The Effect of SUB-MAXIMAL Exercise Upon Students Suffering Chronic Hepatitis B Infection

Chia-Li Lin, Ming-Feng Chen, Meng-Chuei Chung1, and Man-Hway Lin1

Division of Gastroenterology, Department of Internal Medicine, Changhua Show-Chwan Memorial Hospital, Taiwan, R.O.C.
1Department of Physical Education, National Taiwan Normal University, Taiwan, R.O.C.

Abstract

Physical activity for sufferers of liver disorders has been a controversial topic, there still remaining different opinions about the effect/benefit of physical activity upon sufferers of chronic liver disorders. The purpose of this study is to analyze the effect of sub-maximal exercise upon liver function and exercise fatigue score for high-school students afflicted with chronic Hepatitis B. Twenty-eight male high-school students were enrolled into this study and allocated into one of three study groups, Group A - ten control-group students, Group B - 12 hepatitis B virus (HBV)-infected students featuring normal liver function, and Group C - six HBV-infected students revealing abnormal liver function. All students were asked to use an exercise treadmill for 20minutes to reach a heart rate between their maximal heart rate and 70-85% of their maximal heart rate reserve. This training regimen was performed three times a week, 30 minutes each session for a period of six weeks. During the training program, all students provided blood for serum analysis on the day before exercise was initiated, and on the second week; on the fourth week; on the sixth week, and two weeks after the program was finished (on the eighth week). During the training session, all students were given an exercise rating corresponding to "perceived exertion" according to the perceived exertion test (RPE), and the results recorded.
No significant changes in aspartate aminotransferase (AST); alanine aminotransferase (ALT), total bilirubin, prealbumin, and albumin levels were noted during the training period. On the other hand, a significant decrease in the result of the RPE test was observed ($p<0.05$); group-A decrease 21.63%; group-B decrease 22.55% and group-C decrease 20.97%.
We conclude that six-week sub-maximal regular physical exercise did not exacerbate the liver function of students suffering hepatitis B but improve the estimated work load capacity and decrease the post-exercise fatigue score. Whether exercise can improve the liver function of students suffering hepatitis B or not, warrants more future studies. (J Intern Med Taiwan 2004; 15: 208-213)

Key Words：Sub-maximal exercise, Rating of Perceived Exertion scale

Introduction

Controversy would still appear to rage as regards whether physical activity for patients suffering liver disease is harmful or not 1. During convalescence following acute viral hepatitis, exercise would appear to be well tolerated by affected individuals 1-4, whereas there would still appear to be

a number of different opinions regarding the effect of physical activity upon sufferers of chronic liver disorders. Restricted physical activity is often prescribed for patients afflicted with chronic hepatitis, even after they have come into clinical remission 5. The purpose of this study was to examine the effects of six weeks of sub-maximal exercise upon liver function for patients chronically infected with the hepatitis B virus (HBV).

Materials and Methods

Twenty-eight male high-school students; aged between 16 and 18 years volunteered to participate in this study involving blood sampling before and after a six-week, sub-maximal exercise training program (Table-1). All study participants provided written consent. Amongst them, ten students acted as controls (Group A), 12 students were chronic hepatitis B carriers featuring normal liver function (ALT < 40 U/L) (Group B) and six students were chronic hepatitis B carriers exhibiting abnormal liver function (ALT > 40 U/L) (Group C). Students were excluded if they revealed any of the following: coinfection with hepatitis C virus, hepatitis D virus, or the human immunodeficiency virus; a nuclear antibody titer of more than 1:160; or the presence of confounding medical illness or other types of liver disease. All students demonstrated no history of alcoholic-beverage consumption, none were deemed to be obese (BMI < 27), and no history of long-term drug use. Although there was no specific standard for daily activities and caloric intake, none show any change in their behavior subsequent to the conclusion of the training program as compared to the corresponding activity prior to the commencement of the training program.

All students were asked to use an exercise treadmill for 20 minutes to reach a heart rate of around 70-85% of their maximal heart rate as determined on the treadmill. Based upon the greatest heart rate recorded for each student during treadmill walking, a fairly large heart-rate zone corresponding to 70-85% of maximal heart rate was established of each individual student. Students were provided with a heart-rate monitor (Cardiosport-Heartsafe heart rate monitor, Taiwan) and instructed in its use. They were asked to walk briskly whilst on the treadmill, keeping their heart rate within the designated heart-rate zone, on three days each week, for 30 minutes on each occasion. This training regimen was performed three times a week, 30 minutes each session for a period of six weeks. Blood samples were obtained after students had fasted overnight the day before exercise as baseline, and at two, four, and six weeks subsequent to the commencement of the exercise program and two weeks after they finished the sessions (on the eighth week), the sample was taken in the early morning, in order to determine serum aspartate aminotransferase (AST), alanine aminotransferase (ALT), prealbumin, albumin and total bilirubin levels. Both prior to and immediately after each exercise test, Borg's Rating of Perceived Exertion (RPE) test 6 was performed for all of the students in order to attempt to express their individual's level of exertion.

The Wilcoxon signed rank sum test was used to compare serum levels of AST, ALT, total bilirubin, prealbumin, and albumin prior to and following exercise.

Results

During the eight-week study, AST, ALT, total bilirubin, prealbumin, and albumin levels did not change significantly within groups. (Tables 2-4), whereas for Group-C individuals, the mean AST level decreased from 48±23.3 to 36.7±5.9 at six weeks, after completion of the exercise program. During resting, two weeks after completion of the program the mean AST level increased from 36.7±5.9 (on the sixth week) to 44.0±8.6 (Fig 1). The mean serum ALT level had also decreased from 111.8±77.6 at baseline to 77.7±18 at six weeks after the program completion, the level then

increased to 91.0±28.3 two weeks later (Fig 2), although these level changes did not prove to be statistically significant.

The results of the RPE test revealed that the mean value for each group had decreased significantly six weeks into the exercise program ($p<0.05$), incorporating a decrease of 21.63%, 22.55% and 20.97% for, respectively, groups A, B and C, although no significant inter-group difference was observed. In the first phase of the training period many of the students experienced muscular pain and fatigue, although such complaints had disappeared by the end of the training period.

Discussion

Hepatitis B infection is one of the world's most-common infectious diseases, with more than 350 million people world-wide being reported to suffer chronic HBV infection, accounting for more than five per cent of the world's population. Although widely distributed geographically, hepatitis B prevalence varies from it being a highly endemic disease in China, Southeast Asia, and Africa to a disease of low endemicity in North America, Western Europe and Australia. The incidence of chronic hepatitis B infection in Taiwan is reported to be around 15-20% 7,8. Clearly this disease constitutes a significant global problem and exerts a significant economic burden on certain societies and their medical systems.

Most chronic HBV-infected patients reveal few symptoms and require little or no medical therapy, especially when individuals are youthful. Despite the fact that many of these patients feel well during the chronic infection stage, they are often faced with a restriction to their daily activities 9. In 1983, Ritland 2 reported that 17 patients suffering from chronic active hepatitis B infection were assessed via hepatic biochemical tests, as also for oxygen consumption and work capacity prior to, during and following a standardized-interval training program extending for a period of 12 weeks. During, and at the conclusion of the study, these workers failed to observe any significant change in serum aminotransferase level for study participants. In addition, both oxygen consumption and work capacity for study participants improved significantly during the 12-week training period, although the study did lack control-group comparison.

It has recently been reported that mild exercise exerts positive benefits for patients suffering hepatitis infection, especially during their recovery state, due to improvements rendered by exercise to the general circulation of the liver 10. The indocyanine green (ICG) test was performed for 15 patients suffering chronic hepatitis and 22 patients featuring liver cirrhosis both prior to and following exercise. The ICG test revealed significant (P less than 0.05) improvement following exercise for chronic liver-disease sufferers, such results suggesting that hepatic blood flow increases through moderate exercise for sufferers of chronic liver diseases 11. The results of our present study are in agreement with such observations, in that we did not observe any clinical or hepatic biochemical change following a sub-maximal exercise program for students suffering chronic hepatitis B. Even for our group-C study participants, serum AST and ALT levels were noted to decrease following exercising for six weeks, although such changes did not prove to be statistically significant, supporting the notion that individuals suffering chronic hepatitis may enjoy regular physical exercise regardless of their circulating enzyme levels. When liver cells are damaged or muscles inflamed, AST is released into the blood, such that the rise in AST levels could be explained either by muscle or liver cells inflammation following exercise 12. It is, however, not yet clearly understood what the cause of this rise in AST levels may be, serum ALT levels therefore constituting the main index for destruction of liver cells, whereas AST levels may be used merely as

a reference to hepatocyte decline 12.

Contemporary research using psychophysical ratings of effort sense has led to the recommendation by the American College of Sports Medicine that the rating of perceived exertion by an individual is a useful device for the determination of exercise intensity for that individual 13. In the first phase of our study's training period many of the students experienced muscular pain and fatigue, although these complaints virtually disappeared by the end of the training program. Clinical deterioration was not observed for any group of students participating in our study, most of which individuals reporting that they believed that their capacity for performing everyday duties had improved during the investigation. Taken together, our findings demonstrate that the general condition of hepatitis B-infected patients featuring abnormal liver function is highly unlikely to deteriorate as a consequence of their participating in a short-term sub-maximal exercise program.

We conclude that a six-week sub-maximal regular physical-exercise program did not exacerbate the abnormal liver function of students suffering hepatitis B infection, rather, it improve participants' estimated work-load capacity and decrease their fatigue score. Whether exercise can improve the liver function of students infected with hepatitis B is clearly worthy of future investigations.

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Table 1. Baseline Characteristics of Hepatitis Group and Control Group

	Group A	Group B	Group C	
No	10	12	6	
Age (year)	17.1±0.7	17.3±0.6	17.3±0.5	P > 0.05
Height (cm)	172.6±7.1	173.2±6.5	172.3±3.3	P > 0.05
Weight (kg)	63.0±13.5	66.8±13.2	64.3±5.8	P > 0.05
HBsAg + (No)	0	12	6	
HBeAg + (No)	0	5	5	

Group A – Control group;

Group B – Chronic Hepatitis B with normal liver function;

Group C – Chronic Hepatitis B with abnormal liver function

Table 2. Changes from Baseline in Serum AST, ALT, Prealbumin, Albumin Bilirubin after exercise in the control group

Variable	Before exercise	After 2 weeks	After 4 weeks	After 6 weeks	After 8 weeks	P value
AST (U/L)	19.9±10.1	20.4±4.3	18.4±3.0	15.7±1.6	17.0±2.9	> 0.05
ALT (U/L)	15.0±9.7	15.5±5.5	13.6±4.2	11.4±4.6	12.8±7.4	> 0.05
Prealbumin (mg/dl)	28.7±3.6	29.3±3.5	28.3±4.0	27.2±3.5	27.2±3.5	> 0.05
Albumin (mg/dl)	5.2±0.2	5.0±0.2	4.9±0.2	4.9±0.1	5.0±0.1	> 0.05
Bilirubin Total (mg/dl)	0.6±0.3	0.7±0.4	0.8±0.2	0.7±0.4	1.0±0.8	> 0.05

AST = aspartate aminotransferase; ALT = alanine aminotransferase

Table 3. Changes from Baseline in Serum AST, ALT, Prealbumin, Albumin Bilirubin after exercise in the chronic hepatitis with normal liver function group

Variable	Before exercise	After 2 weeks	After 4 weeks	After 6 weeks	After 8 weeks	P value
AST (U/L)	20.3±3.9	21.0±3.6	22.8±4.4	20.6±3.6	19.9±4.6	> 0.05
ALT (U/L)	19.8±7.5	20.4±7.1	22.0±10.1	20.8±9.2	20.0 ±8.8	> 0.05
Prealbumin (mg/dl)	28.2±4.3	28.2±5.4	27.8±4.9	26.6±5.8	26.6±5.8	> 0.05
Albumin (mg/dl)	5.1±0.3	5.0±0.2	4.8±0.1	5.0±0.2	5.0±0.2	> 0.05
Bilirubin Total (mg/dl)	0.9±0.4	0.6±0.3	0.8±0.3	0.7±0.3	0.9±0.4	> 0.05

AST = aspartate aminotransferase; ALT = alanine aminotransferase

Table 4. Changes from Baseline in Serum AST, ALT, Prealbumin, Albumin Bilirubin after exercise in the chronic hepatitis with abnormal liver function group

Variable	Before exercise	After 2 weeks	After 4 weeks	After 6 weeks	After 8 weeks	P value
AST (U/L)	48.8±23.3	46.7±16.9	41.3±7.4	36.7±5.9	44.0±8.6	> 0.05
ALT (U/L)	111.8±77.6	105.0±55.2	88.7±23.5	77.7±18.0	91.0±28.3	> 0.05
Prealbumin (mg/dl)	23.8±6.0	23.9±6.1	24.0±5.9	22.4±4.7	22.4±4.7	> 0.05
Albumin (mg/dl)	4.9±0.2	4.9±0.3	4.8±0.3	4.8±0.3	4.8±0.2	> 0.05
Bilirubin Total (mg/dl)	0.7±0.3	0.7±0.3	0.8±0.3	0.8±0.2	0.7±0.3	> 0.05

AST = aspartate aminotransferase; ALT = alanine aminotransferase

Fig.1. Changes in serum AST level during sub-maximal exercise at baseline and at eight weeks subsequent to commencement of exercise for controls (group A), chronic hepatitis-infected individuals featuring normal liver function (group B) and chronic hepatitis sufferers revealing abnormal liver function (group C)

Fig.2. Changes in serum ALT level during sub-maximal exercise at baseline and at eight weeks subsequent to commencement of exercise for controls (group A), chronic hepatitis-infected individuals featuring normal liver function (group B) and for chronic hepatitis sufferers revealing abnormal liver function (group C)

次大運動強度對 B 型肝炎學生肝功能及疲勞自覺量數之影響

林家禮　陳明豐　鐘孟錐 1　林曼蕙 1

彰化秀傳醫院 胃腸科　1 國立台灣師範大學 體育系

摘　　要

慢性肝炎病患是否適合作規律運動，目前仍是未有確實定論，本研究的目的在於探討規律的次大運動對 B 型肝炎學生疲勞自覺量數(RPE)以及肝功能指數的變化進行分析以瞭解所產生之影響。受試對象爲 28 位高中男生，進行一般健康檢查及血液分析後，篩選出 B 型肝炎併肝功能指數正常 12 人、B 型肝炎併肝功能指數異常 6 人、正常控制組 10 人。所有高中生皆接受原地跑步機運動訓練，訓練時間持續 20 分鐘，並且心跳率要達到次大運動強度目標的範圍，次大運動強度訂於 70%-85% 心跳率保留值。接著以次大運動強度爲基準，實施每週三次，每次 30 分鐘，爲期 6 週的跑步運動訓練。所有高中生在運動訓練前、第 2 週、第 4 週、第 6 週並追蹤至第 8 週，皆進行抽血檢驗分析以及疲勞自覺量數(RPE)問卷調查。經過六週的運動訓練介入後，AST; ALT; 總黃疸(total bilirubin)；前白蛋白(prealbumin)以及白蛋白(albumin)指數皆沒有意義差別(p>0.05)。疲勞自覺量數三組皆有顯著下降（p＜0.05），正常控制組下降 21.63%，B 型肝炎併肝功能指數正常組下降 22.55%，B 型肝

炎併肝功能指數異常組下降 20.97%。本研究發現，以中高強度的次大運動實施的運動訓練，對於患 B 型肝炎的高中男生並不會使他的肝功能指數惡化，但運動訓練卻有提昇運動能力及降低疲勞自覺量數（RPE）的趨勢。至於運動是否能改善 B 型肝炎患者的肝功能則值得未來進一步研究探討。