytic enzyme, lactate dehydrogenase, in EXE rabbits compared with SEDN animals. Total lipid content, mean diameter of perimysial adipocytes, and activities of core lipogenic enzymes in the SMA and BF muscles did not differ between EXE and SEDN rabbits. Meat color in BF was shifted toward greater a^* (red; $P = 0.001$) and b^* (yellow; $P = 0.02$) values in EXE rabbits compared with SEDN rabbits. Cooked Achilles tendon and patellar ligaments in the legs had greater stiffness ($P \geq 0.05$) in EXE rabbits compared with SEDN rabbits. This experiment demonstrates that rabbit muscles turn to a more oxidative metabolic pattern in response to jump exercise. The quality of attachment of cooked meat to bone is also improved in active rabbits.

Key Word :

fiber type composition, intramuscular lipid, jump exercise, meat quality, oxidative enzyme, tendon