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Effect of 10 weeks of swimming exercises with nigella sativa supplement on plasma lipid profile in inactive obese women

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Abstract

Purpose: Obesity is a complex disease that causes oxidative stress by disrupting fat metabolism. The aim of this study was to investigate the effect of ten weeks of swimming exercises with nigella sativa (Black Seed) supplementation on the plasma lipid profile of inactive obese women. **Method:** In this study, 40 inactive obese women with a body mass index (BMI) higher than 26, and an average age (29.06 ± 7.94 years), were voluntarily selected and randomly divided into four groups of 10 people. The control group, the training group, the training group - nigella sativa supplement and the nigella sativa group were divided. The control group had a normal diet and no training; the nigella sativa supplement group consumed 2 nigella sativa capsules of 1000 mg daily for 10 weeks; The swimming training group performed swimming exercises for 10 weeks and three sessions a week with an intensity of 60% of the maximum heart rate and the duration of each session was 75 minutes; the nigella sativa -training group also performed both the training and supplement protocols. At the end of the period, blood indicators of (low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglyceride (TG) and total cholesterol. Total (TC)) and anthropometric variables were measured. Covariance analysis and paired t-test at a significance level of 0.05 were used for data analysis. **Results:** Investigations showed that there is no significant difference between the groups in the values of HDL-C, LDL-C, TG and TC (P>0.05). However, in the intra-group comparison, hockey results have a significant difference in HDL-C, LDL-C, TG and TC in the exercise and exercise +supplement and nigella sativa groups (P>0.05). **Conclusion:** It seems that taking two weeks of swimming exercises along with nigella sativa supplement improves some of the fat profile indicators and can probably be effective in improving the complications caused by obesity.

Keywords: swimming exercises, nigella sativa, obese, lipid profile.

Introduction

The main cause of obesity is the imbalance between energy intake and energy consumption. Currently, the prevalence of overweight and obesity is growing worldwide (Jehan et al., 2020). According to statistics published in 2005 by the World Health Organization, 1.6 billion adults (over 15 years old) in the world are overweight, of which at least 400 million are clinically obese (James & Gill, 2022). Also, in the past, the problem of overweight was less prevalent compared to today (Remus Popa et al., 2020). At that time, due to their special conditions, people inevitably had a more active lifestyle and physical activity to provide for their large families; Also, the use of traditional and fresh diets instead of the common fried and prepared foods of today and sleeping more at night (due to the lack of electricity supply) were among the advantages of a healthy lifestyle at that time (Soltani, 2021). The World Health Organization has recognized inactive life and obesity as one of the top 10 health problems (A. Fasihi, Siahkouhian, Jaafarnejad, Bolboli, & Fasihi, 2021; Nittari et al., 2019). This type of lifestyle is the most important risk factor for cardiovascular disease, which causes disorders such as increased blood fat, high blood pressure, and obesity (Bull et al., 2020; L. Fasihi, Siahkohian, & Ebrahimi-Torkamani, 2023). Obesity is the main cause of many chronic diseases such as type 2 diabetes, insulin resistance, blood lipid abnormalities and hypertension (Janssen, 2021).

Nowadays, the use of supplements and herbal foods in the treatment of diseases and metabolic disorders has spread among the general public (Adetuyi et al., 2022). One of the issues emphasized by the researchers is the effect of exercise along with the consumption of herbal supplements on improving obesity and treating complications related to it (Wierzejska, 2021). Nigella sativa (Black Seed) is known by the scientific name Nigella sativa and is a plant from the Ranunculaceae family and is widely used in the treatment of obesity, cardiovascular disease, blood pressure and digestive problems (Ahmad et al., 2021). The medicinal properties of this plant are attributed to its ingredients, including proteins, amino acids, carbohydrates, fibers, oils

(a combination of fatty acids, especially unsaturated fatty acids), alkaloids, and minerals (Ojueromi, Oboh, & Ademosun, 2022) The nigella sativa plant has various effects, including It has been shown to reduce blood sugar, anti-obesity, anti-blood pressure, antioxidant and anti-inflammatory (Hannan et al., 2021).

Lifestyle changes, such as increasing physical activity and using a low-calorie diet, have been recommended as another intervention to reduce excess body fat and prevent the development of metabolic complications, therefore, forced muscle activity is often an essential part of obesity treatment (Salam et al., 2020). It is considered and due to the high risk of obesity, the reduction of related indicators in middle-aged obese women due to sports exercises is of particular importance (Papadopoulou et al., 2020). Exercises are effective in reducing fat accumulation and preventing overweight, improving profile and lipid metabolism (Muscella, Stefàno, & Marsigliante, 2020). Among sports exercises, swimming is a sport whose unique physiological stimuli distinguish it from other sports that are performed on the ground (Kałużyński, Kałucka, Prokop, & Kikowski, 2022). And it can be classified among the fibers that have many isotonic contractions (Jokar, Behpoor, Fasihi, Fasihi, & Ebrahimi Torkamani, 2021). Hijazi (2021) investigated the effect of eight weeks of combined training (aerobic and resistance) on lipid profile and overweight women (Hejazi, Fathi, Salkhord, & Dastani, 2021). Their results showed that in the combined exercise group, there was a significant decrease in the variables of triglyceride, total cholesterol, low-density lipoprotein and a significant increase in the level of high-density lipoprotein. However, research on the effects of swimming and nigella sativa supplementation on the plasma lipid profile of obese women is scarce (PK, 2024). Therefore, the purpose of this study is to investigate the effect of ten weeks of swimming exercises with nigella sativa supplementation on the plasma lipid profile of women.

Methods

The present study was a semi-experimental study with pre-test and post-test, which was conducted with the cooperation of non-athlete obese women. After registering from all the volunteers, according to the examination of the timing of the menstrual period, 40 volunteers were selected as a statistical sample and randomly divided into four groups of 10 people: swimming exercises, nigella sativa supplement, exercise with the supplement, and the control group. Inclusion and exclusion criteria are given in table number (1). After completing the informed consent to participate in the study, the subjects were familiarized with all the terms and conditions of the study during an initial familiarization session. Before the beginning of the training protocol, the subjects first did the water familiarization training program for 3 sessions under the supervision of the project researcher. The 10-week endurance swimming training program was such that the subjects trained three days a week. The duration of each activity session was 75 minutes. Training sessions were held between 6 and 7:30 in the evening in the indoor swimming pool with a relative temperature of 32 degrees Celsius and a relative humidity of 70%. The first 10 minutes of each training session before entering the pool water were devoted to general warm-up exercises. Also, after entering the water, a 10-minute special warm-up for breaststroke swimming (first to fourth week) and breaststroke swimming (fifth to eighth week) and combined swimming (ninth to twelfth week) was done to control the training intensity and heart rate from the pulse. Polar meter made in Finland was used. The nigella sativa supplement consuming groups consumed 2 1000 mg nigella sativa capsules daily for 10 weeks. The subjects of the control group did not consume any supplements and did not exercise during the study. Blood samples were collected 24 hours before the start of the exercises and 48 hours after the end of the exercises, fasting, from the brachial vein of the subjects' left hand. Lipid profile measurement including TG, TC, HDL, LDL was measured by calorimetric method and using Pars Azmoun kits. The collected data were analyzed using descriptive statistics methods. In order to check the normality of the data, the

Kolmogorov-Smirnov test was used and in order to analyze the results, the analysis of covariance test was used. Also, the dependent t-test was used to determine intra-group differences in the pre- and post-test phases. All statistical analyzes were performed using SPSS version 25 software.

Table1. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
✓ No use of any type of supplements, alcohol or drug treatment ✓ Age between 20 and 35 years ✓ BMI > 27.0 kg/m^2 ✓ No regular exercise for at least 12 months prior to the study ✓ No injury or medical condition that restricts participation in the exercises	✓ Smoking ✓ Blood pressure>140/90 mmHg ✓ Anemia (Hb < 120 g/L) ✓ Pregnancy ✓ Preexisting CVD, diabetes or any other diagnosed disease ✓ Refusal to give informed consent ✓ Withdrawal from the intervention for personal reasons

Results

Descriptive statistics were used to determine the mean and standard deviation. In the inferential statistics section, analysis of covariance and paired t tests were used to test the research hypotheses. Anthropometric characteristics and results of descriptive statistics of all four groups are presented in table (2).

Table 2. Anthropometric characteristics of subjects

Groups Variables	Exercise+ Nigella sativa Mean + SD	Nigella sativa Mean + SD	Exercise Mean + SD	Control Mean + SD
Age (Year)	28.15±7.14	28.91±7.3	29.56±8.12	31.86±9.23
Weight (kg)	71.11±5.3	73.13±6.3	74.14±7.3	76.21±5.17
Height (cm)	160.01 ± 5.15	161.31 ± 4.15	162.11±8.3	163.21±7.23
BMD (kg/m2)	27.48± 1.24	28.66± 1.74	28.60±1.18	27.71±1.83

The results of the data analysis show that in the post-test stage, there was no significant difference in the mean profile indices, differences between TG, TC, LDL-C, and HDL-C indices between the four studied groups. In the intra-group comparison, based on the results of the dependent t-test, the values of HDL-C, TG, TC, LDL-C, body weight and body mass index were significant in the exercise -nigella sativa , exercise and nigella sativa groups (Table 3).

Table3. Comparison of the mean and standard deviation of dependent variables before and after 10 weeks of swimming training in four groups using analysis of covariance and paired t test

Variable	group	pre-test Mean + SD	post-test Mean + SD	Significant level p
TG (mg/dl)	Exercise + nigella sativa	163.12 ± 48.44	138.62±31.46	0.045
	Exercise	158.50±39.81	132.12±22.40	0.037
	nigella sativa	169.22 ± 42.34	142.60±32.36	0.025
	Control P*	152.32±30.61 0.624	150.12±31.51 0.456	0.829
HDL-C (mg/ dl)	Exercise + nigella sativa	32.75±11.04	46.62±8.01	0.001
	Exercise	35.25±13.55	47.62 ± 9.03	0.047
	nigella sativa	33.65±12.14	42.52±9.12	0.021
	Control	34.27±12.58	34.62 ± 11.53	0.637
	P*	0.692	0.082	
LDL-C (mg/dl)	Exercise + nigella sativa	134.62±28.63	95.75±22.48	0.001
	Exercise	128.25±32.73	99.54±17.16	0.008
	nigella sativa	125.39±30.64	95.75±25.34	0.031
	Control	124.26±30.34	124.75±27.14	0.108
	P*	0.336	0.494	
TC (mg/ dl)	Exercise + nigella sativa	198.12 ± 37.72	152.50±35.90	0.011
	Exercise	192.25 ± 42.54	150.50±25.56	0.026
	nigella sativa	201.12 ± 35.72	166.50±30.75	0.041
	Control	182.20 ± 41.34	183.50±40.53	0.306
	P*	0.731	0.531	
BMI (kg/m2)	Exercise + nigella sativa	27.47±0.92	25.96±1.23	0.004
	Exercise	27.07±0.88	26.71±0.96	0.034
	nigella sativa	27.87±0.86	26.51±0.75	0.026
	Control	27.07±0.88	27.01±0.90	0.082
	P*	0.502	0.588	

Discussion

The aim of the present study was to investigate eight weeks of swimming exercises with nigella sativa supplementation on plasma lipid profiles of obese women. The results of inter-group comparison showed that the values of lipid profiles in all four research groups were not significantly different. These findings are consistent with some previous researches. Shabani et al. (2018) showed that in overweight and obese women, eight weeks of training has no effect on lipid profile (Shabani, Jalali, & Nazari, 2018). In another study, Jurima et al. (2006) showed that TC and TG did not change significantly after 24 weeks of training compared to the initial values (Jürimäe et al., 2006). Soori et al. (2016) investigated the effect of 10 weeks of combined exercise on lipid profile levels in overweight and obese women and the results showed no significant difference in blood lipid levels (Soori, Choopani, Falahian, & Ramezankhani, 2016). The researchers attributed the lack of change in TC and TG to insufficient training intensity.

However, the findings of our research were in conflict with the results of some researches. Couillard et al. (2001) studied male and concluded that doing 6 weeks of endurance training leads to an increase in HDL levels (Couillard et al., 2001). Shahraki et al. (2020) concluded that eight weeks of combined training on overweight and obese women leads to improvement of lipid profile (Shahraki, Vahidian-Rezazadeh, & Nikoofar, 2020), Zarei et al. (2021) reported that the effect of three combined aerobic and resistance training programs with different intensities on Lipid profile in men with type 2 diabetes decreased triglycerides in all three groups (Zarei, Nakhzari Khodakheyr, Rashidlamir, & Montazeri, 2021). The possible cause in the present research can be due to the intensity, time, type of sports activity, conditions of the subjects and different methods of supplementation.

Another result of this study was an increase in HDL-C and a decrease in TC, LDL-C and TG in the intra-group comparison after 10 weeks in the group of swimming training + nigella sativa and nigella sativa. Many studies have investigated the effect of this supplement on the lipid profile, all of which indicate a reduction in the levels of body fat

indicators with nigella sativa consumption (Ali, Suthama, & Mahfud, 2014; Darand et al., 2019; Heshmati & Namazi, 2015; Naghsh et al., 2023). It has been shown in two clinical reports that consumption of capsules containing nigella sativa in patients with type 2 diabetes improved glycemic indices and improved insulin resistance (El-Sayed, 2011; Heshmati, Namazi, Memarzadeh, Taghizadeh, & Kolahdooz, 2015). In another study, the daily administration of 1 gram of nigella sativa powder for 2 months in patients with blood lipids caused a decrease in total cholesterol, triglycerides, LDL and an increase in HDL (Qidwai & Ashfaq, 2014). In another study on diabetic rats, receiving 300 mg of nigella sativa per kilogram of body weight caused a significant decrease in the concentration of cholesterol, serum triglycerides and LDL (Taha, Thabet, & El Desouky, 2022). nigella sativa is able to reduce blood lipid concentrations through several mechanisms (Tavakkoli, Mahdian, Razavi, & Hosseinzadeh, 2017). Thymoquinone is one of the effective compounds of nigella sativa , which increases LDL removal by increasing the expression of hepatic LDL receptor. Another effective mechanism of thymoquinone is reducing the expression of 3-hydroxy-3-methyl-glutaryl enzyme gene and thus inhibiting hepatic cholesterol synthesis (Al-Naqeep, Ismail, & Allaudin, 2010). Another mechanism is related to the soluble fiber content of nigella sativa, which reduces the absorption of dietary cholesterol and stimulates the synthesis of bile acid, which itself leads to more cholesterol excretion (Chen, Ma, Liang, Peng, & Zuo, 2011).

Another result of this research was a significant improvement in the lipid profile in the swimming training group, which shows that 10 weeks of swimming training can improve the lipid profile of obese people. There is a lot of evidence that regular exercise affects the hormones of adipose tissue and liver, accelerates lipolysis and the entry of fats into the bloodstream and their use leads to an improvement in the lipid profile (Rodrigues, Prímola-Gomes, Peluzio, Hermsdorff, & Natali, 2021). It seems that with the increase in the duration of sports activities, the glycogen reserves are reduced and the oxidation of fats is the major part used and necessary for muscle activities, which reduces

the level of blood lipids. Increasing the activity of the electron transport chain enzymes increases the activity of the enzymes involved in the oxidation of fats, especially the enzymes of the beta oxidation cycle, and also increases the activity of lipoprotein lipase (Zhang, Keung, Samokhvalov, Wang, & Lopaschuk, 2010). On the other hand, the density of beta-adrenergic receptors on the cellular surface of fat tissue, which increases due to aerobic exercise, leads to an increase in their sensitivity to the lipolysis process (Houten & Wanders, 2010). Perhaps the main cause of this distribution of catecholamines is the decrease in insulin due to aerobic activity and the increase in fat oxidation. Therefore, obese women can probably benefit from the beneficial effects of swimming exercises along with nigella sativa supplementation to reduce TC, LDL-C, and TG and increase HDL levels, while more research is needed.

Conclusion

According to the results of the present study, it can be said that eight weeks of swimming exercises with nigella sativa supplementation can improve the lipid profiles of obese women. In the end, it is suggested to evaluate the long-term effect of different training methods and long-term use of nigella sativa on other blood factors and inflammatory indicators in obese women.

Conflict of interest

The authors of this article have no mutual benefit from its publication.

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