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Research Article

The effect of combined exercises and chromium supplementation on body composition and some liver risk factors in fat men

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Abstract

Background: Liver disease is one of the most serious chronic diseases, where inactivity, obesity and lack of antioxidants in the diet are the main causes of this disease. This research investigates the effect of combined exercise and chromium supplements on body composition and liver risk factors in obese men.

Materials and Methods: In this semi-experimental research, 40 obese men (20 to 30 years old) with a six-month history of bodybuilding training were selected as research samples and randomly divided into 4 groups (exercise, supplement, exercise + supplement, control)**.** Combined exercises for six weeks, three sessions a week, each session 60 minutes. At first, strength exercises (3 upper body movements and 3 lower body movements) were performed in 3 sets with 8 repetitions and 80% 1RM, and then aerobic exercise (1.5 miles It was done with 70% to 80% of maximum heart rate (on a treadmill). During this period, 200 micrograms of chromium supplement were given to the supplement groups. A two-way variance analysis was used at a significance level of $p \leq 0.05$**.**

Results: The research showed a significant decrease in fat percentage, abdominal circumference, alanine aminotransferase and alkaline phosphatase in obese men after performing combined exercises and consuming chromium supplements.

Conclusion: Combined exercise and chromium supplementation alone can improve liver indices and improve body composition. However, the combination of exercise and chromium supplementation improves body composition and reduces liver enzymes in obese men.

Keywords:
combined exercises, chromium supplementation, alanine aminotransferase, obese men

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1. Introduction

As one of the most serious chronic diseases, liver disease is on the rise due to urbanization, diet changes, and physical activity reduction. The main causes of this disease are inactivity, obesity, and a lack of antioxidants in the diet (1). Fatty liver disease is divided into two types, non-alcoholic fatty liver and alcoholic fatty liver. Alcoholic fatty liver disease occurs in alcoholics and is caused by excessive alcohol consumption. An increase in body fat, which is usually associated with abdominal obesity in sedentary people, can lead to diseases such as fatty liver (1.2). Non-alcoholic fatty liver disease is liver inflammation caused by excessive accumulation of fat in the liver tissue and is associated with cardiovascular risk factors such as type 2 diabetes, central obesity, high blood pressure and dyslipidemia, which are components of the metabolic syndrome. This disease sometimes disrupts the normal activity of the liver tissue and can progress and result in liver failure or liver cirrhosis (2). In this disease, liver enzyme levels change, including aspartate aminotransferase and alanine aminotransferase, the most sensitive diagnostic enzymes of the liver. Aminotransferase is an enzyme present in different tissues of the body. This enzyme is actually a type of protein that the body needs to carry out chemical reactions. Abnormal levels of this substance can cause liver damage (3). Previous studies have shown that exercise training can improve liver indices and body composition. Davodi et al. (2012) observed that after eight weeks of aerobic training, the amount of aspartate aminotransferase and alanine aminotransferase in the serum of the experimental group decreased considerably. (4).

Davoudi et al. (2012) observed that the amount of aspartate aminotransferase and alanine aminotransferase in the serum of the experimental group decreased significantly after eight weeks of aerobic training (4). Shams Aldini et al. (2015) investigated the effect of aerobic and resistance training on men and concluded that AST and ALT values decreased significantly in both groups (2). However, Doris et al. (2008) stated that 12 weeks of endurance training had no significant effect on body fat percentage and ALT levels (5). One of the ways to reduce body fat is to use supplements and fat burners, including chromium. Some studies have shown an increase in fat burning following chromium supplementation due to its insulin regulatory effect (6). Excessive intake of simple sugars and refined grains, if accompanied by chromium deficiency, increases overweight and obesity (7). Rabati et al. (2016) investigated the effect of chromium supplementation along with 30 minutes of aerobic exercise on overweight people. It showed that these people's weight, BMI and waist circumference decreased significantly (6). Considering the role of physical exercise in reducing the risk factors for liver disease and the order of the Food and Drug Organization to reduce the consumption of chemical drugs, and the lack of research in the field of simultaneous examination of combined exercise and consumption of chromium supplements on obese men, the researcher investigated the effect of a course of combined exercise and consumption of chromium supplementation affecting body composition and some liver risk factors in obese men.

2. Materials and Methods

The statistical population of this semi-experimental research included all the male athletes who did bodybuilding exercises in district 4 clubs in the last year. 40 male athletes in the age range of 20 to 30 years and BMI above 30 were purposely selected as the research sample. The subjects were randomly divided into 4 groups: exercise, supplement, exercise + supplement and control. The criteria for selecting the samples was not having any diseases such as cardiovascular, kidney, liver, alcohol, tobacco, medicine, supplements, and not being treated with special diets. This was obtained through a questionnaire. Written consent to participate in the study was obtained from the subjects and their health was confirmed by a trusted doctor.

Exercise protocol

Combined exercises were done for six weeks, three sessions a week and each session lasted 60 minutes at Dalke Sports Club. The training program consisted of 10-15 minutes of warm-ups: soft running, static stretching, and joint rotational movements. After that, strength training consisted of 3 upper and 3 lower body movements. The upper body movements included barbell chest press, shoulder press with the machine while sitting and rowing (boat) movement, and the lower body movements included leg press, front thigh and back thigh press with the machine. All exercises were performed in 3 sets with 8 repetitions and 80% 1RM. And 1RM was measured every two weeks to adjust training pressure. Then, aerobic training was done on a treadmill for 1.5 miles (2.4 kilometers) at a constant speed and with 70% to 80% of the maximum heart rate, and at the end, 10 minutes of cooling were done (8).

Supplementary protocol

200 micrograms of a chromium supplement approved by the Ministry of Health were given to the subjects. Subjects took the supplement daily between lunches (9).

Before and after the completion of the research protocol, the subjects' weight without shoes and socks and with minimal clothing was determined in kilograms and height in centimeters. Body mass index was calculated using the formula of weight in kilograms per square of height in meters (10). To check the waist circumference, the narrowest part above the navel was measured with a tape measure. The percentage of body fat was also measured using an in-body device model 270.

Blood sampling was done 24 hours before the first training session and 48 hours after the last training session in a 12-hour fasting state. This was done at Lavazieh Laboratory in Resalat Square at 8 am. 5 cc of blood was taken from the brachial vein of the subjects' right hand during the experiment by a laboratory technician. Blood samples were put into EDTA tubes and centrifuged (3000 rpm). The plasma obtained for the measurement of liver enzyme variables was kept in a freezer at -80 until the variables were measured. Liver enzymes were measured by the enzymatic method using Pars Company kit.

The Shapiro-Wilk test was applied to test the normality of the samples' distribution, and the Levine test was applied to test variance homogeneity. To determine the effect of independent variables in the groups, the two-way covariance test was used, and if the hypotheses were significant, Tukey's post-hoc test was applied. All tests were $p \geq 0.05$. All statistical procedures were performed using SPSS software version 22.

3. Results

The mean and standard deviation of research variables in four groups are shown in Table 1.

Table 1: Mean and standard deviation of research variables in four groups

Statistics	Control		combined training		Chrome consumption		combined training + Chrome consumption	
	Pre-test	post-test	Pre-test	post-test	Pre-test	post-test	Pre-test	post-test
average	28	28	29	27.2	275.	26	284.	26
Standard deviation	۱۳/۱	۱۵/۱	۶۳/۱	۹۱/۰	۲۶/۱	۳۳/۱	۳۵/۱	۶۶/۰
average	۹۴	۹۴	۹۴	۹۲	۹۳	۹۲	۹۴	۹۱
Standard deviation	۲	۱	۲	۱	۱	۱	۲	۲
average	۲۰/۲۸	۴۰/۲۸	۸۰/۲۷	۱۰/۲۶	۲۸	۲۷	.۲۰	۸۰/۲۵
Standard deviation	۷۸/۰	۸۴/۰	۰۳/۱	۹۹/۰	۸۱/۰	۸۱/۰	۰۳/۱	۹۱/۰
average	۱۰/۱۵۳	۴۰/۱۵۳	۹۰/۱۵۴	۱۵۴	۳۰/۱۵۴	۶۰/۱۵۳	۱۰/۱۵۶	۴۰/۱۵۴
Standard deviation	۷۲/۱	۷۱/۱	۵۱/۲	۳۵/۲	۱۱/۲	۲۲/۲	۳۷/۲	۱۱/۲

The results of the research showed that there was a considerable decrease in fat percentage, abdominal circumference, alanine aminotransferase and alkaline phosphatase in obese men. This was after performing combined exercises and consuming chromium supplements. The results of the follow-up test showed that there was a significant difference between the control group and the exercise and exercise+supplement groups, between the exercise group with supplement and exercise+supplement groups; Also, there was a significant difference between the supplement group and the training+supplement group ($P \leq 0.05$).

4. Discussion

The results of the research showed that a period of combined exercise and chromium supplements had a significant effect on fat percentage and abdominal circumference in obese men. This effect decreased it. This result is consistent with Parastesh et al (2018) and Ray et al (2022) (7,11). Some studies have shown that chromium increases insulin effect and, as a result, better blood sugar control. Therefore, it can probably help burn body fat (12). In addition, studies have shown that excessive intake of simple sugars and refined grains, combined with chromium deficiency, increases the risk of obesity and overweight (13).

In Wang's study (2010), the body mass index and body fat percentage of obese people decreased significantly after 6 weeks of supplementation with chromium picolinate along with a balanced diet (14). Ahmadi and his colleagues (2024) also showed in their study, consumption of 200 gμ of chromium supplement for 8 weeks caused a significant decrease in the ratio of waist circumference to hip circumference in patients with fatty liver (15).

Improving insulin sensitivity, increasing plasma lipid concentration, an essential element in the normal metabolism of fats, carbohydrates, proteins, and weight loss are among the roles listed for chromium supplementation (14). Due to having a calmodulin component, chromium will probably enhance insulin action by stimulating insulin receptors and increasing insulin sensitivity. As a result, it will enhance insulin's functional capacity (15). Since insulin is considered an anabolic hormone, an increase in insulin sensitivity improves hyperinsulinemia and as a result can be associated with a decrease in fat accumulation on the one hand and an increase in fat burning on the other hand (1). Therefore, it seems that chromium picolinate supplement can reduce body fat and, as a result, reduce weight. However, Ulema et al. (2022) found that supplementation with chromium picolinate and 12 weeks of resistance exercise had no effect on the body composition and blood sugar of relatively obese women (16). It is possible that the inconsistency of the results with the present research is due to the difference in the subjects and the different consumption amount of chromium supplement. In addition, there is the different training protocol. The results of the research showed that a period of combined exercise and chromium supplementation had a significant effect on the alanine aminotransferase enzyme and alkaline phosphatase enzyme in obese men and caused it to decrease. This result is consistent with Parastesh et al. (2018) and Jamshidpour et al. (2022) (7, 17). Jamshidpour et al. (2022) in a study investigating the effect of eight weeks of aerobic exercise and artichoo sweat on the fat profile and liver enzymes of women with non-alcoholic fatty liver disease found that aerobic exercise caused a significant decrease in serum

levels of alanine aminotransferase and aspartate aminotransferase (17). Rigi et al. (2023) investigated the effect of yoga practice and spirulina supplementation on elderly women's liver enzymes. The results of the study showed that exercising and consuming spirulina for eight weeks caused a significant decrease in the levels of aspartate aminotransferase and alanine aminotransferase enzymes (18). Insulin sensitivity plays a crucial role in liver fat internal homeostasis. Researchers stated that a regular exercise program reduces blood glucose by increasing its absorption in body tissues, which is at least partially due to increased expression of the gene (GLUT4) in skeletal muscles and glycogen storage (19,20).

Conclusion

In general, combined exercise training and chromium picolinate consumption can improve liver enzyme indices. This can reduce body fat and waist circumference. However, performing combined exercise and taking chromium picolinate supplements at the same time has a more effective effect on improving body composition and liver enzyme indices. Regarding the limitations of the present study, we can mention the small sample size of this study. Undoubtedly, a large sample size is necessary to increase the validity of the results.

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Compliance with ethical standards

Conflict of interest None declared.

Ethical approval the research was conducted with regard to the ethical principles.

Informed consent Informed consent was obtained from all participants.

Author contributions

Conceptualization: A.A, M.H, SH.R.M ; Methodology: A.A, M.H, SH.R.M ; Software: A.A, M.H, SH.R.M ; Validation: A.A, M.H, SH.R.M ;Formal analysis: A.A, M.H, SH.R.M ;Investigation: A.A, M.H, SH.R.M ; Resources: A.A, M.H, SH.R.M ;Data curation: A.A, M.H, SH.R.M; Writing - original draft: A.A, M.H, SH.R.M; Writing - review & editing: A.A, M.H, SH.R.M; Visualization: A.A, M.H, SH.R.M ;Supervision: A.A, M.H, SH.R.M ;Project administration: A.A, M.H, SH.R.M; Funding acquisition: A.A, M.H, SH.R.M.

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