

## Lipid profile of postmenopausal women

### *Lipidni profil kod žena u u postmenopauzi*

Dunja Šojat, Romana Marušić, Klara Ormanac, Saška Marczi, Tatjana Bačun\*

---

#### Summary

**Objectives:** The main objectives of the research are to examine the incidence of hyperlipoproteinemia in postmenopausal women and to determine the differences in lipid profile considering age, duration of menopause and body mass index in postmenopausal women.

**Respondents and methods:** The research is structured as cross-sectional with historical data. The research used data collected during regular check-ups in primary health care clinics in Osijek Health Center from November 2021 to March 2022. Collected data: demographic data, information on the duration of menopause, body mass, body height, body mass index, values of total, LDL, HDL cholesterol and triglycerides, and data on associated diseases.

**Results:** 98 postmenopausal women were included in the research, of which over 50% had elevated total and LDL cholesterol values, and 39.8% had elevated triglyceride values. Subjects aged 45 to 65 years and subjects with a duration of menopause of 10 or more years had significantly higher values of total and LDL cholesterol while no difference was observed in the lipid profile with regard to the body mass index. Using the SCORE2 table, it was estimated that 65% of the subjects had a very high cardiovascular risk, and only 6% of the subjects achieved the target values of LDL cholesterol in accordance with the cardiovascular risk.

**Conclusion:** There is a very high incidence of hyperlipoproteinemia in postmenopausal women, and the age and duration of menopause have an impact on the poorer achievement of the target values of the lipid profile, while the body mass index showed no impact. Given the high prevalence of subjects with a very high cardiovascular risk (SCORE 2 tables), intensive interventions are needed at all levels of health care, especially at the primary level of health care, which include non-pharmacological and pharmacological methods of treating hyperlipoproteinemia.

**Key words:** cardiovascular diseases; hyperlipoproteinemia; HMG-CoA reductase inhibitors; postmenopause

---

#### Sažetak

**Cilj istraživanja:** Osnovni ciljevi istraživanja jesu ispitati incidenciju hiperlipoproteinemije u žena u postmenopauzi i utvrditi razlike u sastavnicama lipidnog profila obzirom na dob, trajanje menopauze i indeks tjelesne mase.

**Ispitanici i metode:** Istraživanje je ustrojeno kao presječno s povijesnim podacima. Za istraživanje su se koristili podaci prikupljeni u ambulantama primarne zdravstvene zaštite u Domu zdravlja Osijek, od studenoga 2021. do ožujka 2022. g. a prikupljeni su na redovitim kontrolama. Prikupljeni podaci: demografski podaci, podaci o trajanju menopauze, tjelesna masa, tjelesna visina, indeks tjelesne mase, vrijednosti ukupnog, LDL, HDL kolesterola i triglicerida, te podaci o pridruženim bolestima.

---

\* Sveučilište Josipa Jurja Strossmayera, Medicinski fakultet Osijek (Dunja Šojat, dr.med., Romana Marušić, dr.med.; doc.dr.sc. Saška Marczi, dr.med.; izv.prof.prim.dr.sc. Tatjana Bačun, dr.med.); Dom zdravlja Osječko-baranjske županije (Dunja Šojat, dr.med.); Nacionalna memorijalna bolnica „Dr. Juraj Njavro“ Vukovar (Romana Marušić, dr.med.); Klinički bolnički centar Osijek (Klara Ormanac, dr.med.)

Correspondence address /Adresa za dopisivanje: Dunja Šojat, dr.med., Dom zdravlja Osječko-baranjske županije, Park kralja Petra Krešimira IV 6, 31000 Osijek E-mail: [dunja.skojat@gmail.com](mailto:dunja.skojat@gmail.com)

Primljeno/Received 2022-12-07; Ispravljeno/Revised 2023-03-15; Prihvaćeno/Accepted 2023-05-17

**Rezultati:** U istraživanje je uključeno 98 ispitanica od kojih preko 50 % njih ima povišene vrijednosti ukupnog i LDL kolesterola, a 39,8 % povišene vrijednosti triglicerida. Ispitanice starosti 45 do 65 godina i ispitanice s trajanjem menopauze od 10 ili više godina imaju značajno više vrijednosti ukupnog i LDL kolesterola, dok nije uočena razlika u lipidnom profilu obzirom na indeks tjelesne mase. Upotrebom SCORE2 tablice procijenjeno je da 65 % ispitanica ima vrlo visok kardiovaskularni rizik, a samo 6 % ispitanica postiglo je ciljne vrijednosti LDL kolesterola u skladu s kardiovaskularnim rizikom.

**Zaključak:** Incidencija hiperlipoproteinemije u postmenopausalnih žena je vrlo visoka, a starija dob i dulje trajanje menopauze povezani su sa slabijim postizanjem ciljnih vrijednosti lipidnog profila, dok indeks tjelesne mase nije pokazao utjecaj. Obzirom na visoku zastupljenost ispitanica s vrlo visokim kardiovaskularnim rizikom (SCORE 2 tablice), potrebne su intenzivne intervencije na svim razinama zdravstvene zaštite, posebice primarnoj razini zdravstvene zaštite, a koje uključuju i nefarmakološke i farmakološke metode liječenja hiperlipoproteinemija.

**Ključne riječi:** hiperlipoproteinemija; inhibitori HMG-CoA reduktaze; kardiovaskularne bolesti; postmenopauza

Med Jad 2023;53(2):137-144

## Introduction

Menopause is the last period in a woman's reproductive age and is caused by the gradual loss of ovarian function. Menopause is diagnosed retrogradely (when a woman has not had a period for the past twelve months). The average age of women in the Republic of Croatia is 77 years, and the average age at which menopause occurs is 50 years, which means that women spend almost a third of their life in postmenopause.<sup>1</sup> Postmenopause refers to the period that occurs after the last menstruation, and consists of early postmenopause and late postmenopause (occurs after the age of 70). The postmenopausal period is characterized by numerous hormonal changes that include a decrease in the levels of estradiol, progesterone, androgens and growth hormones, which leads to a multitude of symptoms such as hot flashes, night sweats, difficult sleeping, lack of concentration, decline in sexual function, while late consequences include cardiovascular changes, osteoporosis and dementia.<sup>1,2</sup>

In postmenopause, there are also significant changes in the lipid profile that favor increased atherogenesis, namely an increase in the level of total cholesterol, low-density lipoprotein (LDL) cholesterol and a decrease in the level of high-density lipoprotein (HDL) cholesterol.<sup>1,3</sup> In addition, with the onset of menopause, the ratio of total cholesterol to HDL cholesterol increases, and it is considered a better indicator of cardiovascular diseases than the value of total cholesterol.<sup>3</sup> The effect of estrogen in the regulation of vascular resistance and the regulation of thrombogenesis has been proven; via estrogen  $\alpha$  receptors, it stimulates the synthesis of cyclooxygenase 1 (COX-1) and prostacyclin synthase and inhibits the production of prostaglandin H2 and thromboxane A2, which results in vasodilation and antiaggregation effects.<sup>4</sup> In the absence of estrogen,

the values of factor VII, fibrinogen and plasminogen activation inhibitor increase, all of which increase the risk of cardiovascular diseases.<sup>1</sup>

The risk increases significantly if the woman is obese (a special risk is obesity of the central type), suffers from diabetes, hypertension or polycystic ovary syndrome.<sup>1</sup> The connection between type II diabetes and hypoestrogenism in postmenopause is multiple. Postmenopause itself, due to estrogen deficiency, is susceptible to disturbances in glycemic homeostasis.<sup>5</sup> An increase in glycosylated hemoglobin was observed in the group of postmenopausal women, but it should be taken into account that aging itself, together with obesity and smoking, is associated with an increased risk of developing type II diabetes.<sup>6</sup> In women with preexisting type II diabetes, global metabolic, oxidative, and inflammatory damage low estrogen levels increases susceptibility to developing postmenopausal complications such as cardiovascular disease (CVD), osteoporosis, and metabolic syndrome.<sup>7,8</sup>

Due to all of the above, it is extremely important to promptly recognize and treat dyslipidemia in postmenopausal women with increased cardiovascular risk. Prevalence of dyslipidemia in premenopausal women is 35%, while in postmenopausal women it is 65.2%. Dyslipidemia is highly correlated with the development of hypertension and diabetes and represents a high risk factor for the occurrence of cardiovascular disease.<sup>9</sup> In a woman aged 50, the probability of developing coronary disease during her lifetime is 46%, and the probability of death from it is 31%. The probability of developing a cerebrovascular insult in the postmenopausal age is 20%, and the probability of death is 8%.<sup>1</sup>

The main therapeutic approach in patients with dyslipidemia, also in postmenopausal women, is to

lower the level of LDL cholesterol, all in order to reduce the risk of developing or progressing cardiovascular disease. For this reason, special target values were set based on the associated cardiovascular risk determined according to the SCORE2 tables.<sup>10</sup> Target values are listed in Table 1.

Table 1 Target values and therapeutic goals for the prevention of cardiovascular diseases

Tablica 1. Ciljne vrijednosti i terapijski ciljevi za prevenciju kardiovaskularnih bolesti

Cardiovascular risk <i>Kardiovaskularni rizik</i>	Target values and therapeutic goals <i>Ciljne vrijednosti i terapijski ciljevi</i>
Low/ <i>niski</i>	LDL cholesterol/ <i>LDL kolesterol</i> < 3.0 mmol/L
Moderate/ <i>umjereni</i>	LDL cholesterol / <i>LDL kolesterol</i> < 2.6 mmol/L
High/ <i>visoki</i>	LDL cholesterol < 1.8 mmol/L and/or reduction of initial LDL values 50% or more <i>LDL- kolesterol &lt; 1.8 mmol/L i/ili smanjenje početnih vrijednosti LDL kolesterola za 50 % i više</i>
Very high/ <i>vrlo visoki</i>	LDL cholesterol < 1.4 mmol/L and/or reduction of initial LDL values by 50 % or more <i>LDL- kolesterol &lt; 1.4 mmol/L i/ili smanjenje početnih vrijednosti LDL kolesterola za 50 posto ili više</i>

Current recommendations are to screen for hyperlipidemia during systematic examinations in all persons with an increased risk of developing hyperlipidemia, all men over 40 years of age and all women over 50 years of age, regardless of the presence of possible comorbidities.<sup>11</sup>

The goals of our research were to examine the frequency of hyperlipoproteinemia in postmenopausal women and to determine differences in the lipid profile in relation to age, duration of postmenopause and body mass index.

### Respondents and methods

The research was organized as a cross-sectional study with historical data and was conducted in the Osijek Health Center, in primary health care clinics, in the period from November 2021 to March 2022. The research was approved by the Ethics Committee of the Faculty of Medicine Osijek, J.J. Strossmayer University in Osijek. Data was collected through regular controls from the database "Central Health

Information System of the Republic of Croatia" (CEZIH) in primary health care clinics in Osijek Health Center. The collected data is anonymous. Collected data: demographic data, data on duration of postmenopause, body mass, body height, body mass index (BMI), values of total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides and data on associated comorbidities.

Categorical data are represented by absolute and relative frequencies. Differences in categorical data were tested with Fisher's exact test. The normality of the distribution of continuous variables was tested with the Shapiro - Wilk test. Due to the distribution of continuous variables that do not follow a normal distribution, continuous data are described by the median and interquartile range. Differences in numerical variables between two independent groups were tested with the Mann Whitney U test, and between three or more groups with the Kruskal Wallis test (post hoc Conover). All P values are two-sided. The significance level was set at Alpha = 0.05. For statistical analysis we used the statistical program MedCalc® Statistical Software version 20.026 (*MedCalc Software Ltd, Ostend, Belgium; https://www.medcalc.org; 2022*) and SPSS ver. 23 (*IBM Corp. Released 2015. IBM SPSS, Ver. 23.0. Armonk, NY: IBM Corp.*).

### Results

The research was conducted on 98 female subjects with a median age of 68, while the median duration of postmenopause was 17 years. The median body height of the test subjects is 166 cm, and the body weight is 73 kg. The median body mass index in the test subjects is 27.67 kg/m<sup>2</sup>.

The largest number of respondents, 43% of them, belong to the age group of 45 to 64 years, while in 57% of respondents, menopause lasts from 10 to 29 years. 24% of the subjects were of normal body weight, as many as 59% were overweight (BMI 25.0 - 29.9 kg/m<sup>2</sup>), and 17% were obese. 2% of the subjects had third-degree obesity with a body mass index greater than 40 kg/m<sup>2</sup>.

The most common comorbidity is arterial hypertension, which is present in 80.6% of the respondents, while in second place are thyroid diseases and type 2 diabetes (31.6%). 10.2% of the subjects had a diagnosis of atrial fibrillation, and 8.2% had a diagnosis of chronic kidney disease. 12.2% of the subjects had a history of acute myocardial infarction or cerebrovascular incident. The values of the lipid profile are shown in detail in Table 2.

Table 2 Lipid profile of postmenopausal women who participated in the research

Tablica 2. Lipidni profil postmenopausalnih žena uključenih u istraživanje

	Median (interquartile range) <i>Medijan</i> ( <i>interkvartilni</i> <i>raspon</i> )	Range (minimum – maximum) <i>Raspon</i> ( <i>minimum –</i> <i>maksimum</i> )
Total cholesterol (mmol/L) <i>Ukupni</i> <i>kolesterol</i> ( <i>mmol/L</i> )	5.60 (4.50 – 6.80)	2.70 – 9.60
HDL cholesterol (mmol/L) <i>HDL-</i> <i>kolesterol</i> ( <i>mmol/L</i> )	1.50 (1.20 – 1.70)	0.70 – 3.40
LDL cholesterol (mmol/L) <i>LDL-</i> <i>kolesterol</i> ( <i>mmol/L</i> )	3.25 (2.48 – 4.33)	1.20 – 6.40
Triglycerides (mmol/L) <i>Trigliceridi</i> ( <i>mmol/L</i> )	1.50 (1.10 – 2.10)	0.60 – 6.10

Regarding the lipid status values, it can be observed that more than 50% of the subjects have total cholesterol and LDL cholesterol above the recommended values, while triglyceride values are above the recommended values in 39.8% of the subjects (Table 3). The recommended values used in our study were as follows: total cholesterol < 5 mmol/L, LDL cholesterol < 3 mmol/L, triglycerides < 1.7 mmol/L, HDL cholesterol > 1 mmol/L in men and > 1.5 mmol/L in women.

The values of total cholesterol (Kruskal Wallis test, P = 0.001) and LDL cholesterol (Kruskal Wallis test, P = 0.01) are significantly higher in the group of respondents aged 45 to 64 years, compared to older respondents (Table 4) while no significant differences were found in the lipid profile in relation to the duration of postmenopause and the level of nutrition. Statin therapy is used by 40 (40.8%) women, and considering the type and dose, the most common therapy is atorvastatin in a dose of 20 mg (Table 5).

Most of the respondents, 65% of them, have a very high cardiovascular risk, 24% of the respondents have a high cardiovascular risk, and 10% of the respondents have a moderate cardiovascular risk. Target values of LDL cholesterol according to the associated cardiovascular risk were achieved by only 6% of the subjects. Subjects who did not reach the target values are significantly older compared to the subjects who reached the lipid profile target values (Mann Whitney U test, P = 0.01). Also, subjects who did not achieve the target values were significantly longer in postmenopause compared to subjects who achieved the target values (Mann Whitney U test, P = 0.009). No association of body mass index with the achievement of lipid profile target values was found (Table 6).

Table 3 Distribution of the respondents according to the reference values of lipoproteins

Tablica 3. Raspodjela ispitanica prema referentnim vrijednostima lipoproteina

	Number (%) of respondents <i>Broj (%) ispitanica</i>	
	Within the recommended values <i>Unutar</i> <i>preporučenih</i> <i>vrijednosti</i>	Above the recommended values <i>Izvan</i> <i>preporučenih</i> <i>vrijednosti</i>
Total cholesterol (mmol/L) <i>Ukupni</i> <i>kolesterol</i> ( <i>mmol/L</i> )	34 (34.7)	64 (65.3)
HDL cholesterol (mmol/L) <i>HDL-kolesterol</i> ( <i>mmol/L</i> )	38 (38.7)	60 (61.2)
LDL cholesterol (mmol/L) <i>LDL-</i> <i>kolesterol</i> ( <i>mmol/L</i> )	44 (44.9)	54 (55.1)
Triglycerides (mmol/L) <i>Trigliceridi</i> ( <i>mmol/L</i> )	59 (60.2)	39 (39.8)

Table 4 Lipid profile of postmenopausal women in relation to age groups  
 Tablica 4. Lipidni profil postmenopausalnih žena obzirom na dobne skupine

	Median (interquartile range) according to age groups <i>Medijan (interkvartilni raspon po dobnim skupinama)</i>			P*
	45 – 64	65 - 79	80 and more <i>80 i više</i>	
Total cholesterol (mmol/L) <i>Ukupni kolesterol (mmol/L)</i>	6.15 (5.4 – 7.1)	5,0 (4.4 – 6.6)	4.8 (4.2 – 5.5)	<b>0.001</b> †
HDL cholesterol (mmol/L) <i>HDL-kolesterol (mmol/L)</i>	1,6 (1.3 - 1.9)	1,4 (1.2 – 1.60)	1.4 (1.1 – 1.5)	0.06
LDL cholesterol mmol/L <i>LDL-kolesterol (mmol/L)</i>	3.9 (2.9 – 4.7)	2.8 (2.2 – 4.2)	2.6 (2.2 – 3.4)	<b>0.01</b> †
Triglycerides (mmol/L) <i>Trigliceridi (mmol/L)</i>	1.6 (1.1 – 2.2)	1.5 (1.1 – 1.8)	1.36 (0.9 – 2.1)	0.28

\*Kruskal Wallis test (post hoc Conover); Bold denotes statistical significance/*Podebljano označava statističku značajnost*  
 †at the P<0.05 level, higher values are significant in the 45-64 age group/*†na razini P<0.05 značajne su više vrijednosti u skupini od 45 – 64 godine*

Table 5 Use of statin therapy in postmenopausal women  
 Tablica 5. Korištenje statinske terapije u postmenopausalnih žena

Therapy – dose <i>Terapija - doza</i>	Number (%) of respondents <i>Broj (%) ispitanica</i>
atorvastatin – 10 mg	4 (4.1)
atorvastatin – 20 mg	13 (13.3)
atorvastatin – 40 mg	8 (8.2)
atorvastatin – 80 mg	1 (1)
rosuvastatin – 10 mg	4 (4,1)
rosuvastatin – 20 mg	8 (8.2)
rosuvastatin – 40 mg	2 (2)
ezetimib - 10 mg	3 (3.1)

Table 6 Differences in age, duration of postmenopause and body mass index in relation to achieving the target values of all components of the lipid profile

Tablica 6. Razlike u dobi, trajanju menopauze i indeksu tjelesne mase u odnosu na postizanje ciljnih vrijednosti svih sastavnica lipidnog profila

	Median (interquartile range) <i>Prosjek</i> <i>(interkvartilni raspon)</i>		Difference <i>Razlika</i>	95 % confidence interval of the difference <i>95% interval</i> <i>pouzdanosti razlike</i>		P*
	Did not achieved target values <i>Nisu postigle</i> <i>ciljne vrijednosti</i>	Achieved target values <i>Postigle su ciljne</i> <i>vrijednosti</i>		From/od	To/do	
	Age (years) <i>Dob (godine)</i>	69 (61 – 77)		56 (54 – 58)	-10	
Postmenopause duration (years) <i>Trajanje</i> <i>postmenopauze</i> <i>(godine)</i>	18 (10 – 27)	5 (3 – 6)	-10	-19	-3	<b>0.009</b>
Body mass index (kg/m <sup>2</sup> ) <i>Indeks tjelesne</i> <i>mase (kg/m<sup>2</sup>)</i>	27.74 (25.2 – 29.1)	26.65 (22.23 – 27.43)	-1.62	-5.46	0.99	0.21

\*Mann Whitney U test; Bold denotes statistical significance/*Podebljano označava statističku značajnost*

Considering the present comorbidities, subjects with arterial hypertension achieved significantly less lipid profile target values (Fisher's exact test,  $P = 0.01$ ), while there is no significant difference in achieving target values compared to other comorbidities.

### Discussion

Cardiovascular diseases are the leading cause of death in women and are responsible for 50% of deaths of which 20% are attributed to ischemic heart disease and 15% to cerebrovascular insult. Ischemic heart disease appears on average 7-10 years later in the female population compared to the male population, and this is attributed to the protective effects of estrogen on the progression of atherosclerotic processes.<sup>12</sup> Many studies have shown a significant increase in the prevalence of dyslipidemia associated with a woman's older age; in the third decade of life, the prevalence is 14.9%, and by the age of 60, this percentage rises to 56.4%.<sup>13</sup>

In our research, data was collected on 98 women in the postmenopausal period. The youngest respondent was 46 years old and the oldest 87 years old, therefore the median age is 68 years. The most frequently recorded comorbidity in this study was arterial hypertension, which was recorded in 80.6% of the subjects. Also, subjects with associated arterial hypertension achieved the target values of lipid parameters less. Other recorded comorbidities did not have the same impact. The increased prevalence of hypertension in the perimenopausal and postmenopausal period has been undoubtedly proven, but there are divided opinions about the role of menopause itself in the development of hypertension.<sup>14,15</sup> The increased prevalence of hypertension may be a consequence of the aging process itself and the associated reduced vascular elasticity and atherogenic processes.<sup>16</sup> Some studies suggest that an increased body mass index and the presence of metabolic syndrome contribute to the increased prevalence of hypertension in perimenopausal women more than menopause itself.<sup>15</sup> On the other hand, it is known that the prevalence of hypertension and cardiovascular diseases is significantly lower in premenopausal women compared to the male population of the same age, but this advantage is lost after the age of 45 when morbidity rates from cardiovascular diseases increase faster in the female population.<sup>14,16,17</sup> The next comorbidity in terms of frequency in our patients is thyroid disease, with 31 subjects suffering from it, and the same number suffering from diabetes. Thyroid diseases occur more often in the female

population, their incidence is 5-20 times more common in women than in men. Research showed that the incidence of increased TSH in the general female population is 7.6%, while it is 17% in women over 70 years old.<sup>18</sup> Most studies also have found that total cholesterol, triglyceride, low-density and very low-density lipoprotein cholesterol levels are higher in clinical hypothyroidism and lower in clinical hyperthyroidism.<sup>19,20</sup> Changes in the lipid profile have also been extensively reported in subclinical thyroid function, but no consistent conclusion has been reached. Some studies found no significant differences in lipids between patients with subclinical hypothyroidism and those with normal thyroid function.<sup>21</sup>

It was observed that more than half of the subjects had total and LDL cholesterol values above the recommended values, while triglyceride values were above the reference value in 39.8% of the subjects. Our results are supported by earlier studies, and the above is explained by the well-established modulation of the LDL receptor by estrogen, which is lost in menopause. Older age is associated with less achieved target values of lipid profile parameters. In this study, elderly subjects have significantly worse lipid profile values overall. Significantly higher values of total cholesterol and LDL cholesterol were observed in the age group of 45-64 years. Longer duration of postmenopause (10 years and more), in line with older age, is also associated with worse lipid profile values. It is difficult to determine how much influence the menopause has on the proatherogenic lipid profile, and thus on the increased cardiovascular risk, compared to the biological processes of aging, since the two processes mentioned are closely related and dependent on each other.<sup>22</sup> In this study, the body mass index did not show an influence on the achievement of the target values of the lipid profile parameters.

In our study, 40.8% of the subjects used statin therapy, and the most frequently prescribed therapy was atorvastatin in a dose of 20 mg. The given dose of atorvastatin belongs to the category of moderate intensity therapy, which is expected to reduce the value of LDL cholesterol by 30 to 49%.<sup>13</sup> The reduction in the value of LDL cholesterol is proportional to the values before the start of therapy, therefore, when choosing the intensity of statin therapy, the percentage of reduction in the value of serum LDL cholesterol is considered. In a study conducted on 35 postmenopausal women, after 8 weeks of atorvastatin therapy at a dose of 20 mg, the vast majority of subjects achieved LDL target values. The remaining test subjects received an increased dose of atorvastatin of 40 mg in the next 8 weeks, and

they also achieved the target values after a total of 16 weeks of statin treatment.<sup>23</sup>

To assess cardiovascular risk, SCORE (Systemic Coronary Risk Estimation) tables are used, which estimate the ten-year risk of developing the first fatal atherosclerotic event.<sup>24</sup> The latest guidelines published in 2021 by the European Society of Cardiology contain new SCORE2 tables, that estimate the ten-year risk of fatal and non-fatal cardiovascular events. In this study, the SCORE2 table for high-risk countries (Croatia) was used to assess cardiovascular risk. Out of 98 test subjects, 64 of them had an estimated very high risk. According to the estimated cardiovascular risk and the associated values of LDL cholesterol, it was determined that only 6 subjects achieved the target values of LDL cholesterol. A possible explanation for the above results is the short period of time between the publication of the latest guidelines and their implementation in clinical practice.

In one study, estimates of cardiovascular risk in patients with systemic lupus erythematosus obtained using the SCORE2 tables were compared with the previously used SCORE table. According to the SCORE table, 3% of respondents pertain to the high risk category, and 8% of them pertain to the very high risk category. When a new assessment was made according to the SCORE2 table, 29% of the respondents now are in the high risk category and 1% of the respondents are in the very high risk category. In addition to the mentioned differences, further research revealed that even 63% of respondents in the high and 74% of respondents in the very high category according to the SCORE2 table did not have statin therapy. SCORE2 tables change not only the approach to the assessment of cardiovascular risk, but also the target value of LDL cholesterol, which needs to be adjusted to the latest guidelines in accordance with the estimated cardiovascular risk, and thus the indications for the use of pharmacological therapy.<sup>25</sup>

A similar study was conducted in which 1168 patients with rheumatoid arthritis participated. According to the SCORE table, 12% of the respondents belonged to the high risk category, and 8% of the respondents belonged to the very high risk category. According to the re-evaluation (SCORE2 table) 34% of the respondents pertain to the high risk category, and 8% of the respondents pertain to the very high risk category.<sup>26</sup> As both studies showed significant differences between the percentages of subjects in certain categories, it is certainly necessary to emphasize the need to adapt to the latest guidelines and to change the existing therapy in the subjects in order to achieve the target values of LDL cholesterol. Due to estrogen deficiency, postmenopausal women

are at an increased risk of developing cardiovascular diseases, which is certainly influenced by increased waist circumference, hypertension, hypertriglyceridemia, hyperglycemia, and reduced HDL cholesterol values, which are often present.<sup>27</sup> In a study conducted on 271 postmenopausal women, it was shown that waist circumference and waist-to-hip ratio exceeded the recommended values in normolipemic and hyperlipemic women. The same study proved the association of genetic polymorphisms with eating habits of postmenopausal women with dyslipidemia. In the aforementioned study, dyslipidemia was proven for the first time in 80% of the subjects.<sup>28</sup> The beneficial effects of moderate physical activity on reducing the progression of atherosclerosis and the stiffness of blood vessels are known. Study also showed that 30 minutes of moderate intensity training on a treadmill over 3 months increased HDL cholesterol values by 30%, decreased LDL cholesterol values by 30% and triglyceride values by 18%. In addition to the above, physical activity in postmenopausal women can help in the development of muscle mass, thereby improving the symptoms of osteoporosis and the overall quality of life.<sup>29</sup>

## Conclusion

Based on the conducted research, it can be concluded that postmenopausal women have a high incidence of hyperlipidemia and LDL cholesterol values are significantly higher in the age group between 45 and 64 years. Older test subjects and those whose postmenopause lasts for 10 or more years are less likely to achieve the target values of all components of the lipid profile, while the influence of the body mass index in this case was not observed. Also, subjects with associated arterial hypertension have significantly higher lipid profile values. Although women generally have a lower cardiovascular risk, due to postmenopausal changes, this risk increases and LDL cholesterol levels may be higher than in men of the same age. That is why it is crucial to control postmenopausal women and their lipid profile, especially if they belong to the category of high and very high cardiovascular risk. It is therefore crucial to adequately assess cardiovascular risk (SCORE2 tables) preventively at all levels of health care and, based on them, to categorize patients into risk groups so that we can recommend and introduce adequate pharmacotherapy and intervene to change lifestyle (diet and physical activity).

### References

1. Šimunić V i sur. Ginekologija. 2. izdanje. Zagreb: Naklada Ljevak; 2001.
2. Lobo RA, Gompel A. Management of menopause: a view towards prevention. *Lancet Diabetes Endocrinol.* 2022;10:457-70.
3. Ko SH, Kim HS. Menopause-Associated Lipid Metabolic Disorders and Foods Beneficial for Postmenopausal Women. *Nutrients.* 2020;12:202.
4. Novella S, Pérez Cremades D, Mompeón A, Hermenegildo C. Mechanisms underlying the influence of oestrogen on cardiovascular physiology in women. *JPhysiol.* 2019;597:4873–4886.
5. Anklam CFV, Lissarassa YPS, Dos Santos AB et al. Oxidative and Cellular Stress Markers in Postmenopause Women with Diabetes: The Impact of Years of Menopause. *J Diabetes Res* 2021;3314871.
6. Nogueira IAL, Da Cruz ÉJSN, Fontenele AMM, Figueiredo Neto JAD. Alterations in postmenopausal plasmatic lipidome. *Plos One* 2018;13:e0203027.
7. Ko SH, Jung Y. Energy Metabolism Changes and Dysregulated Lipid Metabolism in Postmenopausal Women. *Nutrients.* 2021;13:4556.
8. Nappi RE, Chedraui P, Lambrinoudaki I, Simoncini T. Menopause: a cardiometabolic transition. *Lancet Diabetes Endocrinol.* 2022;10:442-456.
9. Jeong J, Kim M. Awareness and Related Factors of Dyslipidemia in Menopausal Women in Korea. *Healthcare (Basel)* 2022;10:112.
10. Authors/Task Force Members; ESC Committee for Practice Guidelines 2019 ESC/EAS guidelines for the management of dyslipidaemias: Lipid modification to reduce cardiovascular risk. *Atherosclerosis.* 2019;290:140–205.
11. Milić D, Mirat J, Včev A i sur. *Interna medicina.* 1. izd. Osijek: Medicinski fakultet Osijek, 2021.
12. Honigberg MC, Zekavat SM, Aragam K et al. Association of Premature Natural and Surgical Menopause With Incident Cardiovascular Disease. *JAMA.* 2019;322:2411-2421.
13. Cho SMJ, Lee HJ, Shim JS, Song BM, Kim HC. Associations between age and dyslipidemia are differed by education level: The Cardiovascular and Metabolic Diseases Etiology Research Center (CMERC) cohort. *Lipids Health Dis* 2020;19:12
14. Liu S, Ding T, Liu H, Jian L. GPER was associated with hypertension in post-menopausal women. *Open Med.* 2018;13:338–43.
15. Oh GC, Kang KS, Park CS et al. Metabolic syndrome, not menopause, is a risk factor for hypertension in peri-menopausal women. *Clin Hypertens* 2018;24
16. Anagnostis P, Lambrinoudaki I, Stevenson JC, Goulis DG. Menopause-associated risk of cardiovascular disease. *Endocr Connect* 2022;11:e210537.
17. Su D, Song A, Yan B et al. Circadian Blood Pressure Variations in Postmenopausal Females with Hypertension. *Int Heart J.* 2018;59:361–366.
18. Gietka-Czernel M. The thyroid gland in postmenopausal women: physiology and diseases. *Menopausal Review. Prz Menopauzalny.* 2017;2:33–37.
19. Chen Y, Wu X, Wu Ret al. Changes in Profile of Lipids and Adipokines in Patients With Newly Diagnosed Hypothyroidism and Hyperthyroidism. *Sci Rep.* 2016;6:26174.
20. Sigal GA, Tavoni TM, Silva BMO, Kalil Filho R, Brandao LG, Maranhao RC. Effects of Short-Term Hypothyroidism on the Lipid Transfer to High-Density Lipoprotein and Other Parameters Related to Lipoprotein Metabolism in Patients Submitted to Thyroidectomy for Thyroid Cancer. *Thyroid.* 2019;29:53-58.
21. Bell RJ, Rivera-Woll R, Davison SL, Topliss DJ, Donath S, Davis SR. Well-Being, Health-Related Quality of Life and Cardiovascular Disease Risk Profile in Women With Subclinical Thyroid Disease? A Community-Based Study. *Clin Endocrinol* 2007;66:548–56.
22. Merz AA, Cheng S. Sex differences in cardiovascular ageing. *Heart;* 2016;102:825–831.
23. Moon J, Yoo S, Koh G, Min K-W, Shin HH. Efficacy and Safety of High-Dose Atorvastatin in Moderate-to-High Cardiovascular Risk Postmenopausal Korean Women with Dyslipidemia. *J Lipid Atheroscler* 2020;9:162-171.
24. Mach F, Baigent C, Catapano AL et al. 2019 ESC/EAS Guidelines for the management of dyslipidaemias: lipid modification to reduce cardiovascular risk. *Eur Heart J* 2020;41:111–188.
25. Quevedo-Abeledo JC, González-Gay MÁ, Ferraz-Amaro I. SCORE2 versus SCORE in patients with systemic lupus erythematosus. *Ther Adv Musculoskelet Dis* 2022;14:1759720X221092373.
26. Ferraz-Amaro I, Corrales A, Atienza-Mateo B et al. SCORE2 Assessment in the Calculation of Cardiovascular Risk in Patients with Rheumatoid Arthritis. *Diagnostics (Basel)* 2021;11:2363.
27. Bobescu E, Bălan A, Moga MA, Teodorescu A, Mitrică M, Dima L. Are There Any Beneficial Effects of Spirulina Supplementation for Metabolic Syndrome Components in Postmenopausal Women? *Mar Drugs* 2020;18:651.
28. Grygiel-Górniak B, Kaczmarek E, Mosor M, Przysławski J, Nowak J. The gene-diet associations in postmenopausal women with newly diagnosed dyslipidemia. *J Nutr Health Aging* 2017;21:1031–1037.
29. Chrysant SG. The cardiometabolic benefits of exercise in postmenopausal women. *J Clin Hypertens* 2020;22:1691–1693.