The Effect of Daily Walnut Consumption on Dyslipidemia

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Received 30 March 2018; Accepted 14 May 2018; Published 21 June 2018

The aim of this study was to investigate the effect of daily walnut consumption on dyslipidemia in dietary. Within a year, the patients who have been suggested taking walnut or not in their individual dietary were scanned retrospectively and randomized into 2 groups. The first group consists of 72 cases (only those taken on the diet program) and the second group consists of 73 cases (walnut consumption in regulated diet). Baseline blood lipid parameters and anthropometric measurements were assessed in both groups and compared with values at 3rd month. Values < 0.05 were considered statistically significant. In addition, Maras 18 walnut cultivar was analyzed to determine the fatty acid profiles by chromatographic technique. When comparing lipid parameters at baseline and at the 3rd month, total cholesterol, low-density lipoprotein cholesterol, very low-density lipoprotein cholesterol, and triglyceride levels significantly decreased and high-density lipoprotein cholesterol levels significantly increased. As compared with the end of 3rd month values of the groups, the reduction in total cholesterol, low-density lipoprotein cholesterol, very low-density lipoprotein cholesterol, triglyceride levels of the subjects group (walnut consumption in regulated diet) were significantly higher than the control group (only regulated diet). Also, there was no significant difference in increase on high-density lipoprotein cholesterol levels between the groups. The results showed that daily consumption of walnut improved blood lipid levels. However, more extensive studies are needed on therapeutic usage in dyslipidemia.

1. Introduction

Cardiovascular diseases are important cause of mortality and morbidity especially in developing countries, and dyslipidemia, a common health problem, is one of the most important cardiovascular risk factors [1, 2]. In recent years, many studies have been conducted to investigate the effects of healthy nutrition on the lipid profile in order to prevent or reduce the risk of cardiovascular diseases. Nuts recommended for healthy nutrition are rich in unsaturated fatty acids with a total fat content of 46% to 76%. Further, nuts contain sterols, antioxidants, vitamins, minerals, and polyphenols [3–5].

Among the nuts, it has been found that the effects of walnuts on health are promising. Walnut has been suggested due to being rich in antioxidant-active polyphenols and unsaturated fatty acids in its composition and nutritionally recommended for healthy nutrition and protective effects against cardiovascular diseases [6]. Other nuts are rich in monounsaturated fatty acids (MUFA) while walnut contains higher polyunsaturated fatty acids (PUFA). The most important characteristic of walnut is that it contains both omega-6 and omega-3 and the highest amount of omega-3 fatty acids. When MUFAs and PUFAs are consumed instead of saturated fatty acids, the total plasma and low-density lipoprotein cholesterol concentration is reduced. Omega-3 and Omega-6 are essential fatty acids and are not synthesized by the body and need to be taken with food. Walnut oil contains 72% PUFAs (59% linoleic (omega-6), 13% linolenic (omega-3)), 18% monounsaturated fatty acids (oleic acid), and 10% saturated fatty acids (SFAs) [7–9].

Walnut has a higher content of PUFAs, including linolenic acid (omega-3), which has antiatherogenic effects and some epidemiological studies suggest that linolenic acid may provide certain cardiovascular benefits [10–12]. Also, it has been shown that consumption of 2-3 portions of walnut a day reduces total cholesterol and low-density lipoprotein.
cholesterol [10] and improves endothelial function in hypercholesterolemic and diabetic individuals [13, 14]. In another study, the protective effect of walnut against coronary heart disease was presented scientifically [10].

Polyphenols, one of the important compounds of walnut, provide a protective effect on the cardiovascular system by preventing oxidation. Walnut contains ellagitannin polyphenols (glansine A), which have antioxidant effects [15]. In addition, studies have shown that walnut is rich in α-tocopherol (23–37 mg/100 g), an effective antioxidant [16], and it acts to protect against low-density lipoprotein cholesterol oxidation and reduce heart disease risk [17].

In these limited studies, although the effect of walnut consumption on the lipid profile has been investigated, more clinical trials are needed in this area. In our study, it is aimed to evaluate whether the possible effect of daily walnut consumption on lipid profile in patients with dyslipidemia is not required or lipid parameters not controlled by lifestyle modification is considered medication according to the guidelines of the American Heart Association/American College of Cardiology (AHA/ACC) of 2013 [18].

2. Materials and Methods

2.1. Study Population. In the study, between June 2015 and June 2016, 145 of 450 cases were examined at the age of 18 and above who applied to the Family Physician Diet Polyclinic of Mersin University (305 cases were excluded due to exclusion criteria). It was structured as a subgroup analysis of the prospective study which was approved by Local Ethic Committee dated May 28, 2015, and number 2015/166.

2.1.1. Inclusion Criteria. The inclusion criteria for the examination were the following: 18 years and over, fasting blood sugar ≤110 mg/dl, and according to the 2013 AHA/AAC Guidelines for the treatment of dyslipidemia, patients who do not need medication or if lipid parameters not controlled by lifestyle modification is considered medication.

2.1.2. Exclusion Criteria. The exclusion criteria for the examination were the following: obesity (Body Mass Index (BMI) ≥35 kg/m²), with known coronary artery disease, acute or chronic inflammation, a known walnut allergy, smoking, with a known systemic or metabolic disease, having antidiabetic, hypolipidemic, antihypertensive or anti-inflammatory drug, vitamin E or hormone replacement therapy in the last 3 months.

2 groups were randomized. Only individualized diet, recommended by AHA Dietary Guidelines [3], was suggested to the first group, and one handful (approximately 40–50 g) Maras 18 cultivar walnut per day (the U.S. Food and Drug Administration (FDA) recommendation [19]) was added into the individualized diet program recommended to the second group for the regulation of dietary habits. The amount of added walnut calories is deducted from the planned daily calorie value by dietitian. The first group consisting of 72 cases (only those taken on the diet program) has 24 males and the second group consisting of 73 cases (walnut consumption in regulated diet) has 25 males.

Baseline blood lipid parameters and anthropometric measurements (height, weight, waist circumference, and BMI) were assessed in both groups and were compared with values at 3rd month.

In addition, Maras 18, one of the walnut cultivar produced in our region, was analyzed to determine fatty acid profiles using chromatographic technique [20].

2.2. Statistical Analyze. SPSS (version 21.0) statistic software package was used for data analysis. For continuous data, the results are presented as mean value ± SDs. The Kolmogorov–Smirnov test was applied to verify whether the continuous variables showed a normal distribution. Independent samples t-test was used for continuous variables with normal distribution and Mann–Whitney U test was used for continuous variables with nonnormal distribution. The difference between the baseline and at 3 months values in groups was tested by the Wilcoxon Signed Rank test. p values < 0.05 were considered statistically significant.

2.3. Oil Extraction. Oil extraction was performed using 5 g of homogenized kernels using hexane as a solvent by automatic Soxhlet equipment (Gerhardt Soxtherm), and triplicate analysis were done. The residue was dried under vacuum concentrator. Methyl esterification was done using Boron trifluoride/methanol (FAMEs) Bligh and Dyer (1959) (AOAC, 1990).

2.4. Fatty Acid Analysis. After the methyl esterification, fatty acids were analysed by Gas chromatography with an auto sampler (Perkin Elmer, Shelton, CT, USA) equipped with a flame ionization detector and a fused-silica capillary SGE column (100 m x 0.32 mm, ID 0.25 μm, BP20 0.25 μm; Perkin Elmer, Austin, TX, USA). The oven temperature was held at 140°C for 5 min and then raised to 200°C at a rate of 4°C·min⁻¹ and raised again 220°C at a rate of 1°C·min⁻¹, while the injector and the detector temperatures were set to 220 and 280°C, respectively. The sample volume was 1 μL, and the carrier gas was controlled at 16 psi and the ratio of split was arranged as 1:100. Fatty acids were detected by comparing the retention indices of the FAMEs with a standard of 37 FAME mixture component (Supelco, Bellefonte, PA, USA).

3. Results and Discussion

3.1. Results. The baseline demographic characteristics, anthropometric measurements, and blood lipid parameters (including total cholesterol (TC), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), very low-density lipoprotein cholesterol (VLDL), and triglycerides (TG) of participants with control group (only regulated diet) and subjects group (walnut consumption in regulated diet)) are given in Table 1. The groups were well matched with respect to gender, age, height, weight, BMI,
and waist circumference (WC). Both groups included subjects with a mean age of around 41 years. The blood lipid parameters of subjects with intake of walnut in their dietary were comparable with those of control subjects.

Triglycerides (TG) at the baseline and at 3rd month measurements of the study population are compared in Table 2 for both groups. In the control group (only regulated diet), weight is significantly decreased at 3rd month ($p < 0.001$). BMI and WC did not change significantly (data not shown). TC, LDL, VLDL, and TG levels were significantly lower at 3rd month than the baseline levels ($p < 0.001$), but HDL levels did not alter significantly at 3rd month ($p = 0.708$). In subjects group (walnut consumption in regulated diet), weight is significantly decreased at 3rd month ($p < 0.001$). BMI and WC did not change significantly (data not shown). When compared with lipid parameters, TC, LDL, VLDL, and TG levels were significantly decreased and HDL levels were significantly increased at the end of 3rd month ($p < 0.001$).

Comparison of the groups at the end of 3 months is presented in Table 3. When comparing the change in weight, no significant difference was found between the groups ($p = 0.427$). The reduction in total cholesterol, LDL, VLDL, and HDL levels were comparable with those of control subjects.
and TG levels of the subjects group (walnut consumption in regulated diet) was significantly more than the control group (only regulated diet) ($p < 0.001$). Also, when comparing the change in HDL levels of the groups, no significant difference was identified between the groups ($p = 0.125$).

The fatty acid analysis of kernel of Maras 18 variety is shown in Table 4. The mean rate of the SFA, including myristic, palmitic, stearic, arachidic, and margaric acids, was found to be 8.51 ± 0.30%, the MUFAs, including palmitoleic and oleic acids, 22.18 ± 2.89% and the PUFAs, including linoleic and linolenic acids, 69.07 ± 3.22%.

### 4. Discussion

In this study, it was intended to examine whether the effect of daily walnut consumption on lipid profile in patients with dyslipidemia medication is not required or if lipid parameters not controlled by lifestyle modification is considered medication according to the guidelines of the AHA/ACC of 2013 [18]. Although there are many medical treatment options in the treatment of dyslipidemia (low HDL and elevated LDL and TG levels), healthy lifestyle modification is recommended at every stage of treatment [21].

Many studies have shown that consumption of walnuts decreases the TC, LDL, and TG and increases the HDL and apolipoprotein levels [22, 23]. On the other hand, according to The Food and Drug Administration (FDA) data, 42.5 g of walnut per day, low intake of saturated fat, and cholesterol diet can prevent chronic heart disease [19]. The main results of our study have shown that daily walnut consumption has positive effects on blood lipid parameters in patients with dyslipidemia, who need to be treated with medication according to the guidelines.

In a study conducted on 49 volunteers with a high LDL level (from 130 mg/dl), walnut diet was recommended for one group instead of olive oil and other fatty foods. The reduction in TC level in the walnut diet group was about 9% (about 25 mg/dl), while in the control group was 5% (14 mg/dl). LDL was reduced 11% (22 mg/dl) in the walnut diet, while in the control group, this ratio was 6%, and the HDL was similar in both diet groups [24]. We found a significant increase in HDL levels in the walnut diet group (9.78%-4.6 mg/dl) and in the control group. In our study, the TC level decreased 12, 31% (about 30 mg/dl) in the walnut diet group and 5, 96% (15 mg/dl) in the control group. Also, we identified 14, 65% (22, 3 mg/dl) reduction in LDL in the walnut diet group and 4.66% in the control group. In addition, TG levels were also assessed in our study, with a further decrease in TG levels (25, 84%) in the walnut diet group. This reduction was found 13, 93% in the control group. In another study of type 2 diabetes patients, a significant increase in HDL level and a 10% decrease in LDL level in the walnut group were reported [25]. These results concluded that this effect was related to the antioxidants, vitamin E, and allergic and gallic acid, as well as the walnut oil acid profile. Also, in a study that investigated the effect of walnut consumption on serum cholesterol, apolipoproteins, and LDL oxidation for four weeks, the total cholesterol, serum apolipoprotein-B, and LDL/HDL levels were found significantly decreased and these results support our study [26]. Differently, in another study conducted on 15 patients with overweight or obese, moderate hypercholesterolemia, the level of satiety TG increased in walnut consumption [27]. Our study differs from this study due to the decrease in fasting TG levels and the large number of the study population. The effects of walnut consumption on TG metabolism should be supported.

Also, our findings of lower cholesterol in response to walnut consumption are in agreement with the recently presented metaanalysis that examined the effects of nuts on blood lipids and cardiovascular risk factors [28, 29].

Although walnuts have very high energy, in our study, weight was significantly decreased (there were no significant difference between the groups) and BMI and WC not changed. This result was also supported by others [30]. Like them in our study, walnut was suggested as a component of a reduced-energy diet. This may promote to reduce total energy intake.

The results of our study have shown that the mean rate of the SFA was 8.51 ± 0.30%, MUFA was 22.18 ± 2.89%, and PUFA was 69.07 ± 3.22% in Maras 18. Also, Kafkas et al. [31] studied fatty acid profile of various walnut varieties and the authors implied that Maras 18 had the highest MUFA (27.7%) content, and the same researches reported that polyunsaturated fatty acids showed higher value than the other fatty acids. Similar results were also obtained by the previous study, and the authors reported that the walnut oil contained 21.2 g/100 g MUFA and 69.0 g/100 g PUFA [32]. Besides, some studies demonstrated that Maras 18 cultivar has high pollen viability percentages (91.10%), which is one of the best qualities [20, 33].

### 5. Conclusion

In conclusion, these results confirm the findings of other studies showing that walnut consumption lowers cardiovascular risk and the walnut support in dietary interventions improve blood lipid levels. In the management of hyperlipidemia, that is an important part of family medicine practices, more studies are needed to ensure definitely walnut consumption into the diet for the ambulatory patients, who do not need medication but suggested lifestyle changes only.
Also, this study has limitations. It could not be made sure whether all the volunteers consumed the same type (Maras) and amount of walnut. In addition, dietary compatibility was assessed on the basis of the notifications of individuals.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References


