THE EFFECT OF OMEGA-3 FATTY ACID SUPPLEMENT AND AEROBIC EXERCISE ON LIPID PROFILE AND DEPRESSION IN OBESE WOMEN

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ABSTRACT

Background*: Elevated blood lipids and its associated psychological concerns, including depression, are some of the most harmful aspects of obesity, which has made the need for its prevention and treatment more obvious to researchers and authorities.*

Objectives*: This study sought to evaluate the effect of 8 weeks of omeg-3 supplementation combined with aerobic exercise on blood lipid profile and depression in obese women.*

Materials and methods*: 32 inactive obese women with mild to moderate depression with the age range of 25-40 years were selected and then randomly divided into four groups of (n=8): aerobic exercise + omega-3 supplement; omega-3 supplement, aerobic exercise, and control. The aerobic exercise protocol included warming up; main program and cooling down phases lasted for 8 consecutive weeks (5 days/week). The daily intake of omega-3 supplement was 2,000 milligrams. Lipid profiles and the Depression were measured before and after 8 weeks of exercise intervention and supplementation.*

Results*: There was a significant decrease in total cholesterol and LDL in aerobic exercise, aerobic exercise + omega-3, and omega-3 groups and there was a significant increase in HDL in the three groups ($p \leq 0.05$). Compared to the omega-3 supplement group, aerobic exercise group and aerobic exercise+omega-3 supplement group had lower total cholesterol and LDL levels and higher HDL after intervention ($p \leq 0.05$). In addition, in all three experimental groups, depression showed a significant improvement ($p \leq 0.05$). The aerobic exercise group and the aerobic+omega-3 supplement group showed a more significant improvement compared to the omega-3 supplement group in terms of depression ($p \leq 0.05$).*

Conclusion*: Given the findings of this study, aerobic exercise and omega-3 supplement simultaneously improve the blood lipids and depression in women. Since blood lipids are improved in the prevention of obesity and related diseases, including depression, omega-3 consumption and aerobic exercise in interaction are recommended for women.*

Keywords*: Omega 3, Lipid profiles, Exercise,Depression.*

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Introduction

Obesity is a chronic disease with increasing prevalence in different age groups. Obesity is also considered a global epidemic which is affected by environmental and genetic factors[1, 2]. Numerous complications such as type 2 diabetes, hypertension, respiratory distress and cardiovascular disease, along with psychosocial complications, are also associated with obesity[3-5]. One the complication of obesity that afflicts many people is the elevated levels of blood lipids[6, 7]. In addition, research shows that patients with severe depression have a low HDL-C concentration and high proportion of total cholesterol to high density lipoprotein[8]. It has also been suggested that elevated as well as higher waist-hip ratio are related to chronic depression[9-11]. Obesity and depression are both a huge contribution to the burden of

disease and costs. A bulk of studies has shown the relationship between cholesterol levels and mental illnesses such as depression[7, 12, 13]. Nowadays, recent studies suggest the use of non-pharmaceutical therapeutic methods that have the least side effects plus to positive effects such as omega-3 fatty acid supplement[14]. the positive effects of omega 3 is not only specific to healthy people[15], but also extends to obese population[16].

On the other hand, aerobic exercise seems to be effective in improving mental status and symptoms of depression in psychiatric patients. Also, these exercises seem to be an appropriate means for preventing cardiovascular diseases, circulatory system, and improving the respiratory system and preventing obesity[17]. Another important advantage of this kind of exercise is the improvement of mental health[17, 18]. It must be noted that exercise can improve the health in general population[19]. Although there has been some studies regarding the effects of either Omega 3 supplementation or exercise on lipid profiles and depression, no inclusive one has investigated both simultaneously. So, the purpose of this study was to investigate whether effect of omega-3 fatty acid supplement and aerobic exercise can modify the lipid profile and depression in obese women.

Materials and methods

Participants

Thirty two inactive obese women (age 45± 5.1 years, height 161.4 ± 5.1 cm, weight 83.91 ± 5.23 kg, BMI 32.40 ± 1.3 kg/m2) participated in this study. The inclusion criteria included BMI>30, no chronic diseases, no drug treatment, no adverse events during the past 12 to 6 months, no use of antidepressants, cigarettes, substances opioid and omega-3 supplement, lack of sensitivity to omega-3 supplement or fish, and scoring the points of 10-23 in the Beck Depression Inventory (mild to moderate depression).

Experimental design

The participants completed the Beck Depression Inventory and a 24-hour recall questionnaire and were then randomly assigned to four groups:

1) aerobic exercises (AE) (n=8);

2) Omega-3 supplement (OM) (n=8);

3) Aerobic exercises + omega-3 supplement (AE-OM) (n=8);

4) Control group which consumed placebo capsules (n=8). The study was approved by the ethics committee board of Imam Khomeini international university (ID: 17628). Informed consent was signed by subjects prior to the beginning of study. The authors confirm that all ongoing and related trials for this intervention are registered.

Anthropometry

Body composition analyzer (InBody-320, South Korea) was used to measure, weight, fat percentage, and body mass index. All measurements were taken, while participants were instructed to refrain from eating and drinking at least four hours before testing. Although the machine has some accuracy problem[20], the obtained results won't be affected in in pre post design.

Exercise training Protocol

The aerobic exercise protocol included warming up (5 minutes); main program (30 minutes) and cooling down (5 minutes) phases lasted for 8 consecutive weeks (5 days/week)[21]. The main program consisted of jogging with moderate intensity (HRmax of 65-75%). The exercise intensity was monitored by using the Polar heart rate checker (Polar RS 400, Polar Electro Oy, Kempele, Finland)[22].

Omega-3 supplementation protocol

The participants in OM and AE-OM received two Omega-3 capsules daily (EPA 180mg, DHA 120mg) in the morning and at night for eight weeks (brand OMEGA 3, Zahravi pharmaceutical company, Tabriz, Iran), while control group was only took placebo during the intervention.

Measures

All subjects were strictly instructed to maintain their dietary intake habits during the study period. A daily average of 24-h calorie intake was monitored for three days at the beginning and the end of study[23]. They were instructed not to consume omega-3 rich foods during the study period. A brochure of omega-3 rich foods were provided to participants. They were also instructed to refrain from doing other exercises during the study.

Blood sample was taken after overnight fast of 12hrs from antecubital vein for lipid profile measurement and estimated using standardized enzymatic methods[24]. Moreover, the Beck Depression Inventory was filled in before and after 8 weeks by the subjects to measure depression.

Statistical Analysis

Values are shown as means ± SE. Data were analyzed using SPSS 21.0 software. Paired samples t-test was used to test for condition effect. A two-way ANOVA analysis was used to assess the interaction of conditions (training vs Omega-3) in. In the presence of significant interactions, Tukey's post hoc tests were used to determine differences between means. Statistical significance was set at P< 0.05.

Results

The results showed that both weight and BMI of the subjects in omega-3 supplement + aerobic exercise group and aerobic exercise group decreased significantly after the intervention ($p \leq 0.05$). The results as shown in Table 1, indicate that total cholesterol, HDL, LDL and depression were significantly changed after exercise intervention ($p \leq 0.05$). Tukey's test results showed that total cholesterol levels decreased significantly in the three experimental groups (P = 0.001). On the other hand, aerobic exercise group and aerobic exercise + omega-3 supplement group showed lower levels of total cholesterol than omega-3 supplement group (P = 0.027, P = 0.015, respectively). The results of Tukey's test regarding HDL values showed that there significant differences in the three experimental groups of aerobic exercise, omega-3 supplement, and aerobic exercise + oomega-3 supplement (P= 0.001). On the other hand, the aerobic exercise + oomega-3 supplement group showed a higher amount of HDL after the intervention than omega-3 supplement group (P=0.026). Tukey's test results showed that total LDL values decreased significantly in the three experimental groups compared to the control group. (p=0.001). On the other hand, aerobic and aerobic exercise + omega-3 supplement groups showed lower LDL levels after intervention (P = 0.036, P = 0.012, respectively).

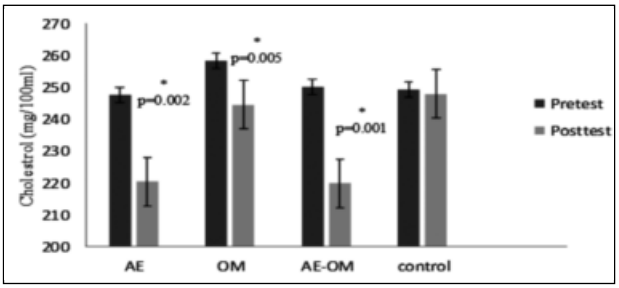

Figure 1: Differences in total cholesterol levels in the research groups before and after intervention.
AE: Aerobic Exercise; OM: Omega-3

The depression factor showed significant improvement in the three experimental groups (P = 0.001). Aerobic exercise and aerobic+omega-3 supplement groups showed a significant improvement compared to the omega-3 supplement group in terms of depression (P = 0.103, P = 0.001, respectively). The results of the t-correlation test are shown in Fig 1. The results revealed that all three intervention groups had a significant increase in cholesterol levels compared to the pre-test.

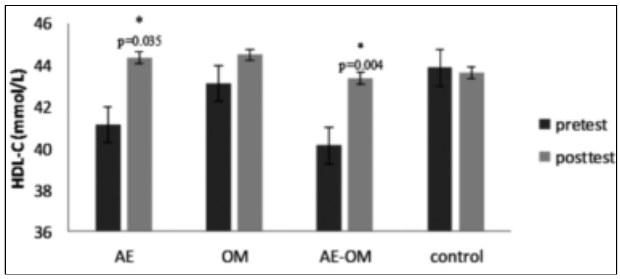

Figure 2: Difference in HDL level in the research groups before and after intervention.
AE: Aerobic Exercise; OM: Omega-3

The results of the t-correlation test are given in Fig. 2. The results showed that aerobic exercise and aerobic exercise+omega-3 supplement had a significant effect on HDL.

As shown in Fig. 3, all three intervention groups had a significant improvement in LDL values in comparison to the pre-test.

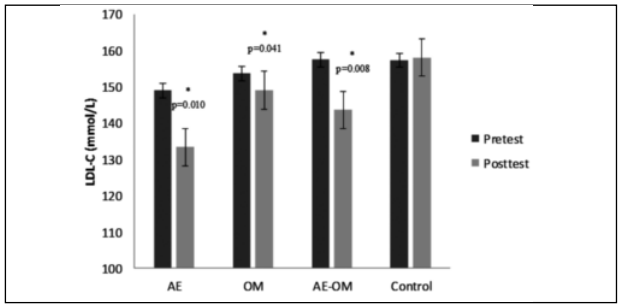

Figure 3: Differences in LDL-C level in the research groups before and after intervention.
AE: Aerobic Exercise; OM: Omega-3

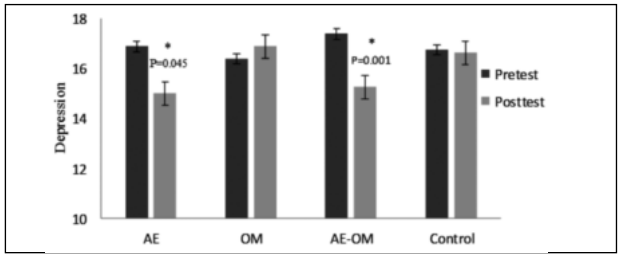

Figure 4: Difference in the level of depression in the research groups before and after intervention.
AE: Aerobic Exercise; OM: Omega-3

As shown in Figure 4, The results indicated that aerobic exercise and aerobic exercise+omega-3 supplement improved significantly in depression.

Discussions

The main findings of this study is that serum total lipid profile significantly improved after omega-3 supplementation and aerobic exercise. Total cholesterol levels decreased significantly in the three experimental groups of the omega-3 supplement and aerobic exercise + oomega-3 supplement decreased significantly compared to the control group. HDL values were significantly increased in the three experimental groups of aerobic exercise, omega-3 supplement group, and aerobic exercise + omega-3 supplement groups compared to the control group. LDL-C values decreased significantly in the three experimental groups of aerobic exercise, omega-3 supplement group, and aerobic exercise + omega-3 supplement groups compared to the control group. The level of depression in both experimental groups of aerobic exercise and aerobic exercise + oomega-3 supplement showed a significant improvement compared to the control group. The results of this study on the affectedness of fat profiles are inconsistent with the research by the Dangardt et al. (2010). They showed that 4 weeks of omega-3 supplement did not significantly change the serum total cholesterol, HDL-C and LDL-C levels[25]. The reason for this difference may be due to a shorter time to consume the supplement. The results of this study were in line with those of Mohammad Pour et al. (2015). In their study, they concluded that taking 6 months of omega-3 supplement reduces total cholesterol levels[26]. Inconsistent with our study, Rogers et al. (2008), in their study, showed that the use of omega-3 supplementation for 3 months had no beneficial or harmful effects on mild to moderate depression[27].

Omega 3 supplementation mechanism: The major part of the effect of omega-3 fatty acids on the level of lipids in the serum is due to the effect on active enzymes in the pathway of liver metabolism of fatty acids. The inhibition of the synthesis of lipids by reducing the activity of the enzymatic complex of fatty acids and increasing the oxidation of fatty acids are in mitochondria are some of such mechanisms[28].

The effect of omega-3 fatty acids on the serum lipid model is likely to be justified by the following mechanism

Activation of 4 types of nuclear receptors including LXR, PPARs, FXR, and HNF-4α increases the expression of the oxidation of fatty acids and, on the other hand, inhibits the expression of the genes involved in fat synthesis. 2. Activation of DIAG, phosphatidic acid, hormonal-sensitive lipase and beta-oxidation stimulation of fatty acids, phospholipid synthesis and Apo B degradation and as a result of inhibiting production, VLDL 3-through reduction of levels) SREBP-1c is the main regulator of lipogenesis Liver inhibits lipogenesis. 4. Activation of AMPK enzyme plays a role in reducing the synthesis of fatty acids and their oxidation. 5 Reducing the synthesis of LDL-c and improving the activity of LDL receptors in the liver reduces the absorption of cholesterol. Also, studies indicate that by regulating neurotransmitters of dopamine and serotonin in the hippocampus and preventing the inflammations of neurons and the affecting the pathway of the hypothalamus-pituitary-adrenal, omega-3 fatty acids prevents depression[29, 30].

Mechanism of aerobic exercise**.** In describing the geven reults for positive effects of exercise, it can be stated that a key enzyme in the metabolism of lipoproteins is related to the level of physical activity of individuals and is particularly affected by aerobic exercise. Aerobic exercise would moderate the levels of lipid peroxidation by increasing lipoprotein lipase activity, decreasing liver lipase, weight loss and body fat, and improving fat metabolism[31]. It seems that the cause of the increase in HDL-C is due to increased liver production and changes in various enzymes such as increased lipoprotein lipase enzyme activity, lysine cholesterol-asyl-transferase, and decreased hepatic lipase activity following body exercises. Hepatitis Lipase plays a major role in converting HDL2 to HDL3 and converting VLDL to IDL-C and converting large LDL-C to IDL-C and small LDL-C. The amount of this enzyme is lower in active individuals and decreases with further exercise, and leads to a higher concentration of HDL-C, which is associated with improved lipid profile[32]. Some researchers believe that weight loss and body fat percentage through exercise can directly reduce lipid profiles. Moreover, the effect of the exercise on reducing these factors is more evident in people with normal levels whose lipid profiles are more than their normal level[33].

Researchers have found that long-term exercises improve serotonin and its receptors, as well as decrease the level of depression[35].

Omega-3 supplementation and aerobic exercise mechanism

In the present study, simultaneous consumption of omega-3 supplement and aerobic exercise significantly decreased total cholesterol, LDL-C and depression and increased HDL-C. These results are consistent with the results of Mohammadi Sartang et al. (2014) whish suggested that omega-3 supplement has a decreasing effect on total cholesterol and triglyceride. In addition, Exercise can also independently change the blood lipid profile[37] and improve depression[6]. Therefore, the combination of these two together leads to a greater and better improvement of blood lipids and depression.

According to research, there is a direct relationship between body fat percentage and depression As the mean weight of the total subjects decreased in the post-test, it seems logical that their levels of depression also decrease[38]. All in all, Further research with more focus on type, intensity, and length of the training should be done for crucial decisions.

Conclusion

The findings have important implications for improving total cholesterol, HDL-C, LDL-C, and depression following Omeg-3 supplementation and exercise interventions. However, it's highly recommended to perform such a study with larger sample size in future studies.

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