Egyptian Journal of Occupational Medicine, 2016; 40 (1) : 61-70

EFFECT OF HIGH INTENSITY INTERVAL TRAINING VERSUS RESISTANCE TRAINING ON QUALITY OF LIFE AND FUNCTIONAL CAPACITY ON PATIENTS WITH FATTY LIVER DISEASES (PART I)

By

[1]Badr NM, [2]El Batanony MM , [3]Attia DI, [1]El-Sayed SH, [4]Ali HM

[1] Department for Cardiovascular / Respiratory Disorder and Geriatrics, Faculty of Physical Therapy,

[2]Department of Occupational and Environmental Medicine , Cairo University,

[3] Department of Tropical Medicine Faculty of Medicine ,Beny Sueif University and

[4] Department of Fitness and Rehabilitation Unit, Cairo University Hospitals.

Abstract

Introduction: Patients with fatty liver disease complain from fatigue and have decrease quality of life. Life change behaviors as diet and exercise are the most important recommendation from therapists. However little is known about type and intensity of exercise which is beneficial in fatty liver diseases management. **Aim of work:** To assess the effect of high intensity interval training compared to resistance training on quality of life and six minute walk distance in fatty liver disease patients. **Materials and Methods:** Twenty one female patients with fatty liver disease were assigned to supervise high intensity interval training (HIIT) or resistance training (RT) for eight weeks, paired t test was used for statistical comparison. **Results:** The results showed that both types of exercise improved quality of life and six minute walk distance significantly, but HIIT was superior to RT in improving Body Mass Index (BMI), 6 minutes walk distance (6MWD) and Chronic liver disease questionnaire (CLDQ). **Conclusion:** So, it can be concluded that high intensity interval training was more appropriate than resisted exercise training in improving quality of life and six minute walk distance in fatty liver disease patients.

Key words: Fatty liver disease, High intensity interval training, Resistance training and Quality of life.

Introduction

Nonalcoholic fatty liver disease (NAFLD) represents a spectrum of hepatic disorders ranging from simple hepatic steatosis and fibrosis and can progress to cirrhosis. The prevalence of NAFLD in the general population is 10-24% but increases greatly in patients with type 2 diabetes mellitus (T2DM). It is increasingly recognized not only because of its growing prevalence and its potential progression to liver-related morbidity and mortality, but also because of its association with serious medical conditions such as insulin resistance, Type 2 diabetes, obesity, metabolic syndrome, etc. With diabetes and obesity becoming epidemic diseases worldwide, NAFLD becomes the most common explanation for any form of hepatic disease whether in developing or developed countries. Moreover, recent data in some ethnic populations suggested that the presence of NAFLD may increase coronary heart disease (CHD) risk (Hongyun et al., 2009).

Aim of work: To assess the effect of high intensity interval training compared to resistance training on quality of life and six minute walk distance in fatty liver disease patients.

Materials and Methods

- Place and duration of study: The study was carried in the Fitness and Rehabilitation Unit, Kasr Al-Aini Hospital, Cairo University.

- Study sample: Twenty one fatty liver female patients from Kasr EL Aini out clinic,- between May 2012 to January 2015- were enrolled in the study. Criteria required to entrance into the study were: (a) Age is from 40-55 years old. (b) Diagnosed as chronic liver diseases patient by sonography. (c) A written informed consent from the patients to participate in the study. (d) All patients under medical control. Potential participant were excluded if they had cardiovascular disease, physical disability, musculoskeletal disease, renal or hormonal diseases, smokers and pregnant women.

- Study methods: Patients' baseline characteristics, including body weight, body mass index (BMI), and 6 minute walk test distance were collected. Quality of life were assessed by the chronic liver diseases questionnaire (CLDQ), developed by Younossi et al., has been used in most recent studies of health related quality of life (HRQOL)

in patients with chronic liver diseases. The questionnaire contains 29 items divided into domains: abdominal symptoms (AB), activity (AC), emotional function (EM), fatigue (FA), systemic symptoms (SY), and worry (WO). Overall CLDQ scores calculated for each domain range from 1 (most impaired) to 7, with higher scores indicating a minimum frequency of symptoms and hence a better HRQOL. The total score is calculated as the average score of the 29 items. The original questionnaire has good test-retest reliability (r = 0.90) and cross-sectional validity (Younossi et al., 2001)

Finally, we divided the patients into either high intensity interval training or resistive training program .The subjects were divided into two equal groups: the first group (A) received aerobic exercise training; the second group (B) received resisted exercise training three times a week for eight weeks.

Exercise training

The high-intensity interval exercise group carried out a 7 min warm-up period at an intensity corresponding to 65–75% of HRmax (Maximum Heart rate will determined as (MHR=220 – age) (Robergs and Landwehr, 2002), before uphill treadmill walking for 4 intervals of 4 min at 85–90% of HRmaxk with 3 minutes active recovery at 65–75% of HRmax, in between, and a 3 min cool-down period (Tjonna et al., 2009). All patients were exercising using a heart rate monitoring device (fingertip oximeter), and the speed & the inclination of the treadmill were continually adjusted to ensure that all patients were exercising at the desired heart rate range.

The total duration was 20-38 minute and frequency was 3 times / week (day after day). If they experience any chest pain or breathing difficulties during the HIIT workout, cool down immediately done. If the heart rate does not drop back down to about 70% of the max during recovery intervals, we may need to shorten the work intervals and/or lengthen the recovery intervals.

Resistive exercises included the following: The program consisted of eight exercises: biceps curl; calf raise; triceps press; chest press; seated hamstrings curl; shoulder press; leg extension and lateral pull down. Each

session lasted between 45 and 60 min and consisted of a 10 min warm-up at approximately 60% maximum heart rate on a cycle ergometer, and followed by resistance exercise done as a circuit, ending with a repeat of the warm-up described. The one repetition maximum was measure at baseline and following the intervention. Initially, participants do two circuits using 50% of their one repetition maximum, progressing to three circuits, using a minimum 70% of their one repetition maximum by week seven. Participants will encouraged to increase the resistance used each week when possible.

Statistical analysis

All mean values obtained before and after three months in both groups were compared using the paired ‘‘t’’ test. An independent ‘‘t’’ test was used for the comparison between the two groups ($P < 0.05$).

Consent:

Authors declare that a verbal consent was taken from the studied group before making the study.

Ethical approval

The Ethical Committee of Faculty of Physical Therapy approved the study protocol

Results

The study involved twenty one fatty liver female patients with aged from 40 to 55 years. The subjects were divided into two groups groups: the first group (A) received high intensity interval training (HIIT) (n=12), The second group (B) received resisted exercise training (RET) (n= 9)three times a week for eight weeks in order to compare the effect of HITT and RET on quality of life and functional capacity in fatty liver patients.

Table (1) Baseline subjects characteristics

Variables	Group A	Group B	P-value
Age (Years)	46.33±4.96	45.55±4.43	0.693
Height (Cm)	161.58±8.07	157.45±3.50	0.133
BW (Kg)	105.92 ±13.91	107.91 ±13.98	0.736
BMI (Kg/m^2)	40.53 ±4.06	43.51 ±5.36	0.145
6-MWT (Meters)	282.25 ±25.70	269.91 ±30.79	0.307
CLDQ	89.58 ±14.92	85.91 ±9.04	0.488

All data are expressed as means & standard deviations. An independent ''t'', (P≤0.05) was used.BW= Body weight, BMI= Body mass index, 6-MWT = six minutes walk test, CLDQ =Chronic liver disease questionnaire.

Table (1) shows there no significant difference in the demographic and clinical data between high intensity interval training and resistive training program.

Table (2) Mean value and significance in group A before and after treatment.

Variable	Group A			
	Pre	Post	P-Value	% of change
BW (Kg)	105.92 ±13.91	91.83 ±10.15	0.0001*	↓13.30%
BMI (Kg/m2)	40.52 ±4.06	35.38 ±3.28	0.0001*	↓12.71%
6-MWT(Meters)	282.25±25.70	384.25 ±38.08	0.0001*	↓36.14%
CLDQ	89.58 ±14.92	176.25 ±7.77	0.0001*	↓96.75%

All data are expressed as means & standard deviations. Paired t-test, (P≤0.05) was used.BW= Body weight, BMI= Body mass index, 6-MWT = six minutes walk test, CLDQ =Chronic liver disease questionnaire.

*: Statistically significant

Table (2) shows statistically significant decrease weight and BMI, and significant increase in walking distance and quality of life in high intensity interval training group.

Table (3) Mean value and significance in group B before and after treatment.

Variable	Group B			
	Pre	Post	P-Value	% of change
BW (Kg)	107.91 ±13.98	99.18 ±12.6	0.001*	↓8.09 %
BMI (Kg/m2)	43.51 ±5.36	40.01 ±5.00	0.0001*	↓8.04%
6-MWT (Meters)	269.91 ±30.79	322.27 ±24.43	0.0001*	↓19.40%
CLDQ	85.91 ±9.04	168.18 ±7.88	0.0001*	↓95.76%

All data are expressed as means & standard deviations. Paired t-test, ($P \leq 0.05$) was used.BW= Body weight,

BMI= Body mass index, 6-MWT = six minutes walk test, CLDQ =Chronic liver disease questionnaire.

*: Statistically significant

Table (3) shows statistically significant decrease weight and BMI, and significant increase in walking distance and quality of life in resistive training group.

Table (4) Mean value and significance between group A and B .

Variable	Group A (Post)	Group B (Post)	P-value
BW (Kg)	91.83 ±10.15	99.18 ±12.6	0.137
BMI (Kg/m^2)	35.38 ±3.28	40.01 ±5.00	0.015*
6-MWT (Meters)	384.25 ±38.08	322.27 ±24.43	0.0001*
CLDQ	176.25 ±7.77	168.18 ±7.88	0.022*

All data are expressed as means & standard deviations. An independent ''t'', ($P \leq 0.05$) was used.BW= Body weight, BMI= Body mass index, 6-MWT = six minutes walk test, CLDQ =Chronic liver disease questionnaire.

*: Statistically significant

Table (4) shows statistically significant difference in BMI, walking distance and quality of life between high intensity interval training group and resistive training group. There was a significant difference between the groups after treatment.

Discussion

There has been only limited research on the effects of exercise as the sole intervention on functional capacity and quality of life in individuals with fatty liver diseases. The aim of this study was to compare changes in body weight (BW), Body Mass Index (BMI), six minute walk distance and quality of life after high intensity interval training and resistance exercise training in fatty liver patients.

A number of studies have consistently reported impairment in health related quality of life (HRQL) in patients with chronic liver disease compared with healthy individuals (Bonkovsky et al., 1999, Foster et al., 1998, Ware et al., 1999, Hussain et al 2001). In addition, there is a dose-response relationship between BMI and the degree of HRQL impairment (Fontaine and Barofsky, 2001). It remains unknown whether the beneficial effects of weight reduction

on HRQL are observed in patients with chronic liver disease and are sustainable long term.

One of the most important factors associated with successful weight maintenance was the continuation of appropriate levels of physical activity on the long term. Patients who regained weight had significantly higher than recommended exercise levels during the initial three months, suggesting that patients attempting unrealistic short term changes do not sustain these changes and may be more likely to relapse long term. Patients, who maintained weight; sustained recommended levels of activity during follow up. It is widely accepted that exercise has an important role in the treatment of visceral adiposity and insulin resistance. The data further support the important role of exercise in the successful maintenance of weight loss in patients with chronic liver disease (Hickman et al., 2004).

Many studies demonstrates that investment in weight reduction has the ability to reduce risk factors associated with progression of liver disease, decrease abnormal liver enzymes, improve quality of life, and in a proportion of patients improve histological features of liver injury. Importantly, these changes were achievable and sustainable with relatively small but persistent changes in lifestyle. These results suggest that treatment of overweight patients should form an important component of management of those with chronic liver disease (Hickman et al., 2004, Gomez et al., 2009, St George et al., 2009 ,Thoma et al., 2012).

Kistler et al., found an inverse relationship between vigorous-intensity physical activity and NAFLD severity. Moderate-intensity physiccal activity and total volume of physical activity were not related to outcomes. Thus, intensity may be an important dimension of physical activity to consider when counseling patients and planning interventions. Intervention studies with objective measures of physical activity are required to confirm the differential effects of vigorous compared with moderate physical activity on NAFLD severity (Kistler et al., 2011).

As peak VO2 testing is not readily available at all centers, the 6MWD was also used to evaluate submaximal aerobic capacity and functional performance. Both Alameri et al.

and Carey et al. have established the 6MWD as an independent predictor of mortality in patients with cirrhosis. In both studies the optimal 6MWD cut-point for mortality prediction was <250 meters. Carey et al. further reported that every 100-meter increase in walk distance was associated with a 52% reduction in mortality (Alameri et al ., 2007 and Carey et al., 2010).

There was no study investigated the effect of resistance training or high intensity interval training in fatty liver patient in functional capacity and quality of life, however there were many studies investigate their effects on other chronic diseases such as chronic heart disease.

interval training (IT) at very high intensity for patients with heart failure appears to be more effective than continuous training (CT) in improving indices of submaximal exercise capacity and oxygen pulse, oxygen consumption, and the distance walked during the 6MWT (Freyssin et al ., 2012).

Resistance training increased 6-minute walk distance compared to no training, but had no other benefits on cardiac function, exercise capacity, or quality of life if used alone or as an adjunct to aerobic training in people with chronic heart failure. However, further high quality, large scale, randomized trials are needed (Hwang et al., 2010).

Conclusion:

The mean values of BW and BMI were significantly decreased and the mean values of 6MWD and CLDQ were significantly increased in both group A and group B. Also, there was a significant difference between the groups after treatment. This means that in fatty liver patients HIIT exercise is more appropriate to improve functional capacity and quality of life than is resisted exercise training. So, it can be concluded that aerobic exercise training was more appropriate than resisted exercise training.

Conflict of interest:

Authors have declared that no conflict of interests exists.

References

1. Alameri HF, Sanai FM, Al Dukhayil M, Azzam NA, Al-Swat KA and Hersi AS (2007): Six Minute Walk Test to assess functional capacity in chronic liver disease patients. World journal of gastroenterology; 7(29):3996-4001. PubMed PMID: 17663517.
2. Bonkovsky HL and Woolley JM (1999): Reduction of health-related quality of life in chronic hepatitis C and improvement with

interferon therapy. The Consensus Interferon Study Group. Hepatology; 29:264–70.

3. Carey EJ, Steidley DE, Aqel BA, Byrne TJ, Mekeel KL and Rakela J (2010): Six-minute walk distance predicts mortality in liver transplant candidates. Liver transplantation: official publication of the American Association for the Study of Liver Diseases and the International Liver Transplantation Society; 16(12):1373-8. PubMed PMID: 21117246.
4. Fontaine KR and Barofsky I (2001): Obesity and health-related quality of life. Obes Rev; 2:173–82.
5. Foster GR, Goldin RD and Thomas HC (1998): Chronic hepatitis C virus infection causes a significant reduction in quality of life in the absence of cirrhosis. Hepatology; 27: 209–12.
6. Freyssin C, Verkindt C, Prieur F, Benaich P, Maunier S and Blanc P (2012): Cardiac rehabilitation in chronic heart failure: effect of an 8-week, high-intensity interval training versus continuous training. Arch Phys Med Rehabil; 93(8):1359-64.
7. Gomez VE, De Miranda RA, Oramas GB, Soler AE, Navarro LR and Bertot CL (2009): Clinical trial: a nutritional supplements Viusid, in combination with diet and exercise, in patients with nonalcoholic fatty liver disease. Aliment Pharmacol Ther; 30: 999–1009.
8. Hickman IJ, Jonsson JR, Prins JB, Ash S, Purdie DM, Clouston AD and Powell E E(2004): Modest weight loss and physical activity in overweight patients with chronic liver disease results in sustained improvements in alanine aminotransferase, fasting insulin, and quality of life Gut;53:413-419 doi:10.1136/gut.2003.027581
9. Hussain KB, Fontana RJ and Moyer CA (2001): Co morbid illness is an important determinant of health-related quality of life in patients with chronic hepatitis C. Am J Gastroenterol; 96:2737–44.
10. Hwang CL, Chien CL and Wu YT (2010): Resistance training increases 6-minute walk distance in people with chronic heart failure: a systematic review. J Physiother ; 56 (2):87-96.
11. Kistler K D, Brunt EM, Clark JM, Diehl AM, Sallis JF, Schwimmer J B, and the NASH CRN Research Group(2011): Physical Activity Recommendations, Exercise Intensity, and Histological Severity of Nonalcoholic Fatty Liver Disease . Am J Gastroenterol ;106(3): 460–468.
12. Lu Hongyun, Zeng Longyi, Liang Biao, Shu Xiaochun, and Xieb Danhong(2009): High Prevalence of Coronary Heart Disease in Type 2 Diabetic Patients with Non-alcoholic Fatty Liver Disease Archives of Medical Research ;40 :571-575. Robergs RA and Landwehr R (2002): The surprising history of the ''HRmax=220-age'' equation. J Exerc Physiol Online; 5(2):1–10.
13. St George A, Bauman A, Johnston A, Farrell G, Chey T and George J (2009): Independent effects of physical activity in patients with nonalcoholic fatty liver disease. Hepatology; 50:68–76.
14. Thoma C, Day CP and Trenell MI (2012) : Lifestyle interventions for the treatment of non-alcoholic fatty liver disease in adults: A systematic review. Journal of Hepatology ; 56: 255–266
15. Tjonna AE, Stolen TO, Bye A, et al. (2009): Aerobic interval training reduces cardiovascular risk factors more than a multitreatment approach in overweight adolescents. Clin Sci.; 116:317–26.
16. Ware JE jr, Bayliss MS, Mannocchia M, (1999): Health-related quality of life in chronic hepatitis C: impact of disease and treatment response. The Interventional Therapy Group. Hepatology; 30:550–5.
17. Younossi ZM, Boparai N, Price LL, Kiwi ML, McCormick M, and Guyatt G.(2001) : Health-related quality of life in chronic liver disease: the impact of type and severity of disease. Am J Gastroenterol; 96: 2199-2205.