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Effects of Blood Flow Restriction Training on Glycated Haemoglobin and Lipid Profiles among Individuals with Type 2 Diabetes Mellitus: A Case Series

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ABSTRACT

Type 2 Diabetes Mellitus (T2DM) is a complex multifactorial polygenetic disease also known as “noninsulin-dependent diabetes” or “adult-onset diabetes” (due to a progressive loss of adequate beta-cell insulin secretion frequently on the background of insulin resistance). Hyperglycaemia (indication of elevated HbA1c) drives microvascular complications, while diabetic dyslipidaemia (high triglycerides and low-density lipoprotein, and low high-density lipoprotein, etc.) heightens cardiovascular risk in T2DM. Controlling HbA1c and lipid levels among individuals with T2DM is a significant challenge for a multidisciplinary team. This case series aimed to determine the effects of BFRT on glycated hemoglobin and lipid profiles among individuals with T2DM.The study included 4 patients having a history of T2DM from 3 to 8 years. The intervention consists of three phases: warm-up, Blood Flow Restriction training programme, and cool-down. The BFRT protocol used 80% arterial pressure for lower-limb exercises (leg curls, leg extensions, hip flexion) and 50% for upper-limb exercises (arm curls, triceps extensions). Training began at 20% of 1Rep Max (RM), with lower-limb intensity increasing to 30% in the final two weeks and the training was at 20%of 1 RM for the upper extremity. Each session included four sets (30 reps in the first set, 15 in the next three) with 30-second breaks. The cool-down phase repeats the warm-up exercises. The treatment was given for 3 days a week for 4 weeks.HbA1c and lipid parameters (Total Cholesterol (TC), High-density Lipoprotein (HDL), Low-density Lipoprotein (LDL), Very-low Density Lipoprotein (VLDL), and Triglycerides (TGs)) were measured at baseline and after 4 weeks of intervention. The result showed significant improvement in all the outcome variables, HbA1c ($p=0.003$), TC ($p=0.01$), HDL ($p=0.008$), TG ($p=0.051$), VLDL ($p=0.002$), and LDL ($p=0.04$).. This study concluded that BFRTis effective in improving HbA1C and lipid profiles suggesting its potential to reduce cardiovascular as well as metabolic risks. Through the principle of peripheral vascular occlusion, BFRT promotes muscle hypertrophy by enhancing mechanotransduction, hormonal responses, reactive oxygen species generation, and cell swelling. It also stimulatesglucose transporter 4(GLUT4) translocation via calmodulin-dependent protein kinase ($Ca2+$/CAMKII) pathway and activates AMP-activated protein kinase, improving glucose uptake and metabolic regulationand may improve metabolic regulation in individuals with T2DM.

Keywords: Dyslipidaemia, Hyperglycemia, Microvascular complications.