Original Article
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Lipid Profile in the Elderly and Middle-Aged Patients with Type 2 Diabetes Mellitus in Relation with Gender

Tip 2 Diabetes Mellituslu Yaşlı ve Orta Yaşlı Hastalarda Lipid Profili ve Cinsiyet ile İlişkisi

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Abstract

Objective: The aim of the present study was to determine the lipid profile in the elderly and middle-aged patients with Type 2 diabetes mellitus (DM) and its relation with gender.

Material and Methods: A total of 592 patients with Type 2 DM aged ≥60 years and 269 diabetic patients aged <60 years as middle-aged with initial admissions or patients with two months of antihyperlipidemic medicine pause were recruited from the internal medicine outpatient clinic during December 2012-March 2018. Demographic and biochemical data were collected retrospectively. Abnormal lipid levels were accepted as total-cholesterol >200 mg/dL, low density lipoprotein-cholesterol (LDL-C) ≥100 mg/dL, triglyceride (TG) ≥150 mg/dL, and high density lipoprotein-cholesterol (HDL-C) <50 in women <40 mg/dL in men.

Results: In total, 506 (85.4%) elderly and 248 (92.1%) middle-aged patients had one or more types of dyslipidemia. There were statistically significant differences in the frequencies of isolated high TG (x^2=7.54, p=0.01) and combined two parameter dyslipidemia such as LDL-C ≥100 mg/dL & HDL-C <40 mg/dL & TG <150 mg/dL (x^2=4.30, p=0.03) for men between elderly and middle-aged patients. Combined two-parameter dyslipidemia such as LDL-C ≥100 mg/dL, TG ≥150 mg/dL & HDL-C >50 mg/dL (x^2=6.64, p=0.01), and isolated low HDL-C (x^2=2.91, p=0.05) for women were found to be different between the elderly and middle-aged patients.

Conclusion: Hypertriglyceridemia with high LDL-C and isolated low HDL-C were more common in the elderly women than that in middle-aged women where isolated hypertriglyceridemia and combined high LDL-C with low HDL-C were higher in the elderly than the middle-aged for men.

Keywords: Lipids; diabetes mellitus; aged; middle-aged

Özet

Amaç: Bu çalışmanın amacı, Tip 2 diabetes mellitus (DM)lu yaşlı ve orta yaşlı hastalarda lipid profilini ve cinsiyet ile ilişkisini belirlemektir.

Gereç ve Yöntemler: Aralık 2012-Mart 2018 tarihleri arasında, iç hastalıkları polikliniğine başvuran hastalardan ilk başvurusu olan veya iki ay boyunca antihiperlipidemik tedaviye ara vermiş olan Tip 2 DM tanılı 592 yaşlı (≥60 yaş) ve 269 orta yaşlı (<60 yaş) hasta çalışmaya alındı. Hastaların demografik ve biyokimyasal verileri retrospektif olarak incelendi. Anormal lipid düzeyi; total-kolesterol >200 mg/dL, düşük yoğunluklu lipoprotein-kolesterol [low density lipoprotein-cholesterol (LDL-C)] ≥100 mg/dL, trigliserid (TG) ≥150 mg/dL ve yüksek yoğunluklu lipoprotein-kolesterol [high density lipoprotein-cholesterol (HDL-C) kadınlarda <50 mg/dL ve erkeklerde <40 mg/dL olması olarak tanımlandı.

Bulgular: Beş yüz altı (%85,4) hasta ve 248 (%92,1) orta yaşlı hastada bir veya birden fazla dislipidemi türü vardı. Yaşlı ve orta yaşlı erkekler arasında izole yüksek TG düzeyi (x^2=7,54, p=0.01) ile LDL-C ≥100 mg/dL ve HDL-C <40 mg/dL ve TG <150 mg/dL gibi kombine tip dislipidemi türleri arasında istatistiksel olarak anlamlı farklılık saptandı (x^2=4,30, p=0,03). Yaşlı ve orta yaşlı kadınlar arasında LDL-C ≥100 mg/dL, TG ≥150 mg/dL ve HDL-C >50 mg/dL gibi kombine tip dislipidemi türü (x^2=6,64, p=0,01) ile izole düşük HDL-C (x^2=2,91, p=0,05) düzeyleri arasında anlamlı farklılık vardı.

Sonuç: Yaşlı kadınlarda hipertrigliseridemi ile beraber yüksek LDL-C ve izole düşük HDL-C orta yaşlı kadınlarda daha sık görülür iken, yaşlı erkeklerde izole hipertrigliseridemi ile kombine yüksek LDL-C ve düşük HDL-C orta yaşlı erkeklerden daha sık bulundu.

Anahtar kelimeler: Lipidler; diabetes mellitus; yaşlı; orta yaşlı

Introduction

The incidence of type 2 diabetes (1) and also diabetic dyslipidemia is common in older individuals (2,3). An association between diabetes mellitus (DM) and serum lipid profile has been reported in many stud-

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ies (4-7). Diabetes impairs the utilization of lipids and lipoproteins which cause diabetes-induced atherogenic dyslipidemia (8). Diabetic dyslipidemia includes a triad of raised triglycerides, reduced high density lipoprotein-cholesterol (HDL-C), and an excess of low density lipoprotein-cholesterol (LDL-C) (9-11). In a previous study (12), over 90% of patients with type 2 DM had one or more types of dyslipidemia and high LDL-C and triglycerides were found to be the most common form of dyslipidemia. Ozder et al. reported widespread lipid abnormalities in the course of diabetes triggered dyslipidemia such as hypercholesterolemia, hypertriglyceridemia, elevated LDL-C, and decreased HDL-C (13). Likewise, Elmasri et al. reported a statistically significant association of triglycerides and HDL-C with increasing age, female sex, obesity, physical inactivity, and poor glycemic control of diabetes (4). However, there are very few studies related to the frequencies of common types of dyslipidemia according to gender in elderly diabetics in comparison with the middle-aged patients, especially in the Turkish population. Therefore, the aim of the present study was to determine the lipid profiles of the elderly and middle-aged patients with DM and delineate the effect of gender.

Material and Methods

Subjects

In total, 789 elderly and 422 middle-aged diabetic patients, at initial admission without antihyperlipidemic treatment and those with two months of antihyperlipidemic medicine holiday (or pause) were recruited to the study. Patients using antihyperlipidemic treatment continuously and those younger than 35 years of age were excluded. After excluding non-eligible patients, 592 diabetic patients aged ≥60 years as elderly and 269 diabetic patients aged <60 years as middle-aged were recruited in the study during December 2012 and March 2018 from the internal medicine outpatient clinic. Demographic and biochemical data were collected, retrospectively. A history of hypertension, stroke, cardiovascular disease or chronic complications such as neuropathy, retinopathy, and nephropathy among the study groups were considered. This study was approved by the Ethical Committee of the University of Ege and conducted in accordance with the Helsinki Declaration. Informed consent was taken from all participants.

Dyslipidemia Criteria

Abnormal lipid levels were accepted as total cholesterol (T-C) >200 mg/dL, LDL-C ≥100 mg/dL, as triglyceride (TG) ≥150 mg/dL and HDL-C <50 mg/dL in females and <40 mg/dL in males. Dyslipidemia was defined by the presence of one or more abnormal serum lipid concentrations (14).

Statistical Analysis

All statistical analyses were performed with SPSS for Windows (16.0) software. The effect size, statistical power, and sample size calculation were performed using G*Power Version 3.1.9.4. considering an alpha value of 0.05. The data were expressed as mean ±standard deviation (SD) and categorical variables were represented by percentages. Groups were compared using Student's t-test for quantitative variables and chi-square test for categorical variables. All statistical tests were two-tailed and a p-value ≤0.05 was considered to be statistically significant.

Results

The mean ages of elderly and middle-aged patients were 68.1±6.6 years (age range of 60-96 years) and 51.9±5.5 years (age range of 35-59 years), respectively. Of them, 506 (85.4%) elderly and 248 (92.1%) middle-aged patients had one or more types of dyslipidemia (x^2=3.36, p=0.06). The demographic and biochemical characteristics of patients are shown in Table 1, Table 2.

The common types of dyslipidemia in elderly and middle-aged are shown in Table 3. There were statistically significant differences in the isolated high TG (x^2=8.30, p=0.04) and combined two parameters dyslipidemia such as LDL-C ≥100 mg/dL & TG <150 mg/dL & HDL-C <40 mg/dL or <50 mg/dL (x^2=6.53, p=0.01) and LDL-C ≥100 mg/dL, TG ≥150 mg/dL & HDL-C >40 or >50 mg/dL (x^2=5.54, p=0.01) between elderly and middle-aged patients.

Table 1. Demographic and biochemical characteristics of elderly and middle-aged patients.

Variables	Elderly (n=592)	Middle-aged (n=269)	Student's t-test p-value
Age (years)	68.1±6.6	51.9±5.5	0.01
Body Mass Index (kg/m^2)	29.8±8.8	30.9±5.4	0.029
Weight (kg)	75.3±12.4	83.6±15.3	0.001
Height (centimeter)	159.3±10.1	164.4±7.4	0.001
Duration of diabetes mellitus (years)	11.5±6.8	7.2±4.3	0.01
Systolic blood pressure (mmHg)	132.3±25.2	121.4±18.7	0.001
Diastolic blood pressure (mmHg)	72±18.4	65.1±14.1	0.001
Microalbuminuria (mg/day)	20.8±44.8	12.2±32.4	0.03
Number of drugs	5.8±2.9	4.0±2.7	0.001
Total-C (mg/dL)	210.7±45.9	210.6±41.2	0.98
TG (mg/dL)	153.5±96.5	173.2±108.9	0.012
HDL-C (mg/dL)	47.3±14.5	48.4±13.8	0.33
LDL-C (mg/dL)	127.0±37.7	140.7±168.5	0.19
HbA1c (%)	7.2±3.4	7.2±1.6	0.39
Serum creatinine (mg/dL)	1.0±3.1	1.4±8.2	0.39

Total-C: Total cholesterol; LDL-C: Low-density lipoprotein; HDL-C: High-density lipoprotein; TG: Triglyceride; HbA1c: Hemoglobin A1c. Data are expressed as means ±SD or n (%).

Table 2. Comorbidities and antidiabetic treatment characteristics of the elderly and middle-aged patients.

Variables	Elderly (n=592)	Middle-aged (n=269)	Pearson's x^2 p-value
Men (n, %)	189 (22.1)	99 (11.6)	0.14
A history of cardiovascular disease (n, %)	117 (15.7)	12 (1.6)	0.001
A history of stroke (n, %)	46 (6.3)	0 (0)	0.001
A history of peripheral arterial disease (n, %)	52 (7.1)	0 (0)	0.001
Neuropathy (n, %)	199 (26.3)	32 (4.2)	0.001
Retinopathy (n, %)	130 (17.2)	27 (3.6)	0.001
Albuminuria present (n, %)	160 (21.2)	37 (4.9)	0.001
Receiving only oral hypoglycemic treatment (n, %)	401 (72.6)	205 (84.3)	0.75
Receiving oral hypoglycemic and insulin treatment (n, %)	139 (27.4)	64 (15.7)	0.10

Common types of dyslipidemia were evaluated according to gender in the elderly and middle-aged groups. There were statistically significant differences in the frequencies of the isolated high TG (x^2=7.54, p=0.01) and combined two-parameter dyslipidemia such as LDL-C ≥100 mg/dL & HDL-C <40 mg/dL & TG <150 mg/dL (x^2=4.30, p=0.03) for men and combined two-parameter dyslipidemia such as LDL-C ≥100 mg/dL, TG ≥150 mg/dL & HDL-C >50 mg/dL (x^2=6.64, p=0.01) and isolated low HDL-C (x^2=2.91, p=0.05) for women between the elderly and middle-aged (Table 4).

Discussion

The prevalence of diabetes increases with age and is likely to affect 20% of the population with >75 years of age (15). Increased cardiovascular morbidity and mortality are common in diabetic populations. Similar to diabetes, dyslipidemia is also a significant risk factor for cardiovascular diseases (16,17) and has been reported to be positively associated with age (18). Therefore our findings indicate that the frequency of dyslipidemia in diabetic elderly is similar to those in diabetic middle-aged. However, dyslipidemia patterns like isolated increased

Table 3. The common types of dyslipidemia in the elderly and middle-aged patients.

	Elderly (n=92)	Middle-aged (n=269)	Pearson's x^2 p value
Isolated high LDL-C (≥100 mg/dL) (%)	54.4	25.1	0.98
Isolated low HDL-C [<40 mg/dL (M) <50 mg/dL (W)] (%)	35.7	14.7	0.08
Isolated high TG (≥150 mg/dL) (%)	22.9	14	0.04 (x^2=8.30)
Combined two parameter dyslipidemia [LDL≥100 mg/dL & TG<150 mg/dL, HDL<40 mg/dL (M) or <50 mg/dL (W)] (%)	15.7	4.9	0.01 (x^2=6.53)
Combined two parameter dyslipidemia [LDL≥100 mg/dL & TG≥150 mg/dL, HDL>40 mg/dL (M) or >50 mg/dL (W)] (%)	6.5	4.8	0.01 (x^2=5.54)

Total-C: Total cholesterol; LDL-C: Low-density lipoprotein; HDL-C: High-density lipoprotein; TG: Triglyceride; M: Men; W: Women.

Table 4. The common types of dyslipidemia according to gender in the elderly and middle-aged patients.

	Women Elderly (n=381)	Men Middle-aged (n=163)	Pearson's x^2 p-value	Elderly (n=178)	Middle-aged (n=97)	Pearson's x^2 p-value
Isolated high total–C (>200 mg/dL) (%)	34.5	15.4	0.62	31.3	20	0.14
Isolated high LDL-C (≥100 mg/dL) (%)	56.1	24.3	0.70	51.1	26.5	0.60
Isolated low HDL-C [<40 mg/dL (M) <50 mg/dL (W)] (%)	42.4	15.7	0.05 (x^2=2.91)	22.6	12	0.94
Isolated high TG (≥150 mg/dL) (%)	23	11.2	0.26	23.4	18.6	0.01 (x^2=7.54)
Combined two parameter dyslipidemia [LDL ≥100 mg/dL, TG <150 mg/dL& HDL <50 mg/dL (W) or<40 mg/dL (M)] (%)	20.4	6.8	0.13	6.6	1.1	0.03 (x^2=4.30)
Combined two parameter dyslipidemia [LDL ≥100 mg/dL, TG≥ 150 mg/dL & HDL >50 (W) or>40 mg/dL (M)] (%)	4.4	3.9	0.01 (x^2=6.64)	10.6	6.6	0.62

Total-C: Total cholesterol; LDL-C: Low-density lipoprotein; HDL-C: High-density lipoprotein; TG: Triglyceride; M: Men; W: Women.

TG levels and combined two parameters dyslipidemia in the elderly were found to be higher than those of middle-aged.

Dyslipidemia is one of the major risk factors for cardiovascular disease in DM (19) and more than 70% of patients with type 2 DM have one or more types of dyslipidemia (20). In a previous study, Yadav et al. reported the prevalence of dyslipidemia as 64.1% in type 2 diabetic patients (21). However, Kaithala et al. reported the prevalence of dyslipidemia, defined as derangement or abnormality in any one of the serum lipids, to be 97.2% in their study sample (22). Likewise, Sarfraz et al. reported that the prevalence of dyslipidemia was 95% in hyperglycemic patients (23), which was similar to the prevalence found in another study as 90.3% in diabetic patients (24). In the present study, dyslipidemia was found 75.8.0% in the elderly and 81.8% in the middle-aged population.

Patients with type 2 DM show characteristic lipid profile of normal or slightly raised LDL-C, with low HDL-C and mildly elevated TG concentration (25). The most common pattern observed previously was mixed type dyslipidemia such as LDL-C, and triglycerides were increased and HDL-C was decreased in type 2 DM (26). However, Agrawal et al. reported that 34% of type 2 diabetics had a high T-C level and 56% had high TG levels (27) and LDL-C was high in 22% patients and HDL-C was low in 52% of the diabetics. In the present study, isolated hypertriglyceridemia (22.9%) and the prevalence of combined two-parameter dyslipidemia was high in elderly patients than that in middle-aged patients with DM, though the mean TG levels were significantly lower in the elderly patients. The loss of appetite and weight are common with advancing age, thus BMI was found to be lower in the older patients than the middle-aged patients. Thus, these factors related to aging may have led to a decline in the TG levels in elderly patients as reported in our study. Besides, the variation of body composition among individuals might have an impact on the results.

Gender affects lipid parameters and this effect is independent of age and menopausal status (28). On the other hand, estrogens increase HDL-C (29,30) but also enhance hepatic clearance of LDL-C (31,32) thus the final result is decreased LDL-C levels. In an earlier study, lower values of body mass index (BMI), TG, T-C/HDL-C ratio and higher levels of HDL-C were reported in women than in men (33). However, Habib et al. observed no difference in the lipid profiles of diabetic females and diabetic males (34). On the other hand, Ali et al. reported that the degree of dyslipidemia increased with the increase in age in both genders (35). The females are more prone to diabetic dyslipidemia and hence have more risk of developing atherosclerosis with increasing age. In another study, Anagnostis et al. suggested that the male gender is associated with a more atherogenic profile than the female gender, with appreciably lower levels of the HDL_2-C subfraction (36). Likewise, combined two-parameter dyslipidemia with high LDL-C and low HDL-C was higher in the elderly diabetic men than that in the middle-aged patients in our study. Isolated hypertriglyceridemia was also common in elderly diabetic men. Hypertriglyceridemia in combination with high LDL-C and isolated low HDL-C were more common in elderly women than middle-aged women.

The limitations of our study include its retrospective design and the study population was limited to internal medicine outpatient clinic, which makes difficult to generalize the results. Besides, the relationship between the variables was out of the scope of this study, thus such relations were not studied.

Conclusion

Though lipid profiles in DM have been widely studied for various purposes, the literature on the differences of the characteristics of the lipid profile in the elderly and the middle-aged patients with DM in relation to gender especially in the Turkish population is scarce. Dyslipidemia profile differed in the older and the middle-aged patients and varied with gender. Considering the fact that nutritional status differs between the elderly and middle-aged population, interventions and suggestions also differ accordingly. Defining the differences in the lipid profile would lead to better care of older patients with DM, especially subsequent prospective interventional studies considering the gender differences would be of great importance.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Fulden Saraç; Design: Fulden Saraç; Control/Supervision: Fulden Saraç, Sumru Savas, Fehmi Akçiçek; Data Collection and/or Processing: Fulden Saraç, Bahattin Gökdemir; Analysis and/or Interpretation: Bahattin Gökdemir; Literature Review: Fulden Saraç; Writing the Article: Fulden Saraç, Sumru Savas, Fehmi Akçiçek; Critical Review: Fulden Saraç, Sumru Savas, Fehmi Akçiçek; References and Fundings: Bahattin Gökdemir; Materials: Bahattin Gökdemir.

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