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Physical activity modify skeletal muscle fiber types in an animal model of metabolic syndrome

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Metabolic Syndrome (MetS) is a cluster of clinical conditions, associated to an increased cardiovascular risk, as well as to hypogonadism in males. Lifestyle modification (including physical exercise, PhyEx) may be beneficial for the condition. Skeletal muscles (SkM) are some of the most highly plastic tissues, able of remodeling in response to use, disuse and disease. In particular, transformations of fiber type may occur in response to physiological milieu to induce functional adaptations. This study is aimed at investigating in experimental MetS, high fat diet-induced in male rabbits [1], the effect of PhyEx on hormonal and metabolic parameters, as well as on SkM composition. Control and MetS rabbits were exercise-trained to run on a treadmill for 12 weeks. Quadriceps femoris samples were collected for histomorphological and gene expression analyses. We found that exercise resistance was significantly reduced in MetS rabbits, as demonstrated by the significant reduction of both running time and distance, compared to control group. MetS rabbits also exhibited the lowest quadriceps mass. Fiber typing by PAS-staining showed a pronounced shift from slower type I to faster type II fibers in MetS group in response to PhysEx, suggesting that MetS condition addressed SkM function towards anaerobic metabolism. Accordingly, extracellular lactate levels were significantly increased and mitochondrial respiration-related genes reduced in SkM of MetS rabbits respect to controls. Interestingly, PhyEx significantly counteracted MetS-related testosterone deficiency and hypercholesterolemia. In conclusion, our results indicate that dysmetabolic milieu induces a reduced proportion of fatigue-resistant type I fibers in response to PhysEx, which however resulted beneficial for MetS condition.

References

[1] Filippi et al. (2009) Testosterone partially ameliorates metabolic profile and erectile responsiveness to PDE5 inhibitors in an animal model of male metabolic syndrome. J Sex Med. 6:3274-88.

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Exercise resistance, metabolic dysfunction, testosterone