Walking Exercises Modulate Liver Enzymes in Fatty Liver Patients

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ABSTRACT

Purpose: *The purpose of this study was to investigate the effect of walking exercise program on liver enzymes in fatty liver patients.* ***Subjects and Methods:*** *Forty five fatty liver patients (male and female) participated in this study. Their age ranged from 36 to 50 years old with the mean value of (43±7) age. Their height ranged from 163 to 182 centimeter with the mean value of (173±9) cm. Each patient participated in an exercise training program with a moderate intensity (from 60% to75% of his or her individualized maximal heart rate), for forty minutes three times / week for two month. The alanine aminotransferase (ALT) and aspartate aminotransferase (AST) Liver enzymes, waist to hip ratio (W/H), body mass index (BMI) and body weight were measured for each patient before and after the training program* ***Results:*** *The results proved that there are significant reductions in the concentration of ALT and AST serum levels of liver enzymes. These reductions were associated with significant reductions in body weight, BMI and W/H ratio.* ***Conclusion:*** *It was concluded that treadmill exercise training program with moderate intensity reduced the serum levels of ALT and AST liver enzymes, W/H ratio, body weight and BMI in fatty liver patients.*

Key Words*: Treadmill Exercise, Liver Enzymes, Fatty Liver.*

INTRODUCTION

Non-alcoholic fatty liver disease (NAFLD) is a condition characterized by hepatic steatosis in the absence of a history of significant alcohol use or other liver diseases. Its progressive form is called non-alcoholic steatohepatitis (NASH). The prevalence of NAFLD averages is 20% and that of NASH is from 2% to 3 %[13,34, 48]. These conditions are the most common liver diseases in the United States and developed countries[13,48]. It was stated that NAFLD covers a wide spectrum of diseases ranging from simple fatty deposition in the liver to inflammation and finally to fibrosis and cirrhosis. NASH has the potential to Progress to cirrhosis and hepato-cellular carcinoma[10,18,27,30,33,38].

NAFLD has been associated with obesity and other features of the metabolic syndrome. As a result of a lack of other effective treatment lines, the weight loss through lifestyle modifications combined with diet and exercise training have been promoted as the standard treatment. The most common laboratory abnormalities of patients with NAFLD are mild to moderate elevations of AST and ALT liver enzymes. The ratio of AST to ALT is less than 1 in 65% to 90 % of patients[13,19,31,45,48]. The higher the levels of elevated liver enzymes the more likely damage to the liver on the direct examination of patients. About half of these patients complain of fatigue and/or upper abdominal discomfort the other half has no symptoms[12,46]. Liver enlargement is sometimes detected on physical examination[3]. Exercise training results in a sustained improvement in liver enzymes, serum insulin levels, and quality of life in overweight patients with liver disease[11,15,34].

NFLD is probably the most common cause of liver disease in the preadolescent and adolescent age groups. It is likely related to the dramatic rise in the incidence of obesity during the past three decades[5,28]. Obesity, insulin resistance and oxidative stress have critical roles in the pathogenesis of NASH. Currently there is no effective available medical therapy. This metabolic disorder occurs mainly in overweight or obese individuals, but as nowadays NAFLD is emerging as one of the main causes of chronic liver disease. It is considered to be the hepatic component of the metabolic Syndrome, whose central features include obesity, hyperinsulinemia, peripheral insulin

resistance, diabetes, dyslipidemia, and hypertension[10,18,27,31].

It was reported that NAFLD is a well recognized form of chronic liver disease that has recently gained greater recognition. NAFLD is currently considered the leading cause of abnormal liver enzyme levels in the united state. It is closely paralleling in obesity and diabetes mellitus. NAFLD has a worldwide distribution, affecting both adults and children. Therapeutic modalities remain limited and they are largely focused on correcting the underlying insulin resistance or reducing oxidative stress[27,31].

Weight reduction may improve the disease. Liver-transplantation in end-stage liver disease is a potential therapeutic option in patients with NASH[11,24]. Obesity is the hallmark of NAFLD which is a potentially progressive disease that is associated with the metabolic syndrome[25,45].

Weight loss and regular exercise were significantly associated with improvement in serum of ALT liver enzyme. The reduction of weight by at least 5% with subsequent weight control and regular exercise may be beneficial in treating NAFLD[6,17]. The current management of NAFLD/NASH is largely conservative. The treatment should be based on the prevention and changing the lifestyle. It includes diet regimen, aerobic training in addition to the weight reduction, insulin sensitizers, lipid-lowering agents, antioxidants, and the bile salts that increase the mitochondrial transport of fatty acids[1,14,16,29,30,45]. The feeding of a high-fat diet induces a state of hepatic glucagon resistance which is partially attenuated by concurrent exercise. The lipid infiltration may interfere with the action of glucagon thus inducing glucagon resistance in liver[7,47].

Restricted diet and exercise therapy as walking and jogging are useful means to improve blood biochemical analysis and histological findings in fatty liver patients[42]. They encouraged obese subjects to gradually reduce their body weight to improve the liver abnormalities and enzymes[2,45]. They assessed the short-term (12-week) multidisciplinary therapy on visceral adiposity and NAFLD. The results indicated that after intervention the adolescents had a significant reduction in visceral adiposity and NAFLD prevalence from 52% to 29%. It is a positive result because NAFLD can progress to cirrhosis, even in children and adolescents[43,11,12,14,10].

The waist circumference and body mass index were both predictors in men. Waist-to-hip ratio was also a predictor in men, but not as strong a predictor as waist circumference and body mass index. This difference is probably explained by differences in the accumulation of intra-abdominal adipose tissue among men and women with the same degree of obesity. It was reported that Serum ALT and AST activities correlated significantly with total body fat in both overweight men and women. Subjects having high total body fat with fatty liver showed significant elevated hepatic enzymes compared with those without fatty liver. Elevated hepatic enzyme activities are associated with increase total body fat[8,9,10]. The current management of NAFLD/NASH is largely conservative and includes diet regimen, aerobic exercise, and interventions towards the associated metabolic abnormalities. Weight reduction, drugs, insulin sensitizers, lipid-lowering agents, antioxidants, bile salts and co-factors increase the mitochondrial transport of fatty acids[2,3,4]. So the purpose of this study was to investigate the effect of a treadmill training program with a moderate intensity on liver enzymes in fatty liver patients.

SUBJECTS, MATERIALS AND METHODS

Subjects

Forty five patients (male and female) with fatty liver participated in this study. Their age ranged from 36 to 50 years old with the mean value of (43±7). They were selected from outpatient clinic of internal medicine at Central Berket Al Shbaa Hospital. They were diagnosed with specialized physician as a NAFLD. They were under medical treatment. Patients with any disease that affects the liver enzymes or interferes with study were excluded.

Equipment

1-Assessment equipment:

- **Weight and height scale** was used to determine the weight and height of each patient before and after the study.
- **Tape measurement** was used to measure waist to hip ratio.
- **Plastic syringes** were used to draw venous blood sample from each subject before and after the exercise training program.
- **Centrifuge 5804**: (made in Germany) was used to separate the serum from the plasma.
- **Stanbio** (AST/GOT): procedure for the quantitative determination of AST/GOT in serum.

2- Training equipment:

- **Electronic treadmill**: (RAM 770 CE, made in Germany) was used to perform the exercise training program with moderate intensity.

Procedures of the Study

1- Evaluative procedure:

Each patient assigned a consent form before starting the exercise training program. A venous blood sample was drawn from the anti-cubital vein of fasted patient for 2 hours to detect the serum level of liver enzymes (ALT and AST). Blood pressure, weight, height, and waist to hip ratio also were measured for each patient before the first and after the last sessions of the training program.

2- Training procedure:

Each patient practiced treadmill exercise training program at zero inclination with a moderate intensity for forty minutes three times per week for 2 months. This program included the following phases which are:

a) ***Warm up phase*:** Each patient practiced treadmill exercise for 5 minutes with the lowest speed to enhance the cardiovascular adjustment and prevent the musculoskeletal injuries.

b) ***Stimulus phase*:** Each patient continued the treadmill exercise training with a moderate intensity from 60% to 75% of the pre determined individualized maximal heart rate (HR_{max}) for thirty minutes.

c) ***Cool down phase*:** Each patient continued the treadmill exercise training for 5 minutes with the lowest speed.

Statistical Analysis

The collected data were statistically analyzed by using **paired t-test** to detect the significant difference before and after the exercise training program.

RESULTS

I- Liver enzymes

The mean value of ALT and AST enzymes significantly reduced after the treadmill exercise training from (45.17± 10.55) to (34.64± 5.98) and from (44.62± 6.34) to (35.33± 3.41) respectively P- value < 0.005 (Table 1 and Fig. 1).

Table (1): The mean values of ALT and AST liver enzymes pre and post treadmill exercise.

Variables	ALT		AST	
	Pre	Post	Pre	Post
Mean	45.17	34.64	44.62	35.33
SD	10.55	5.98	6.34	3.41
T-value	5.492		8.17	
P-value	0.005*		0.001*	

*Significant (P<0.05) ALT: alanine aminotransferase SD: stander deviation AST: aspartate aminotransferase

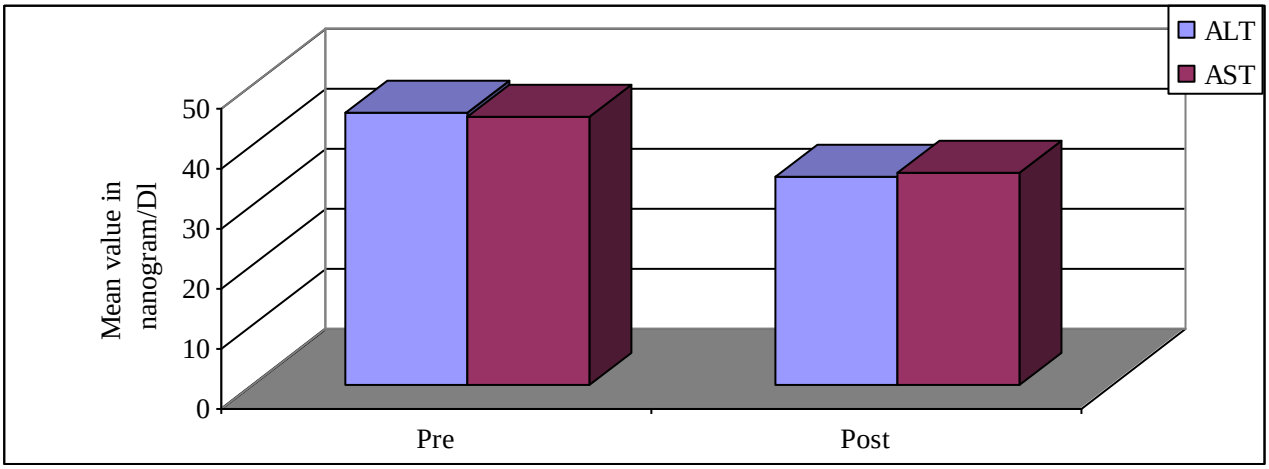

Fig. (1): The mean values of ALT and AST liver enzymes pre and post treadmill exercise.

II- The body weight, BMI and W/H ratio

The mean value of the body weight, BMI and W/H ratio significantly reduced after the exercise training program from (94.5± 7.3) to (84.3± 8.2), (43.3± 3.51) to (39.7± 3.5) and from (0.95± .06) to (0.92± .05) respectively P < 0.005 (Table 2, Fig. 2).

Table (2): The mean values of body weight, BMI and W/H ratio pre and post exercise in patients.

Variables	Body weight		BMI		W/H ratio	
	Pre	Post	Pre	Post	Pre-t	Post
Mean	94.5	84.3	43.3	39.7	0.95	0.90
SD	7.3	8.2	3.5	3.5	0.06	0.05
T-value	11.46		11.8		0.820	
P-value	0.005*		0.001*		0.001*	

*Significant (P<0.05) SD: stander deviation

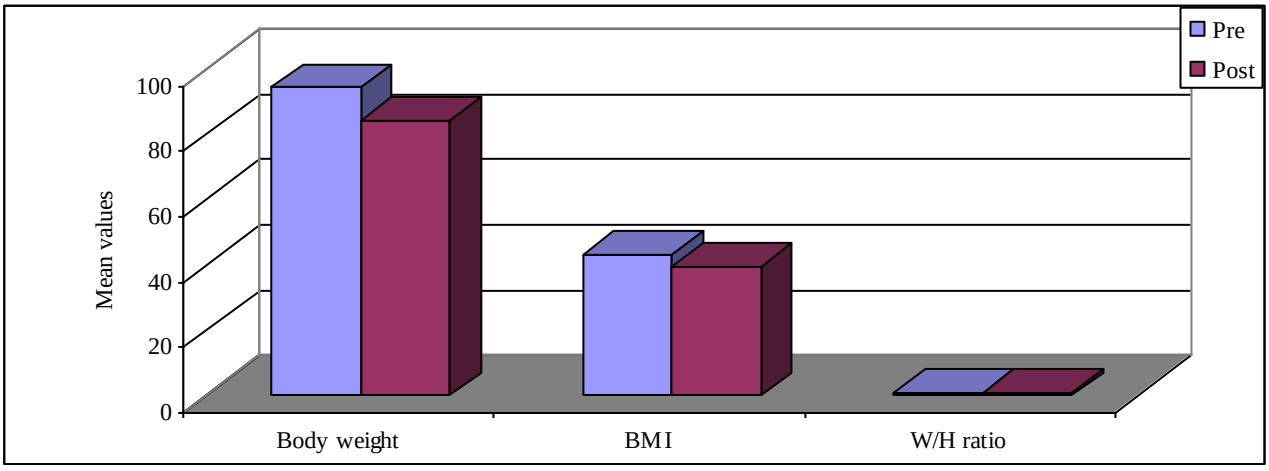

Fig. (2): The mean values of body weight, BMI and W/H ratio pre and post treadmill exercise.

The Correlation values between ALT enzyme and body weight, BMI and W/H ratio post treadmill exercise were (0.03342), (0.04354) and (0.013455) respectively. It means that the reduction of the body weight, BMI and W/H ratio are associated with reduction in ALT enzyme.

The Correlation values between AST enzyme and body weight, BMI and W/H ratio post treadmill exercise were (0.135542), (0.002367) and (0.064768) respectively. It means that the reduction of the body weight, BMI and W/H ratio are associated with reduction in ALT enzyme.

So there is a positive correlation between the concentration levels of ALT, AST liver enzymes and the body weight, BMI and waist to hip ratio. It means that the reduction of the body weight, BMI and waist to hip ratio are associated with the reduction and improvement of ALT and AST enzymes. So it was concluded that treadmill exercise improves liver enzymes in fatty liver patients.

DISCUSSION

The results of this study proved that the serum levels of ALT and AST enzymes significantly reduced after moderate treadmill program. These results were supported with many previous studies[11,15,19]. They reported that exercise training results in a sustained improvement in liver enzymes, serum insulin levels, that were be reflected on the quality of life in overweight patients with liver disease. Restricted diet and exercise therapy, as walking and jogging, are useful means of improving blood biochemical data and histological findings in liver tissues related to fatty liver. Physical exercise would interfere with the development of NAFLD by stimulating lipid oxidation and inhibiting lipid synthesis in liver through the activation of the cyclic adenosine mono-phosphate activated protein kinase pathway(C-AMP)[40,42,45].

These findings demonstrate that lifestyle interventions reduced risk factors associated with progression of liver disease, decreased abnormal liver enzymes, improved quality of life and in a proportion of patients improved histological features of liver injury. Importantly, these changes were sustained and achievable with relatively small persistent changes in lifestyle. Treatment of overweight should form an important component of the management of patients with chronic liver disease[12,45,49].

The reduction of the body weight and lifestyle changes in combination with regular exercise significantly associated with improvement in serum level of ALT enzyme. The circulating non-esterified fatty acids seem to be a major determinant in the pathogenesis of NAFLD. Finally the inhibition of very low density lipoprotein secretion may also result in hepatic steatosis. This appears to be mainly controlled by the esterification of non-esterified fatty acids into tri-acylglycerols by di-acyglycerol acyltransferase-I, II and the microsomal transfer protein[20,31,45].

Physical exercise training attenuates the development of hepatic steatosis by stimulating lipid oxidation and inhibiting lipid synthesis in liver through the activation of the C-AMP-activated protein kinase pathway[2]. The progressive running in rats from 15 min/day up to 60 min/day for 4 weeks prevents the induced macro-vesicular hepatic steatosis. They found that weight loss and regular exercise were significantly associated with improvement in serum ALT and increased the odds of ALT normalization, while starting smoking was significantly associated with deterioration in serum ALT. They suggested that reducing weight by at least 5% with subsequent weight control and exercising regularly may be beneficial in treating NAFLD[1,20,32].

The hepatic lipase enzyme plays an important role in the metabolism of synthesized and secreted anti-atherogenic lipoproteins. The liver hepatic lipase enzyme carries out the hydrolysis of triglycerides, the lypolysis of phospholipids, the modulation of low density lipoprotein cholesterol (LDL) particles, and the catabolism of high density lipoprotein cholesterol (HDL)[9,45]. It was found that there is an association between insulin resistance and NAFLD in obese children. The insulin resistance and liver enzymes functionally improved exercise training and weight reduction[3,26,23].

The significant reduction of the serum levels of ALT and AST after treadmill training program may be due to diminished delivery of lipids to the liver, increased hepatic oxidation and increased incorporation of triacyle-glycerols into very low density lipoprotein cholesterol. Exercise training decreases the circulating plasma non-esterified fatty acids, lowers plasma triacyle-glycerols levels and Prevents hepatic fat accumulation rather than an increased hepatic oxidation or an increased very low density lipoprotein cholesterol synthesis[24,40,45]. The reduced non-esterified fatty acids and glycerol plasma concentrations are most likely due to an increased fat utilization[3,26,23,34]. The interpretation of the

reduction in liver lipid accumulation with exercise training may be due to a decrease the circulating lipids rather than an increased output from the liver. Training is more efficient in reducing hepatic fat accumulation where the accumulated fat drained into the hepatic portal vein, and completely prevented by exercise training[22,34].

Conclusion

It was concluded that treadmill exercise training program with moderate intensity reduces the serum levels of ALT and AST liver enzymes, W/H ratio, body weight and BMI in patients with fatty liver.

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الملخص العربي

تمرينات المشى تعدل أنزيمات الكبد في مرضى الكبد الدهنى

يهدف البحث إلى معرفة مدى استجابة أنزيمات الكبد لتمرينات المشي في مرضى الكبد الدهنى . أجريت هذه الدراسة على مجموعة مكونة من خمس واربعون مريضا بالكبد الدهنى من الرجال والنساء تراوحت أعمارهم بين خمس وثلاثين وخمسون عاما . تم ممارسة تمرينات المشى ذات الشدة المتوسطة باستخدام جهاز سير الجرى الألكترونى و ذلك لمدة اربعون دقيقة ثلاث مرات أسبوعيا لمدة شهرين . ثم قياس انزيمات الكبد والوزن ومعدل كتلة الجسم و محيط الوسط الى الفخد لكل مريض قبل وبعد الانتهاء من برنامج المشى . وقد أظهرت النتائج انخفاض ذو دلالة احصائية فى انزيمات الكبد والوزن ومعدل كتلة الجسم . كما اثبتت وجود علاقة طردية بين انزيمات الكبد والوزن ومعدل كتلة الجسم . لذلك يوصى باستخدام جهاز المشى لمرضى الكبد الدهنى .