

時間運動学を基盤とした運動による抗肥満効果の解明 -メラトニンの役割に着目して-

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Research on Exercise-Induced Anti-Obesity Effects Based on Chrono-Exercise -A Focus on The Role of Melatonin-

by

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ABSTRACT

Epidemiological studies and animal studies have shown that regular exercise is effective for preventing and improving obesity and diabetes. Melatonin manipulates wide variety of biological processes including circadian rhythms, immune functions, and antioxidant properties. Here, the present study aimed to investigate the effect of daily melatonin administration on exercise training-induced alteration of body and adipose tissue weights, profiles of adipokines, and antioxidant properties in rats. Two experiments were conducted in this study. First, rats were randomly divided into five groups: normal diet- fed plus sedentary, high-fat diet (HFD) -fed plus sedentary, HFD-fed plus melatonin plus sedentary, HFD-fed plus exercise, and HFD-fed plus melatonin plus exercise group. Rats were subjected to treadmill running and/or melatonin (7.5

mg/kg body weight, i.p.) for 9 weeks. Second, rats were randomly assigned to a control and sedentary (CS) group, control and voluntary exercise (CV) group, and melatonin and voluntary exercise (MV) group. The exercise rats were subjected in cages equipped with running wheels where voluntary access to physical activity was available at all times for 11 days. After exercise training periods, serum and mature adipocyte isolated from inguinal adipose tissue were analyzed. We showed that body weight and fat mass were lower in exercise with combination with melatonin group than in other groups. The expression of inflammatory adipokines were reduced, whereas anti-obesity cytokine, FGF-21 was dramatically enhanced in combined group. Furthermore, the levels of beige adipocyte markers in MV group were significantly higher than CS and CV group. These results suggest that exercise with daily melatonin administration may contribute to efficient control of body mass and adiposity.

要 旨

運動は、肥満を改善し生活習慣病を予防する。松果体ホルモンであるメラトニンは強力な抗酸化能を有し、抗肥満効果が期待されている。本研究では、運動効果の最大化を目指し、運動による抗肥満効果に及ぼすメラトニンの影響を検討した。実験にはWistar雄性ラットを使用し、トレッドミルを用いた9週間の運動トレーニング実験と回転輸付きケージを用いた11日間の自発運動実験を実施した。介入終了後、採取した血液および鼠蹊部脂肪組織から血清および成熟脂肪細胞を調整し、アディポカインの網羅的解析および脂肪細胞の機能およびベージュ化に関連する項目を評価した。その結果、運動とメラトニンの併用は体重および脂肪組織重量を顕著に減少させ、さらに炎症性のアディポカイン分泌を減少させた。また血中の抗酸化能を亢進させ、ベージュ脂肪細胞のマーカータンパク質の発現量も増加させた。これらの結果は、メラトニンが運動による抗肥満効果を増強する可能性を示唆している。