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Effect of Olive Oil Consumption in Mediterranean Type Diet on Blood Lipid Profiles of Obese Individuals

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ABSTRACT

The objective of this study was to determine the effect of olive oil consumption on the blood lipid profiles of obese individuals (n=100). Blood lipid values and one-day food consumption records were collected. Statistically significant relation was found between the consumption of salad with olive oil, low-fat cheese, semi-skimmed milk, walnut and triglyceride (TG) values; and of total olive oil, fresh fruit consumption and low-density lipoprotein (LDL) values ($P<0.05$). A positive correlation ($P<0.05$; r=0.253; r=0.432) existed between red meat and chicken (without skin) consumption and TG values. Correlation between sunflower oil consumption and TG and LDL values was statistically insignificant. Fried food consumption and LDL values were positively correlated ($P<0.05$; r=0.272). Positive correlation between physical activity and LDL value was also identified ($P<0.05$). Results indicated that the consumption of moderate amounts of olive oil, fresh vegetables and fruits, walnuts, low-fat dairy products, legumes and cereals, major contents of the Mediterranean type diet, can change LDL and/or TG values in a positive way.

Key Words: Hyperlipidemia, Obesity, Lipids, Olive oil, Mediterranean diet

Akdeniz Tipi Diyetle Zeytinyağı Tüketiminin Obez Bireylerde Kan Lipit Profili Üzerine Etkileri

ÖZET

Bu çalışmanın amacı, obez bireylerin (n=100) kan lipit profili üzerine Akdeniz diyetiyle zeytinyağı tüketiminin etkisinin belirlenmesidir. Kan lipit değerleri ölçülmüş ve bir günlük gıda tüketim kayıtları alınmıştır. Zeytinyağlı salata, az yağlı peynir, yarım yağlı süt ve ceviz tüketimi ile trigliserit (TG) değerleri, zeytinyağı ve taze meyve tüketimi ile de düşük-yoğunluklu lipoprotein (LDL) değerleri arasında önemli bir istatistiksel ilişki olduğu ortaya konulmuştur. Kırmızı ve derisi alınmış beyaz et tüketimi ile TG değerleri arasında da pozitif bir korelasyon olduğu tespit edilmekle birlikte, ayçiçek yağı tüketimi ile TG ve LDL değerleri arasında önemli bir korelasyon bulunmamıştır. LDL değerleri, kızartılmış gıda tüketimi ile de pozitif yönde bir korelasyon sergilemiştir. Aynı zamanda fiziksel aktivite ile LDL değeri arasında pozitif bir ilişki olduğu gözlenmiştir. Çalışma sonucunda, Akdeniz tipi beslenme düzeni içerisinde zeytinyağı, taze meyve sebze, ceviz, düşük yağlı süt ürünleri, baklagil ve tahılların orta düzeyde tüketilmesinin obez bireylerde LDL ve/veya TG değerlerinde olumlu değişikliklere yol açabileceği gözlenmiştir.

Anahtar Kelimeler: Hiperlipidemi, Obezite, Lipit, Zeytinyağı, Akdeniz diyeti

INTRODUCTION

Mediterranean diet is typically defined as a diet which mainly consists of a variety of fresh vegetables and seasonal fruits, legumes, whole grains, seafood and fish, as well as moderate amounts of dairy products, poultry, and wine. Olives and olive oil is the main source of fat in this diet. 25-35% of total daily calorie is contributed by fats, but saturated fat should not exceed 8% of total daily calories in this type diet. Olive oil is the very characteristics of the Mediterranean diet which contains large proportions of monounsaturated oleic acid. The diet has been linked to reduction in coronary heart diseases and cancers [1].

In one study, the relationship between olive oil and other types of oil consumption and obesity and body mass index (BMI) was investigated in Spain among a large number of samples. Daily food consumption recall records of the study group were linked to diet composition and body composition. The results indicated no significant correlation between olive oil consumption and obesity in Spain [2]. In another study [3], the effects of the consumption of diets rich in olive oil and sunflower oil on the blood lipid composition in peripherally cardiovascular patients were studied. The results showed that the group consuming sunflower oil had higher LDL and tocopherol levels, whereas the olive oil consuming group had intact LDL levels but reduced oxidized LDL levels. People consuming olive oil on a regular basis were monitored for 28 months in order to detect any increase in their weight, and no significant relationship was found [4]. On the other hand, 613 subjects were followed for six years for diet fatty acid composition, obesity, physical activity status, smoking, BMI and total energy levels, and it was found that enhancement of obesity prevalence is directly linked to the fatty acid amount and type of the diet consumed. It was suggested that sunflower consuming group carried more risks to develop obesity than olive oil consuming group [5]. In another study [6], 18 patients were fed for 4 weeks within 3 groups consuming olive oil, hazelnut and Mediterranean diet. It was found that those consuming olive oil, hazelnut and walnut on a regular basis had LDL levels reduced by 7.3, 10.8 and 13.4%. Additionally, total cholesterol and LDL/HDL ratios were reduced. Issa *et al.* [7] conducted a questionnaire on 798 adults about their diets, socio-demographic and anthropometric measures and found that there was a significant negative correlation between Mediterranean type diet and obesity and visceral adipose tissue content.

The objective of this study was to observe the effects of olive oil and Mediterranean type diet consumption on the blood lipid profiles of the individuals classified as obese or overweight with no other chronic diseases.

MATERIALS and METHODS

Selection of the Study Group

This study was conducted on the obese and hyperlipidemic classified individuals who were referred to the Akdeniz University, Nutrition and Dietetic Department, Adult Nutrition and Diet Polyclinics through consultation from other clinics. Those individuals who applied to the polyclinics in October-December 2010, aged over 18, with a body mass index (BMI) ≥ 25, low density lipoprotein (LDL) of ≥ 130, triglyceride (TG) of ≥ 200, total cholesterol of ≥ 200 and classified as overweight and/or obese, hyperlipidemic and having no other known chronic disease were accepted for this study. There were 72 females and 28 males who voluntarily accepted to be subjects of this study.

Anthropometric Measurements

Height, weight, waist, hip measurements of the selected study group were performed when they were wearing light clothes by a Seca electronic balance with height measuring instrument. The body mass index (BMI) of the individuals were then calculated by BMI = weight / $(height)^2$ formulae according to World Health Organization (WHO) classification [8].

Blood Lipid Analyses

The blood samples of the study group were collected after overnight fasting in the Biochemistry Laboratory of Akdeniz University Hospital. Blood glucose levels were measured by enzymatic techniques with PPP auto analyzer. Similarly blood triacylglycerol, total cholesterol and HDL cholesterol levels were measured by using kits (Roche Diagnostics, GmbH, Mannheim, Germany) and PPP auto analyzer. Blood VLDL and LDL levels were calculated by the Frieldewald formulae and given as mg/dl. The results of the measurements were evaluated according to the National Cholesterol Education Program Adult Guidelines [9].

Diet Surveys

There were two different surveys applied to the study group. In the first part, socio-demographic parameters (age, gender, education, family health history), vitamin and supplement consumption patterns, presence of chronic diseases, use of medications, eating habits (dietary education level, number of daily meals, breakfast habits, kind of oil used in the meals) and lifestyle habits (regular physical activity, smoking and alcohol consumption habits) were surveyed. In this part of the survey, also the anthropometric measures (weight, height, waist and hip) were recorded. In the second part of the survey, 24 hour food consumption records were collected from the study group. In this record, foods with the amounts consumed during the last 24 hours were determined by using the record forms.

Ethical Considerations

Ethical approval of this study was awarded by the vice chancellor of the Akdeniz University Hospital with a permission letter to complete the study at the Nutrition and Dietetics Department.

Statistical Analysis

The food consumption records were evaluated with the Nutrition Knowledge System (BeBiS). All other statistical analyses were performed by SPSS 18.0 package program [10]. In this study the descriptive statistics of frequency, mean and standard error and variance were measured. The relationship between the LDL and TG values and those consuming or not consuming different food groups was determined by Mann Whitney U-test. Also, the relationship between the food consumption frequency and measured LDL and TG values was measured with the Spearmen's Correlation analysis.

RESULTS and DISCUSSION

The study group was selected among those who did not have any other known chronic diseases other than hyperlipidemia and obesity. The rate of chronic diseases in the close relatives of the study group was also questioned and the results are shown in Figure 1.

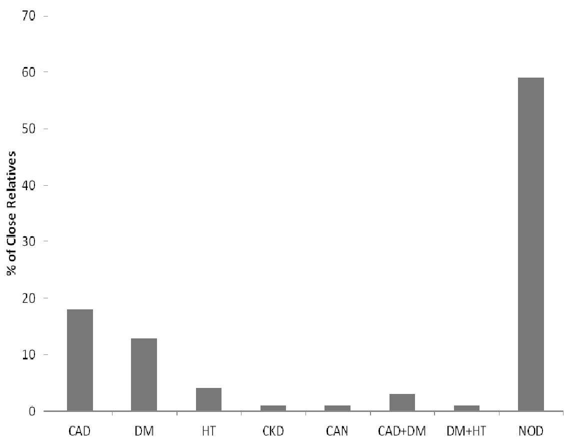

Figure 1. Distribution rate of the chronic diseases in the close relatives of the individuals in the study group (CAD: Cronary Artery Disease, DM: Diebetes Mellitus, HT: Hypertension, CKD: Cronicle Kidney Deficiency, CAN: Cancer, NOD: No Disease).

The majority (59%) of the close relatives of the study group had no chronic diseases. The most common diseases, on the other hand, were coronary artery diseases and diabetes mellitus. This result still may indicate that the study group has the genetic potential for some chronic diseases. The body and blood properties and life style status of the study group are summarized in Table 1. The study group consisted of 72 women and 28 men. It is obvious that their BMI and physical activity status were highly correlated (*P*=0.036), while there was no relation between alcohol consumption and blood TG and LDL values (Table 1).

The study group is well fit to the definition of obese due to their calculated BMI and waist to hip ratio in both sexes, according to the common survey of Turkish population studied previously [11]. Similarly, the blood lipid results imply that the study group shows visceral adiposity, and this may yield some risks of metabolic syndrome and cardiovascular diseases (CVD). The alcohol consumption rate was 1-2 times per week, hence, it can be said that the amount and frequency of alcohol consumption can be an important factor for obesity incidence. Since the amount of alcohol consumption was not measured in this study, its effect on the cardiovascular health cannot be estimated. The oil consumption habits of the study group are shown in Table 2. As can be observed, in the Mediterranean region of Turkey, the olive oil is highly predominated in the daily diet, as expected.

Sunflower oil comes as the second most preferred oil. It was found that the blood LDL values of the individuals are significantly affected by the olive oil consumption (p=0.006), while blood TG level was found to be intact. Those consuming olive oil had lower levels of LDL than the non-consuming ones. A similar result was reported [12] indicating that consuming two spoonful olive oil for 6 weeks in 26 subjects had caused LDL level and lipid oxidation level to decrease significantly. Similar results were obtained for fried food consumption (Table 2). Only blood LDL values were affected by fried food consumption (p=0.021), but interestingly the LDL level was lower in fried food consuming individuals. While, there was statistically no significant relationship between fried food consumption and blood TG levels, the mean TG level in fried food consuming individuals was much higher than non-consuming individuals.

By using the daily food consumption records data and BeBiS program, the consumption amounts of selected nutrients for the study group were calculated and shown in Table 3.

Table 1. The body and blood values, and life style status of the study group (n = 100)

Property	Mean ± SD	Life Style	Number
Age (year)	48.11 ± 11.019	Smoking status- Yes	15
Height (cm)	162.84 ± 8.700	No	80
Weight (kg)	91.57 ± 19.979	Quit	5
BMI (kg/m^2)	34.52 ± 7.171	Alcohol drinking- Yes	12
Hipringe (cm)	121.73 ± 12.682	No	88
Waist/Hip	0.97 ± 0.522	Physical activity- Yes	24
FBS (mg/dl)	94.25 ± 10.827	No	76
Triglyceride (TG) (mg/dL)	224.00 ± 180.114		*P* Value
HDL-cholesterol (mg/dL)	46.09 ± 13.298	Alcohol-LDL	0.127
LDL-cholesterol (mg/dL)	146.28 ± 27.474	Alcohol-TG	0.793
VLDL-cholesterol (mg/dL)	44.95 ± 39.211	Physical Activity-BMI	0.036
Total cholesterol (mg/dL)	224.01 ± 31.300		

BMI: body mass index, FBS: fasting blood sugar.

Table 2. The edible oil consumption habits of the indivuduals in the study group

Fats/Oils Used	Number	
Margarin	3	
Olive oil	62	
Sunflower oil	15	
Olive oil- sunflower oil mixture	18	
Other	2	
Non-meal olive oil consumption	LDL (mg/dl) (*P*=0.006)	TG (mg/dl) (*P*=0.225)
Yes (n= 16)	125.04 ± 28.10	167.54 ± 75.40
No (n= 84)	149.11 ± 26.28	233.03 ± 190.41
Fried food consumption	LDL (mg/dl) (*P*=0.021)	TG (mg/dl) (*P*=0.208)
Yes (n= 62)	141.05 ± 26.01	249.93 ± 215.88
No (n= 38)	154.36 ± 28.05	181.58 ± 83.66

Table 3. Data produced from the daily food consumption records of the study group*

Nutrient	Analyzed Mean Amount Consumed	Recommended Daily Consumption	Amount Supplied (%)
Energy	1200.3 kcal	2036.3 kcal	59
Water	855.4 g	-	-
Protein	52.8 g (18%)	60.1 g (12 %)	88
Fat	48.1 g (36%)	69.1 g (< 30 %)	70
Carbohydrate	133.5 g (46%)	290.7 g (> 55 %)	46
Fiber	17.2 g	30.0 g	57
Alcohol	0.9 g	-	-
PUFA	8.8 g	10.0 g	88
Cholesterol	177.5 mg	-	-
Essential amino acid	24.7 g	-	-
Vit. A	1061.4 µg	1001.0 µg	106
Caroten	2.8 mg	-	-
Vit. E	7.1 mg	-	-
Vit. B1	0.6 mg	1.1 mg	57
Vit. B2	1.1 mg	1.3 mg	88
Vit. B6	1.0 mg	1.5 mg	69
Total folic acid	226.7 µg	400.0 µg	57
Vit. C	81.5 mg	100.1 mg	81
Sodium	2548.9 mg	2001.0 mg	127
Iodine	88.6 µg	180.1 µg	49
Potassium	1886.5 mg	3500.0 mg	54
Calcium	644.1 mg	1001.0 mg	64
Magnesium	200.5 mg	350.0 mg	57
Phosphorus	891.9 mg	701.0 mg	127
Iron	8.8 mg	10.0 mg	88
Zinc	7.7 mg	10.0 mg	77

*Calculated by BeBiS program full version according to the Turkish National Recommendations.

Mean daily energy input of the individuals in this study was around 1200 kcal, 18% of which was from proteins, 36% was from lipids and 46% was from carbohydrates. The consumed diet components were providing 8.8 g polyunsaturated fatty acids (PUFA) and 177.5 g of cholesterol. Meantime, the consumed Mediterranean type diet was also supplied 17.2 g of dietary fiber content. According to the Turkish population nutrition survey (TEKHARF Study), which was conducted in 2003-2007 years [11], mean energy input of the population was 1582 kcal, only 33% of which was from dietary fats. In addition, that study indicated that 40% of dietary fats was from visible sources (32% vegetable liquid oil, 8% margarine and butter), and 60% was from invisible sources. The mean cholesterol content was determined in that study as 168.5±146.4 mg daily [11]. Compared to TEKHARF Study, individuals in this study were shown to consume higher amounts of fats and proteins, and lower amounts of carbohydrates, fiber and cholesterol (Table 3). Since the study group was selected among obese individuals and those who typically consume Mediterranean type foods, the results of nutrient intake (Table 3) may suggest some reduction of dietary fat intake and enhancement of dietary fiber intake. Also, it must be kept in mind that this study group is already on diet according to the recommendations of their dieticians.

The relationship between different foods consumed and blood LDL and TG values measured in the study group is shown in Table 4.

Those who consumed white cheese showed different TG values than those of non-consuming group (p=0.026). In fact, the persons consuming white cheese showed lower levels of blood TG measures.

Table 4. The relationship between consumed different foods and the LDL and TG values measured in the blood samples of the individuals in the study group

Food Group	Consumption Status	Number of Individuals	LDL (mg/dL)	*P*	TG (mg/dl)	*P*
Whole milk	+	27	146.11 ± 30.18	0.959	224.44 ±198.30	0.970
	-	73	146.44 ± 26.74		222.42 ± 92.85	
Semi-skimmed milk	+	45	180.73 ± 81.25	0.366	244.00 ± 247.15	0.189
	-	55	143.81 ± 28.27		220.19 ± 158.89	
Whole yogurt	+	38	143.62 ± 25.31	0.451	222.33 ± 159.13	0.938
	-	62	148.07 ± 29.07		229.24 ± 239.08	
Low-fat yogurt	+	62	148.28 ± 28.99	0.386	220.56 ± 184.71	0.538
	-	38	143.22 ± 25.02		263.29 ± 117.53	
Whole white cheese	+	35	143.51 ± 29.93	0.476	213.78 ± 151.86	0.026[1]
	-	65	147.83 ± 26.46		324.87 ± 358.85	
Kashar cheese	+	14	147.02 ± 31.73	0.915	231.17 ± 177.28	0.454
	-	86	146.16 ± 26.88		219.17 ± 183.62	
Lor cheese	+	18	155.61 ± 30.34	0.113	217.74 ± 178.94	0.435
	-	82	144.10 ± 26.66		234.75 ± 184.73	
Dry cottage cheese	+	27	149.61± 27.55	0.483	215.54 ± 165.01	0.961
	-	73	145.09 ± 27.55		272.12 ± 252.79	
Red meat	+	76	145.25 ± 29.51	0.484	245.31 ± 153.12	0.170
	-	24	150.13 ± 18.10		210.43 ± 172.83	
Chicken (with skin)	+	23	138.97 ± 23.47	0.180	269.75 ± 213.55	0.847
	-	77	148.34 ± 28.47		219.36 ± 137.31	
Chicken (skinless)	+	76	148.05 ± 28.56	0.263	182.17 ± 108.23	0.410
	-	24	140.52 ± 23.23		230.69 ± 188.76	
Fish	+	93	146.42 ± 27.69	0.977	165.52 ± 93.89	0.120
	-	7	144.69 ± 26.61		245.80 ± 198.69	
Egg	+	91	146.58 ± 27.22	0.887	232.61 ± 163.77	0.495
	-	9	143.16 ± 31.52		215.19 ± 196.99	
White bread	+	37	136.10 ± 26.80	0.005[1]	235.83 ± 215.93	0.431
	-	63	152.33 ± 26.39		224.64 ± 96.64	
Whole-wheat bread	+	66	151.96 ± 26.18	0.005[1]	224.44 ± 198.30	0.484
	-	34	135.33 ± 26.96		222.42 ± 92.85	
Olive oil	+	87	146.94 ± 28.82	0.569	244.00 ± 247.15	0.038[1]
	-	13	142.23 ± 17.04		220.19 ± 158.89	
Sunflower oil	+	40	140.97 ± 26.16	0.124	222.33 ± 159.13	0.204
	-	59	150.20 ± 28.01		229.24 ± 239.08	
Corn oil	+	8	147.88 ± 32.96	0.674	220.56 ± 184.71	0.351
	-	92	146.14 ± 27.13		263.29 ± 117.53	
Butter	+	13	144.30 ± 22.20	0.780	213.78 ± 151.86	0.322
	-	87	146.61 ± 28.33		324.87 ± 358.85	
Walnut	+	25	142.43 ± 28.65	0.571	231.17 ± 177.28	0.028[1]
	-	74	147.09 ± 26.86		219.17 ± 183.62	
Sugar	+	54	140.97 ± 25.13	0.045[1]	217.74 ± 178.94	0.192
	-	46	152.34 ± 29.02		234.75 ± 184.73	
Honey	+	62	148.22 ± 24.09	0.290	215.54 ± 165.01	0.736
	-	38	142.6 ± 32.19		272.12 ± 252.79	

[1] Significant at p ≤ 0.05.

There were also statistically significant differences between those individuals consuming/non-consuming white bread and whole wheat bread for the measured blood LDL values ($P<0.05$).White bread consuming people showed lower levels of blood LDL than non-consuming group. Interestingly, those consuming whole-wheat bread have higher levels of blood LDL values than their non-consuming counterparts. These results are highly unexpected, which in regular diet recommendations, whole-wheat bread is suggested as cholesterol reducing item due to the high fiber content. Similarly, there were statistically significant differences among those who consume or did not consume olive oil and walnuts (p=0.038; p= 0.028). Those individuals consuming olive oil and walnut had lower levels of blood TG levels than non-consuming individuals. In addition, it was found that those consuming sugar had lower levels of blood LDL value than the non-consuming group. On the other hand, there was no statistically significant relationship between measured blood LDL and TG values and those common 16 foods listed in Table 4. Traditional Mediterranean diet has been recognized and studied since 1950s. The diet is characterized by lower energy and total fat intake, higher olive oil portions among edible oils, higher cereal, legumes, nuts (walnut and hazelnut), vegetable and fruit consumption with moderate levels of red wine intake. The positive health effects and protective effects against CVD of the diet are well recognized [13]. The effects of using olive oil in different meals or food preparations on the blood lipid profiles of the individuals in this study are shown in Table 5.

Table 5. The effects of consuming olive oil in different meals on the LDL and TG values of the individuals in the study group

Meal	Consumption	N	LDL (mg/dL)	*P*	TG (mg/dL)	*P*
Soup	+	58	146.80 ± 29.45	0.843	215.10 ± 177.84	0.291
	-	42	146.27 ± 25.05		235.47 ± 184.74	
Rice-Macaroni	+	51	147.59 ± 27.56	0.647	224.11 ± 184.7	0.561
	-	49	144.98 ± 27.62		226.95 ± 177.4	
Vegetable	+	73	145.08 ± 29.07	0.492	211.68 ± 162.61	0.279
	-	27	149.46 ± 19.65		256.79 ± 220.16	
Salad	+	85	145.98 ± 28.79	0.802	206.43 ± 153.78	0.06
	-	15	147.93 ± 19.79		308.33 ± 261.81	
Beans with olive oil	+	76	145.16 ± 29.62	0.486	210.26 ± 159.67	0.226
	-	24	149.78 ± 19.53		267.19 ± 232.48	
Beans with meat	+	77	145.26 ± 29.28	0.503	208.40 ± 159.19	0.208
	-	23	149.86 ± 29.18		276.25 ± 234.69	
Mixed vegetable without/meat	+	79	145.67 ± 29.27	0.674	207.56 ± 158.14	0.080
	-	21	148.60 ± 19.85		282.84 ± 238.22	
Stuffed vine leaves with meat	+	84	146.26 ± 28.87	0.081	206.94 ± 154.81	0.077
	-	16	146.44 ± 20.03		299.69 ± 258.18	
Flour-based	+	58	147.89 ± 27.65	0.869	221.58 ± 177.80	0.680
	-	42	144.13 ± 27.43		227.27 ± 185.56	
Sweet	+	55	147.96 ± 26.99	0.523	222.00 ± 182.48	0.562
	-	45	144.31 ± 28.23		226.35 ± 179.58	

In general, it was found that whether these foods are cooked or prepared with olive oil did not affect the blood lipid profiles of the study group. Therefore, it can be concluded that moderate olive oil consumption with prepared foods may not have any effects on blood lipid levels.

When all survey data were analyzed for the significant relationships between the consumed food type and blood lipid values, the statistically significant results are shown in Table 6.

Table 6. Significant correlations determined between the consumed foods and TG and LDL values of the study group

Food	TG (mg/dL)	LDL (mg/dL)
Semi-skimmed milk	P=0.034[1] r = -0.344	-
Red meat	P=0.037[1] r = 0.253	-
Chicken with skin	P=0.001[1] r = 0.432	-
Walnut	P=0.002[1] r = -0.491	-
Olive oil	-	P=0.051[1] r = -0.214
Fried food	-	P=0.008[1] r = 0.272
Fresh Fruit	-	P=0.046[1] r = -0.206

[1]Significant at p≤ 0.05.

Consumption of semi-skimmed milk and walnut caused to lower blood TG levels, while consumption of red meat and chicken with skin caused to elevated blood TG levels in the study group. Similarly, consumption of olive oil and fresh fruit lowered blood LDL levels, while consumption of fried foods caused an increase in the blood LDL value. According to the review of Jimenez-Colmenero et al [14], epidemiologic studies indicated that consumption of walnut and hazelnut lowered myocardial infarction and CVD risk regardless of exercise status, weight, hypertension, smoking, gender and age. The mechanism of this situation has not been fully explained yet. Contrarily, consumption of higher amounts of meat and meat products have been found to be linked to higher mortality and morbidity rate, as well as higher CVD risks [15]. In another similar study [16], the effects of consuming higher amounts of dairy products and intake of higher levels of calcium in obese individuals having non-energy limited diet on the blood lipid profile and body composition were evaluated. Results indicated that the intake of higher amounts of dairy products in obese individuals did not have any effects on blood lipids or body composition. In another study, the high antioxidant effects of olive oil consumption in patients with higher LDL cholesterol levels were shown by blood phenolics composition, protection of LDL oxidation and antioxidant capacity measurements [17]. There are many similar studies in the literature about the Mediterranean type diet and/or olive oil consumption and blood lipid relations and general health effects.

CONCLUSION

The interrelationship between daily food intake reports and blood lipid profiles of the selected study group were evaluated in this study. Since there is a significant correlation between the consumption of low fat dairy products and blood lipid measures, it can be suggested that such obese persons should consume low-fat dairy foods. Contrarily, consumption of red meat and chicken with skin is not suggested for the obese individuals. Consumption of olive oil has shown to decrease LDL values; therefore, consumption of olive oil between meals can be suggested for obese individuals without exceeding the recommended total dietary fat intake levels. These results primarily agree with the previous reports about the Mediterranean type diet. On the other hand, consumption of fried foods is linked to higher LDL values in this study. For that reason, overweight or obese people should avoid consuming fried foods. It was shown that the consumption of fresh fruits and walnuts are significantly correlated with lower levels of LDL and TG values. These foods are regular components of Mediterranean diet and might help healthy obese individuals control their blood lipid profiles. Along with nutrition patterns, there was a very important positive relationship between physical activity and BMI and lower blood lipid levels. Based on the overall results of this study, at least 30 minutes of moderately intensive exercise can be suggested for healthy obese individuals. In conclusion, typical Mediterranean diet components and daily physical activity can help obese individuals stay healthy, control their weight and blood lipid profiles.

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