

ABSTRACT

Background: Diabetes mellitus (DM) is a chronic disease associated with several complications, mainly insulin resistance and muscle atrophy, that reduce quality and life expectancy. DM inhibit protein synthesis like caveolin-3 (Cav-3) and insulin receptors that contribute to increasing the insulin resistance in skeletal muscle, also stimulates protein synthesis like myostatin and Foxo3 that play role in muscle atrophy.

Research Objectives: The research has analysed the effect of high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) on the mRNA (Cav-3, IR, MSTN, and Foxo3) expression in the gastrocnemius muscle. Moreover, analysed the effect of HIIT and MICT in producing insulin resistance and the risk of muscle atrophy during DM.

Methods: A total of 20 rats were randomly divided into four groups, namely: control, DM-2, DM1T1, and DM1T2. Diabetes mellitus was established by feeding High Fat Diet (HFD) and drinking 10% sucrose then induced by a single intraperitoneal injection of 35 mg/kg streptozotocin (STZ). Glucose level is measured, the rats with blood sugar more than 250 mg/dl are considered diabetic Mellitus rats. Physical exercise is given in two different doses, HIIT and MICT using a treadmill. Termination of experimental animals was carried out on day 60 after STZ treatment. PCR reverse transcriptase was used to see the change between the four groups in mRNA (Cav-3, IR, MSTN, Foxo3) expression in gastrocnemius muscle.

Results: The DM-2 group showed lower mRNA Cav-3 expressions compared with the C group statistically significant ($p=0.011$). DM1T1 & DM1T2 groups showed higher mRNA Cav-3 expressions compared with the DM-2 group statistically significant. The DM-2 group showed lower mRNA IR expressions compared with the C group but was not statistically significant ($p=0.167$). DM1T1 and DM1T2 groups showed higher mRNA IR expressions compared with the DM-2 group statistically significant. The DM-2 group has higher mRNA MSTN expressions compared with the C group but is not statistically significant (0,092). DM1T2 group showed lower mRNA MSTN expressions compared with DM-2 group statistically significant ($p=0.003$). The DM-2 group has higher mRNA Foxo3 expressions compared with the C group but is not statistically significant ($p=0.723$). DM1T2 group showed lower mRNA Foxo3 expressions compared with DM-2 group statistically significant ($p=0.003$). The DM1T2 group has lower mRNA Foxo3 expressions compared with the DM1T1 statistically significant ($p=0.020$).

Conclusion: Diabetes mellitus group (DM-2) showed lower mRNA Cav-3 and IR expression, this finding confirms the role of DM in increasing insulin resistance, also showed higher mRNA MSTN and Foxo3 expression, this finding confirms the role of DM in inducing muscle atrophy. However, the HIIT and MICT have conversely resulted from the DM group, this finding confirms the role of exercise in decrease insulin resistance and decrease induces muscle atrophy.

Keywords: Insulin resistance, Muscle atrophy, Cav-3, IR, MSTN, Foxo3, HIIT, and MICT.