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Effects of Walnut Consumption on the Lipid Profile of Female Undergraduate Students

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ABSTRACT

Introduction: Cardiovascular diseases (CVDs) are considered to be the leading cause of mortality across the world, representing a major health concern. Factors associated with lifestyle (e.g., nutrition) have an undeniable effect on the prevention and treatment of CVD. Walnut has a unique profile and is rich in polyunsaturated fatty acids, which may improve blood lipids and CVD risk factors. The present study aimed to assess the effects of walnut consumption of the lipid profile of female undergraduate students.
Methods: This randomized clinical trial was conducted on 50 participants with normal lipid profile, who were randomly divided into two groups of intervention and control. The applied regimen involved the addition of 40 grams of peeled walnuts per day to the routine diet of the intervention group for four weeks.
Results: The results of paired t-test indicated that the calorie, protein, and fat intake increased significantly in the intervention group after the consumption of walnuts. At baseline, the body mass index in the control and intervention groups was 21.66±4.06 and 21.22±4.03 kg/m^2, respectively, which showed no significant difference before and after the intervention. However, a significant reduction was observed in the serum levels of low-density lipoprotein (LDL) and triglyceride (TG) in the intervention group after the consumption of walnuts.
Conclusion: According to the results, the consumption of walnuts could effectively decrease serum LDL and TG.

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Introduction

Cardiovascular diseases (CVDs) are the cause of mortality in 17.9 million cases per year, accounting for 31% of all global deaths. Diet is a potent trigger of heart attacks and strokes. More than 75% of the deaths caused by CVDs occur in low- and middle-income countries, while 85% of all CVD deaths are due to heart attacks and strokes (1). Furthermore, CVDs are considered to be the leading cause of death and disability in the United States, imposing socioeconomic burdens worth of 320 billion dollars per year. The treatment costs of CVDs are substantial and predicted to rise in the future (2, 3), and Asian countries are no exception in this regard.

In Iran, CVDs account for 46% of all the reported mortalities (4). Many of these deaths could be avoided by addressing the modifiable behavioral risk factors of CVDs, such as proper nutrition. Evidence suggests that the consumption of healthy foods (e.g., walnuts) could significantly decrease the risk of CVDs (5-8).

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As quoted by Hippocrates, "Let food be thy medicine and medicine be thy food." This remark reflects the desire to cure or prevent diseases by consuming specific foods (5). The dietary guidelines for the prevention of CVDs emphasize on the reduction of fat intake or the replacement of saturated fatty acids by unsaturated fatty acids. Another approach to the invigoration of the current knowledge in this regard is the addition of whole foods to the routine diet in order to achieve such beneficial health effects (6).

According to the literature, the consumption of nuts as whole foods is inversely associated with the incidence of CVDs, cancer, diabetes mellitus, metabolic syndrome, and hypertension. Moreover, it has been associated with several mediators of chronic diseases, including visceral adiposity, insulin resistance, hyperglycemia, oxidative stress, and inflammation (7, 9-17).

Nuts are abundant sources of unsaturated fatty acids and contain potentially beneficial compounds, including antioxidants, L-arginine, fiber, and folic acid (18, 19). Walnuts are widely consumed nuts in every community, which have been reported to reduce serum cholesterol and improve the lipoprotein profile in several controlled clinical trials as recently reviewed by Banel and Hu (5). In addition, walnuts contain high levels of α-linolenic acid, which is a plant-derived ω-3 fatty acid with cardioprotective properties (12, 18, 20). Walnuts may also improve endothelial function in patients with hyperlipidemia and diabetes. Although the mechanisms involved in the beneficial effects of dietary walnuts remain unclear, the favorable changes caused by walnuts in blood lipid profile have been speculated (2).

Based on the review of the literature regarding the effects of walnuts on blood lipids in patients with variable degrees of hyperlipidemia in different age groups (especially adults), the present study aimed to provide the opportunity to improve the current knowledge regarding the effects of walnut consumption on serum lipid and lipoprotein levels in a healthy, young population.

Material and methods

This randomized clinical trial was conducted at the School of Nursing and Midwifery in Bojnurd, Iran during four weeks. The sample population consisted of the female undergraduate students. The inclusion criteria of the study were health, residence in students' dormitories, and consent to participate in the research. None of the participants had a history of metabolic and endocrine disorders. In addition, they used no medications or nutritional supplements routinely and were healthy at baseline and during the study period. Additionally, the participants had no history of elevated blood lipids, smoking habits, and alcohol consumption, and their general health was confirmed by a general practitioner.

In total, 50 female nursing and midwifery students lived at dormitories (non-native), who were clinically healthy and randomly divided into two groups of intervention and control (n=25). Both groups adhered to the same routine diet in terms of the calories per kilogram of the body weight before and during the research. However, the control of calories intake was not possible since the participants were dormitory residents and ate at the university canteen. As such, the calculation and monitoring of the calorie intake of the subjects (kcal/kg) were possible during and after the research owing to their similar conditions. Factors such as the cooking style, food preparation and preservation techniques, and type and amount of the consumed edible oils were assessed by a nutrition expert.

The applied regimen was prepared by adding 40 grams of walnuts (approximately 4 pct. of walnuts) per day to the routine diet of the intervention group for four weeks. Naturally, the energy of the selected amount of walnuts was added to the energy of the intervention group. It is notable that the walnuts used in the present study were obtained from a single tree. The intakes of fat, protein, carbohydrates, and calories were evaluated in the study groups after the intervention using a 24-hour food recall questionnaire. In addition, the demographic data and daily physical activity of the participants were recorded using a researcher-made questionnaire in the intervention and control groups. Weight and height of the participants were also measured.

Before the intervention, 5 cc of blood was collected from the participants in the fasting state at 7-10 AM. After serum isolation, the concentrations of fasting blood sugar (FBS), high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglyceride (TG), and cholesterol were measured immediately. After four weeks, the measurements were repeated in order to assess the concentration of FBS, HDL, LDL, TG, and cholesterol, and the participants in both groups were weighed again. Moreover, the same laboratory kits were used to measure the biochemical variables (Pars Azmoon).

Data analysis was performed using descriptive statistics and t-test.

Results

Table 1 shows the mean values of some of the covariates associated with weight and macronutrient intake in the subjects. Among 48 participants, 25 were in the intervention group, and 23 were in the control group. The participants were within the age range of 18-23 years (mean age: 20.1±4.01 years). Two participants from the control group were excluded from the study due to illnesses, and their data were not considered in the analyses (intention to protocol).

Table 1. Comparison of Weight and Macronutrient Intake before and after Intervention

Variables	Intervention	Control Mean±SD	Intervention Mean±SD	P-value*
Weight (kg)	Before	52.92±6.20	53.90±6.27	>0.05
	After	52.08±6.15	54.16±7.88	>0.05
Fat (g/day)	Before	69.29±23.07	79.76±31.53	0.09
	After	68.17±20.11	102.96±31.53	<0.001
Protein (g/day)	Before	60.31±15.96	70.29±17.01	0.03
	After	61.28±14.11	76.21±17.23	0.004
Carbohydrates (g/day)	Before	315.61±97.32	343.76±72.74	0.3
	After	323.91±90.20	350.08±72.74	0.2
Calorie Intake (kcal/day)	Before	2147.97±504.20	2398.08±549.1	0.07
	After	2231.19±499.01	2658.48±549.14	0.003

*Paired t-test

No significant differences were observed between the intervention and control groups at baseline in terms of calorie, protein, fat, and carbohydrate intake. The results of independent t-test indicated that the calorie, protein, and fat intake increased significantly, while no such increment was observed in carbohydrate intake after the consumption of walnuts. Before the intervention, the body mass index (BMI) of the subjects in the control and intervention groups was 21.66±4.06 and 21.22±4.03 kg/m^2, respectively, which indicated no significant difference in this regard.

The results of t-test showed a significant difference in the weight of the subjects in the intervention and control groups before and after the consumption of walnuts. However, no significant difference was observed between the groups in terms of age since all the participants were bachelor's degree students within the same age range. Based on the theory of nutritional science, the level of physical activity was extremely low in all the participants, and none of the subjects had continuous sports activities.

According to the results of paired t-test, serum LDL and TG were significantly lower in the intervention group compared to the control group (Table 2). Although not statistically significant, total cholesterol decreased in the intervention group.

Table 2. Comparison of Lipid Profiles in Participants before and after Intervention

Variables	Intervention	Control Mean±SD	Intervention Mean±SD	P-value*
TG (mg/dl)	Before	95.28±39.66	86.36±27.39	0.04
	After	82.71±27.70	69.40±17.05	
HDL (mg/dl)	Before	52.71±8.89	54.72±7.02	>0.05
	After	50.01±9.04	50.92±6.84	
Total Cholesterol (mg/dl)	Before	170.14±26.82	171.36±29.47	0.056
	After	175.24±29.35	162.16±21.04	
LDL (mg/dl)	Before	106.71±22.52	97.24±22.05	0.03
	After	98.86±19.54	77.76±14.80	

*Paired t-test

Discussion

According to the results of the present study, the consumption of walnuts significantly decreased the concentrations of TG and LDL in the intervention group compared to the control group. This is consistent with the findings of Torabian et al. and Deirdre K. Banel et al. (6, 21). On the other hand, Jehangir N. Din et al. reported that the moderate intake of walnuts had no effects on lipid profiles in men. Use of walnuts as a source of polyunsaturated fatty acids (PUFAs) could replace saturated fatty acids (SFAs), thereby reducing the levels of TG and LDL (18). As a result, walnut consumption could decrease SFAs, while our findings indicated that walnuts could reduce serum TG and LDL without decreasing the SFAs.

According to the current research, the calorie intake increased with the consumption of walnuts in the intervention group compared to the control group, while no significant changes were observed in the weight of the subjects. According to the information in Table 1, the weight of the subjects unexpectedly increased by approximately two kilograms, while the difference was not considered significant. This could be due to the short duration of the intervention (four weeks), and weight gain would be more significant if the intervention was longer. It is also notable that weight gain is considered to be a risk factor.

The results of the present study confirmed the beneficial effects of walnuts as a supplementation in the routine diet. It is suggested that similar investigations reduce the energy intake of the subjects in the intervention group, so that it would correspond to the amount of the calories found in walnuts. This will in turn decrease the concentrations of TG and LDL with no weight gain. Additionally, this will help researchers realize the mechanisms that are involved in the improvement of the lipid profile as a result of consuming walnuts by increasing in the consumption of PUFAs or decreasing the consumption of SFAs.

According to the results of the present study, the consumption of walnuts as a dietary supplement significantly increased the fat and protein intake in the intervention group, while no such change was observed in the intake of carbohydrates. Considering the components found in walnut, such changes were quite expected, confirming the therapeutic effects of these valuable oily nuts. On the other hand, the consumption of walnuts caused no significant reduction in the level of serum total cholesterol, which is inconsistent with the previous studies in this regard. Therefore, such significant reduction could be achieved at longer study durations as the previous studies conducted with longer periods have denoted the significant reduction of LDL as well (13, 22, 23).

Conclusion

According to the results, diets containing walnuts could effectively decrease serum TG and LDL levels. It is recommended that further investigations in this regard be conducted on other populations with longer periods using variable walnut intakes.

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Conflicts of interest

None declared.

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