THE EFFECT OF INTENSIVE WEIGHT TRAINING ON SOME BLOOD PARAMETERS IN WOMEN

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Abstract

Eighteen healthy female were studied to assess the effect of 15 weeks of resistance training on their blood serum concentration of cholesterol, triglycerides, hemoglobin and packed cell volume (P. C. V).

Resistance training consisted of one set of 8-12 repetitions on universal gym equipment and free weights three times per week. Significant alterations occurred in all parameters measured (P<0.001). The mean value for cholesterol level and triglycerides were decreased by (18.3 and 14.4) respectively. Hemoglobin and (P. C. V) were increased by (0.4) and (1.6) respectively.

It was concluded that such exercise program can yield a reduction in overall risk factors for coronary heart disease (CHD).

1. Introduction
Coronary heart disease (CHD) generally involves degenerative changes in the
intima or inner lining of the larger arteries that supply the heart muscle. These vessels become congested with either lipid-filled plagues or fibrous scar tissue or both. This change progressively reduces the capacity for blood flow and causes the myocardium to become ischemic—that is, poorly supplied with oxygen due to reduced blood flow.

Almost all people show some evidence of coronary artery disease, and it can be severe in seemingly healthy young adults. Elevated blood lipids and other factors have been identified over the past 40 years that appear to make individual more susceptible to coronary heart disease. (Flp and Lakatta (1988); Tzankoff and Norris (1977)-(1978)). Cholesterol and triglycerides are the two most common lipids associated with this CHD risk.

Investigators indicate a strong interaction among aging, genetics, physical inactivity and an imprudent diet to the development of CHD. Their findings suggest that the relative risk for the independent effect of physical inactivity is similar to that of hypertension, hypercholesterolemia, and smoking in both men and women (Powell et al (1987); Goldberg (1988); Rowe (1987).

Resistive exercise have been used extensively among athletes and healthy populations. Exercise such as strength training, isometrics, and isokinetics involve exercising the muscles against moderate to heavy loads. The isometrics form involves little or no movement and is predominantly fueled by the anaerobic breakdown of glycogen to lactate. The other type of exercise involve light to moderate resistance, high repetition with short rest intervals. This isotonic contraction of muscle promotes the utilization of glucose and fat by muscles, which improves insulin sensitivity, blood pressure, lipoprotein lipids and raises HDL cholesterol (Fleck and Lean (1987); Harris and Holly (1987); Goldberg et al (1986); Hurley and Kokkinos (1987); Kovisto and DeFronzo (1986); Stone et al (1983).

Recently, the beneficial effects of resistance training on muscular strength have been reported by Frontera et al (1988) and Hagberg et al (1989) for old men and women. In some younger individual, resistance training appears to result in a chronic elevation in blood pressure (Hunter and McCarthy (1983); Spitzer et al (1980)), however, Conomie et al (1991) reported that the resistance exercise training does not adversely affect, or reduce, blood pressure, while endurance exercise training produces modest reductions in blood pressure in 70-79 year old for men and women.
Research studies have shown previously sedentary men who engage in an aerobic exercise training program demonstrated increased high density lipoproteins-cholesterol. However, studies on the effects of exercise training on lipoprotein profile in women are less (Hughes et al (1991); Durstine et al (1987)). The role of physical activity, however, in the modification of CHD risk factors continues to be of considerable concern and most studies on this topic have used male athletes. Two investigative groups have recently reported lipoprotein-lipid profiles among female strength trained athletes. (Elliot et al (87) and Morgon et al (87). Even though, Elliot et al (1987) conclude that HDL-C values in female bodybuilders were comparable to those of runners, Morgon et al (1987) reported significantly lower HDL-C values in female bodybuilders than runners. In Jordan two investigators have worked out the influence of exercise program on blood lipid (Adel (1991); Wezermes (1989)) non of them included women subjects.

Purpose of Study

The purpose of this study was to determine the effects of an intensive weight training program in female on serum concentration of cholesterol, triglycerides, hemoglobin and packed cell volume (P. C. V).

Methods

Eighteen healthy female student registered in freshman fitness course offered by the Department of Physical Education at Yarmouk University were randomly selected to serve as subjects in this study. Subjects were first screened during an interview and medical reports to exclude those with a history of cardiovascular or pulmonary disease, or medical limitations contraindicating a vigorous exercise training program. A brief introduction of the testing and training program were given to the subjects and informed consents were obtained.

The subject characteristics are shown in table (1). The results of previous investigations (Hughes (1991)) suggested that aerobic fitness and body composition of characteristics account for only a small portion of variance in lipid and lipoprotein concentrations in college women. This was consistent with the result of Durstine et al (1987), who also reported no changes in the concentrations of HDL-C or LDL-C in women. Therefore, in this study body compositions were eliminated from our focus of investigation.
During the first visit to the laboratory, a 12-14 hour fasting blood samples were drawn by a specialist and subsequently analyzed for total cholesterol triglycerides and hemoglobin at health center (Jordan University of Technology and Sciences).

Table (1)

<table>
<thead>
<tr>
<th>Variables</th>
<th>X</th>
<th>SD</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>19.2</td>
<td>1.3</td>
<td>Year</td>
</tr>
<tr>
<td>Height</td>
<td>157.7</td>
<td>3.3</td>
<td>Cm</td>
</tr>
<tr>
<td>Weight</td>
<td>62.2</td>
<td>4.3</td>
<td>Kg</td>
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</table>

The weight training sessions consisted of mandatory warm-up and stretching followed by the execution of the universal gym equipment and free weights. Each subject in the present study selected a weight which can be lifted between 8-12 reps before muscular failure sets in (the point at which she can no longer raise the weight with good form through the muscles, full range of motion). If the weight could be lifted more than 12 times the resistance was increased to the level when it could be lifted not less than 8 reps or more than 12 reps without sacrificing form, speed of movement or technique to do so (Coleman, 1982).

The subjects exercised three times per week for 15 weeks, supervised by study personnel. All subjects were instructed not to change their dietary habits during the course of training.

At the end of the training program, another 12-14 hour fasting blood samples were drawn for serum concentration analysis. The "t" test for repeated measures was used to determine if there were significant changes in the dependent variables. The alpha level of 0.05 was used for all significant tests.

Results and Discussion

This study was designed to investigate the influence of resistance circuit weight training in women on blood lipid constituents. The results are presented in tables 2, 3, 4 and 5. Comparison of pretest and post test data of subjects revealed that significant alterations occurred in all parameters measured in this study.
Because epidemiological evidence indicates that HDL-C and aerobic fitness are inversely related to the incidence of CHD, (Miller (1975)), we hypothesized that resistance training exercise would result in increased levels of HDL-C and decreased level of triglycerides and serum cholesterol. The results of this investigation indicate a significant decrease of both serum cholesterol and triglycerides. See tables (2) and (3). These results are with agreement to those reported by Milesis (1974), Montoyo et al (1959), Johnson et al (1982), and Weltman et al (1987). Who were able to demonstrate reductions in serum cholesterol and triglycerides as a result of engaging in various exercise program. Whereas others have not found any significant changes (Fripp and Hodgson (1987); Hurley et al (1988); Kokkinos et al (1989).

**Table (2)**

Mean and SD for Pre and Post Test of Cholesterol Data

<table>
<thead>
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<th>Post</th>
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<tr>
<td>(\bar{X})</td>
<td>171.3</td>
<td>153*</td>
</tr>
<tr>
<td>SD</td>
<td>27.8</td>
<td>31.3</td>
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<tr>
<td>n</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

* P < 0.001

**Table (3)**

Mean and SD for Pre and Post Test of Triglycerides Data

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</tr>
</thead>
<tbody>
<tr>
<td>(\bar{X})</td>
<td>69.2</td>
<td>54.8*</td>
</tr>
<tr>
<td>SD</td>
<td>25.6</td>
<td>15.0</td>
</tr>
<tr>
<td>n</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

* P < 0.001
These conflicting results revealed that different methodological or design could be in favor to one side than another. According to Haskell, (1984) adult subjects with triglycerides less than 120mg/dl usually do not lower triglycerides significantly with exercise. Results of later study (Weltman et al 1987) and this present study tend to reject this interpretation. The mean and SD of the subjects triglycerides pre to exercise were (69.2±25.6) and a significant reduction have been observed after exercise( See table (3)). Although, Farrell et al (1982) concluded that extensive weight lifting program does not effect cholesterol and triglyceride levels, a study by Goldberge et al (1984) who utilized female subjects in weight training indicated a significant decrease in the total cholesterol ratio. These finding suggest that, duration, or frequency of exercise could be necessary to affect changes in selected CHD risk factors.

The change in the serum lipids may be related to several factors. Lifestyle and individual characteristics could influence the levels of cholesterol and triglycerides. Among these are sex, genes, body weight, diet, drug use, and exercise (Haskell, 1984). Earlier, Paffenbarger and Hale (1975) in their studies on longshoremen indicated that the only group found to have a significant reduction in corrnary mortality were the cargo handlers. The authors concluded that a critical threshold level of exercise may have been the most important factor for protection from CHD.

Hemoglobin and P. C. V concentration increased significantly in this study, see table (4) and (5). Fortunately, erythrocytes contains the heme-iron compound hemoglobin, which can bind O2 according to its partial pressure. In everyone's mind the erythrocyte (red blood cell) and hemoglobin are synonymous with oxygen transport to the tissues to support metabolism. The significant increase of hemoglobin in this study after intensive weight lifting program is apparently due to the greater demand on hemoglobin production to cover the need for more oxygen to the working muscle tissues. Gardner, et al (1975) reported a significant improvement in exercise response after intramuscular injection of iron over 80 days period for individuals who suffer from iron deficiency and associated low hemoglobin levels. Peak heart rate as measured during a 5-minute stepping performance decreased from 152 to 123 beats per minute for women. The extent of the continuation of such high concentration of Hb in the blood after stopping training needs to be investigated.
Table (4)

Mean and SD for Pre and Post Test of Hemoglobin Data

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{x}$</td>
<td>13.2</td>
<td>13.6*</td>
</tr>
<tr>
<td>$SD$</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>$n$</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

* $P < 0.001$

Table (5)

Mean and SD for Pre and Post Test of Packed Cell Volume (P. C. V)

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<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{x}$</td>
<td>39.3</td>
<td>40.94*</td>
</tr>
<tr>
<td>$SD$</td>
<td>2.02</td>
<td>2.9</td>
</tr>
<tr>
<td>$n$</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

* $P < 0.001$

Conclusions

The implications of this study are that females involved in weight training programs would need to increase their overall risk factors for CHD. This study is the first to show the program design for this study to meet the threshold level of effectiveness for placing the risk of the lack of control group in this study. Because of the significant changes in body fat, the pretest is determined the baseline, control, and posttest.


