



## **The Effects of Resistance Training on Body and Liver Fat Stores and Insulin Resistance in Peoples with Non-Alcoholic Fatty Liver Disease**

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### **Dear Editor-in-Chief**

Although the pathogenesis of non-alcoholic fatty liver disease (NAFLD) has not been well recognized yet, obesity, particularly central obesity and physical inactivity are major independent risk factors for the development NAFLD (1). NAFLD is a condition associated with or without inflammation and is the liver's manifestation of insulin resistance. Visceral fat and liver fat are associated with NAFLD and metabolic abnormalities (2). Physical activities and exercise training are currently the main recommendation and major components of treatment for NAFLD, so that several studies have shown beneficial effects of aerobic exercise regimes upon liver function (3,4). However, efficacy of resistance training (RT) in the management of NAFLD has not been thoroughly defined and few limited studies have investigated the implication of RT on NAFLD (5).

Aims of this study were investigation effect of resistance exercise training on body and liver fat stores and insulin resistance in patients with NAFLD.

On December 2015, 27 adults with clinically defined NAFLD at Baqiyatallah Hospital in Tehran, Iran, were divided in two groups, training group and control group. Training group (n=15) was

received resistance training for 8 wk and three times a week. The control group (n=12) had no exercise training program during the 8-week period of the study. However, daily physical activity was performed.

An informed consent was obtained from all patients including agreement to participate as volunteers. The study protocol was approved by the human research Ethics Committees of the Baqiyatallah University of Medical Sciences, Tehran, Iran in December 2015 (IR.BMSU.REC.1395.34).

Anthropometric indicators and body composition elements of subjects were determined in baseline and the end of the study. Height was measured with wall-mounted stadiometer. Fat mass of whole body, Body Mass Index (BMI) and weight of patients were determined using the body composition analyzer. Sonography was used to measure liver fat and performed by one radiologist in all subjects. Liver steatosis detected by liver Sonography was graded from 0 to 3. Grade 0 (no steatosis), grade I (mild) slightly increased echogenicity, grade II (moderate) moderately increased echogenicity and grade III (severe) markedly increased echogenicity (1,3). Insulin resistance was assessed using the homeostasis

model assessment of insulin resistance (HOMA-IR) index. The HOMA was calculated as fasting [serum insulin ( $\mu\text{U/mL}$ )  $\times$  fasting plasma glucose ( $\text{mmol/L}$ )]/22.5 (5). The resistance programme consisted of seven exercises: triceps press, biceps curl, calf raise, leg press, leg extension, lat pull-down and sit-ups. Each training session, ending with 5 min cool down. For each subject, the repetition maximum (RM) was calculated for a particular muscle group at baseline and following intervention.

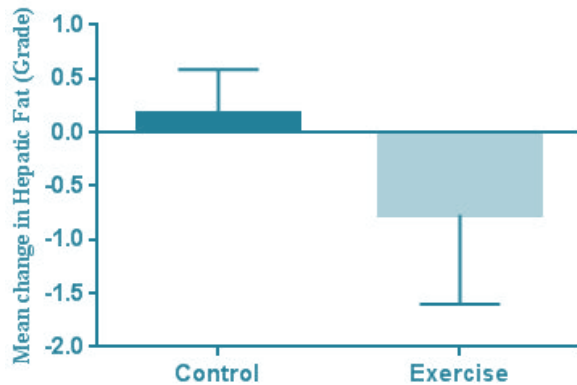
Initially, patients did two circuits using 50% of their one-repetition maximum (1RM) and repeat-

ed them 10 times for the two weeks, progressing to two circuits, using 60% of their 1RM and repeated 10 times for the two weeks. For two weeks, participants did three circuits using 60% of their 1RM and repeated 10 times. In the Seventh and eighth weeks, patients did three circuits using 70% of their 1RM and repeated 10 times. Ninety second rest was allowed between sets of exercises. Each session took about an hour. Weight and BMI in both groups during this study remained constant (Table 1).

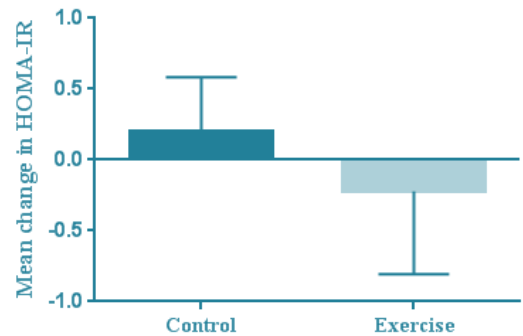
**Table 1:** Comparison between the two groups (mean  $\pm$  SD)

Variables	Control group		P	Trial group		P
	Pre	Post		Pre	Post	
Weight	81.9 $\pm$ 10.7	81.1 $\pm$ 11	0.06	92.6 $\pm$ 16.6	91.2 $\pm$ 16.9	0.08
Body mass index	30.3 $\pm$ 3.3	28 $\pm$ 3.9	0.16	30 $\pm$ 3.4	29.5 $\pm$ 3.7	0.11
Waist to hip ratio	0.95 $\pm$ 0.01	0.93 $\pm$ 0.01	0.23	0.95 $\pm$ 0.01	0.93 $\pm$ 0.01	0.04
Body fat (%)	23.3 $\pm$ 6	23.2 $\pm$ 5.8	0.49	24.1 $\pm$ 5.1	22.7 $\pm$ 5.6	0.001

There were significant changes in percent of body fat and waist to hip ratio in exercise group (Table 1). Moreover, liver echogenicity of patients in trial group following RT was significantly improved (Fig. 1). RT had significant impact on HOMA-IR compared to the control group (Fig. 2).



**Fig. 1:** Change in hepatic fat after 8 weeks in exercise and control group (Means  $\pm$  SD)



**Fig. 2:** Change in HOMA-IR after 8 weeks in exercise and control group (Means  $\pm$  SD)

Based on the results of this trial, decrease in fat mass and hepatic fat, increased strength, lean body mass and hepatic insulin sensitivity after two months of resistance exercise were important findings.

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### Conflict of interests

The authors declare that there is no conflict of interest.

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