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Alterations in Inflammatory Markers and Hepatic Lipid Accumulation following Dietary and Exercise Intervention of Obese Rats

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Objective This study aimed to investigate the effects of diet and different exercise training: High Intensity Interval Training (HIIT) and Continuous Training (CT) on body mass gain, serum inflammatory markers and hepatic lipid accumulation of obese rats.

Methods Male Sprague-Dawley rats were fed with a normal standard diet (N) or a high fat diet (H; 45% kcal as fat) for eight weeks without exercise stimuli. Obese rats were defined as increased at least 20% body weight than normal diet rats. After this period, N rats were continue fed with a normal diet (N), and half of obese rats were fed with a normal diet (ON), while the other half were continue fed with a high-fat diet (OH). Each diet type group was then divided into three subgroups, control (NC, ONC, OHC groups), High Intensity Interval training (NHI, ONHI, OHHI groups) and Continuous Training (NCT, ONCT, OHCT groups) (n=10). The interval and continuous straining consisted of a swimming exercise performed over eight weeks. Body weight, serum inflammatory markers, plasma and liver lipid concentrations were measured.

Results Obese high fat diet rats showed greater body mass gain, visceral adipose tissue (VAT) mass, serum low density lipoprotein (LDL), triglycerides (TG), total cholesterol (TC), and serum inflammatory markers (MCP-1、IL-1 β 、TNF- α) in values than normal diet rats (OHC versus NC). In contrast, for the obese normal diet rats, no significantly difference was observed compared with normal diet rats on VAT weight, serum lipids, inflammatory markers except MCP-1 (ONC versus NC). On the other hand, the trained groups of obese high fat diet rats showed lower values of body and VAT weight, serum lipids, inflammatory markers levels compared with the OHC group and CT showed more remarkable effect than HIIT except on VAT weight, serum IL-1 β levels (OHHI versus OHC and OHCT versus OHC). However, the significantly positive effect of CT on obese normal diet rats was only observed on serum TG, LDL and MCP-1 levels (ONCT versus ONC). In addition, compared to normal rats, hepatic wet weight (HWW), liver triglycerides (TG) in the OHC group presented obvious high level (OHC versus NC), no differences were exhibited between ONC and NC groups. Interestingly, HIIT but not CT significantly decreased liver TG content compared with OHC group (OHHI versus OHC and OHCT versus OHC), which consistent with liver oil red O stain images as well as higher hepatic CPT-1 level.

Conclusions Both training methodologies were shown to be effective in controlling body mass gain and adiposity levels in high-fat diet fed obese rats, HIIT displayed more positive effect on hepatic lipid accumulation. Additionally, diet and exercise was more effective than exercise alone in reducing body weight, VAT mass, serum inflammatory and liver TG content.