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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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LDL-CHOLESTEROL LOWERING WITH ATORVASTATIN, ROSUVASTATIN AND SIMVASTATIN: RESULTS OF A RETROSPECTIVE OBSERVATIONAL STUDY

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Abstract.

Background: Reduction of low-density lipoprotein cholesterol (LDL-C) is a central strategy in the primary and secondary prevention of cardiovascular disease. Statins are the most widely prescribed lipid-lowering agents. However, real-world evidence comparing their relative effectiveness in primary health care settings in middle-income countries remains limited.

Objective: To evaluate and compare the pharmacological effectiveness of atorvastatin, rosuvastatin, and simvastatin in reducing LDL-cholesterol and to assess the impact of combination therapy with ezetimibe on achieving LDL therapeutic targets in routine clinical practice.

Methods: A retrospective observational study was conducted at the Main Family Medicine Center in Ferizaj between January 1 and December 1, 2025. A total of 1,100 adult patients (≥18 years) receiving statin therapy for at least three months were included. Baseline and follow-up LDL-cholesterol levels were analyzed at individual and intergroup levels. Statistical analysis included parametric and non-parametric tests according to data distribution, analysis of variance (ANOVA) for between-group comparisons, and binary logistic regression to identify predictors of LDL target achievement. A p-value <0.05 was considered statistically significant.

Results: Rosuvastatin was associated with the greatest mean reduction in LDL-cholesterol, followed by atorvastatin, while simvastatin demonstrated lower effectiveness. Differences between treatment groups were statistically significant (ANOVA, $p < 0.001$). Patients receiving combination therapy with a statin plus ezetimibe were significantly more likely to achieve LDL therapeutic targets compared with those on statin monotherapy (OR > 1, $p < 0.01$). Multivariate analysis identified statin type and treatment intensity as independent predictors of LDL-cholesterol reduction.

Conclusion: Rosuvastatin and atorvastatin were associated with greater LDL-cholesterol reduction compared with simvastatin in primary health care. Combination therapy with ezetimibe significantly increased the likelihood of achieving therapeutic LDL targets.

Key words. Statins, LDL-cholesterol, atorvastatin, rosuvastatin, simvastatin, ezetimibe, primary health care, dyslipidemia.

Introduction.

Cardiovascular diseases remain the leading cause of mortality worldwide and represent a major public health burden in both high-income and low- and middle-income countries [1,2]. Elevated low-density lipoprotein cholesterol (LDL-C) is one of the most important and modifiable risk factors for atherosclerotic cardiovascular disease. Strong causal evidence confirms a linear association between LDL-C levels and the incidence of myocardial infarction, ischemic stroke, and cardiovascular mortality, supporting the "lower is better" concept in lipid management [3,4].

Statins constitute the cornerstone of lipid-lowering therapy and are universally recommended as first-line agents by major international guidelines [5-7]. Their mechanism of action involves inhibition of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase, resulting in reduced hepatic cholesterol synthesis and increased expression of LDL receptors, thereby enhancing LDL clearance from the circulation [5]. Despite their well-established efficacy, real-world data demonstrate considerable interindividual variability in therapeutic response, influenced by genetic factors, disease severity, treatment adherence, and drug–drug interactions [6,8].

Atorvastatin, rosuvastatin, and simvastatin remain among the most frequently prescribed statins worldwide. These agents differ in their pharmacokinetic and pharmacodynamic properties, affecting lipid-lowering potency, bioavailability, and interaction profiles. Rosuvastatin is characterized by minimal cytochrome P450 metabolism and high LDL-C–lowering efficacy, whereas atorvastatin and simvastatin undergo extensive metabolism via CYP3A4, increasing the potential for drug–drug interactions [5,9]. These pharmacological differences may result in clinically relevant variation in lipid responses, particularly among elderly patients and individuals with multiple comorbidities.

Current European and American guidelines strongly recommend high-intensity statin therapy for patients at very high cardiovascular risk and advocate early treatment intensification when LDL-C targets are not achieved [5-7]. In recent years, combination therapy with ezetimibe has become an important component of contemporary lipid-lowering strategies. By inhibiting intestinal cholesterol absorption via the Niemann–Pick C1-like 1 (NPC1L1) transporter, ezetimibe provides additional LDL-C reduction when combined with statins [6,10].

Real-world observational studies from Europe and North America indicate that patients receiving statin–ezetimibe combination therapy are significantly more likely to achieve guideline-recommended LDL-C targets compared with those treated with statin monotherapy [11,12]. Nevertheless, registry data consistently show that a substantial proportion of high-risk patients fail to reach optimal lipid control, highlighting persistent gaps between guideline recommendations and routine clinical practice [8,11].

Although randomized controlled trials provide robust evidence for the efficacy of lipid-lowering therapies, data from real-world primary care settings in Southeastern Europe remain

limited. Variations in prescribing practices, restricted access to combination therapies, and inconsistent lipid monitoring may influence treatment outcomes in these healthcare systems [1,2]. Consequently, real-world studies are needed to bridge the translational gap between clinical trial evidence and everyday clinical practice.

In this context, the present study aims to perform a comparative evaluation of atorvastatin, rosuvastatin, and simvastatin in lowering LDL-cholesterol and to assess the clinical impact of statin–ezetimibe combination therapy on therapeutic goal attainment in a primary health care setting. The findings are intended to contribute evidence relevant to optimizing dyslipidaemia management and supporting individualized, risk-based lipid-lowering strategies.

Materials and Methods.

This study was designed as a retrospective, observational, comparative study based on real-world clinical data. The aim was to evaluate the pharmacological effectiveness of atorvastatin, rosuvastatin, and simvastatin in reducing LDL-cholesterol and to assess the role of combination therapy with ezetimibe in achieving therapeutic LDL targets.

The study was conducted at the Main Family Medicine Center in Ferizaj, Kosovo, during the period from January 1 to December 1, 2025. Data were obtained from electronic medical records and institutional laboratory databases.

A total of 1,100 adult patients aged 18 years or older were included. All patients had received atorvastatin, rosuvastatin, or simvastatin therapy for a minimum duration of three months. Patients were consecutively selected during the study period based on predefined inclusion criteria.

Inclusion criteria comprised adult patients with at least one documented LDL-cholesterol measurement prior to initiation of statin therapy and at least one follow-up LDL-cholesterol measurement obtained after a minimum of three months of treatment, with complete information regarding statin type and dosage. Patients were excluded if laboratory data were incomplete, statin therapy was changed during the follow-up period, PCSK9 inhibitors were used, or if documented liver disease, end-stage renal disease, or untreated thyroid dysfunction was present. Patients receiving lipid-lowering therapies other than ezetimibe were excluded from the primary analysis. Combination therapy with ezetimibe was analyzed as a separate group.

Patients were classified into four therapeutic groups: atorvastatin monotherapy, rosuvastatin monotherapy, simvastatin monotherapy, and combination therapy with a statin plus ezetimibe. Statin treatment was further categorized according to treatment intensity (low-, moderate-, or high-intensity), in accordance with current European guidelines for the management of dyslipidaemia.

Statin dosages were prescribed according to routine clinical practice and guideline-recommended intensity categories. The most frequently used daily doses were atorvastatin 10–40 mg, rosuvastatin 5–20 mg, and simvastatin 10–40 mg. In the combination therapy group, ezetimibe was administered at a standard dose of 10 mg daily in addition to ongoing statin therapy. The statin plus ezetimibe group included patients receiving different statins and dose intensities, reflecting real-world treatment escalation rather than a uniform high-potency statin regimen.

Primary outcome measures included baseline and follow-up LDL-cholesterol levels, absolute and percentage reductions in LDL-cholesterol, and achievement of LDL therapeutic targets. Secondary outcome measures included total cholesterol, high-density lipoprotein cholesterol (HDL-C), triglyceride levels, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and creatine kinase, when available. Demographic and clinical variables included age, sex, presence of diabetes mellitus, arterial hypertension, and established cardiovascular disease.

Data extraction from electronic medical records was performed by trained personnel using a standardized data collection form. For each patient, the LDL-cholesterol value closest to treatment initiation and the first LDL-cholesterol measurement obtained after at least three months of therapy were included in the analysis.

Statistical analysis was performed using standard statistical software packages. Data normality was assessed using the Shapiro–Wilk test. One-way analysis of variance (ANOVA) was applied to normally distributed variables, while the Kruskal–Walli's test was used for non-normally distributed data. Post hoc comparisons were conducted using the Bonferroni correction for multiple testing. Binary logistic regression analysis was employed to identify independent predictors associated with achievement of LDL therapeutic targets. A p-value of less than 0.05 was considered statistically significant.

The study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the relevant institutional and ethics committees. All patient data were anonymized prior to analysis and handled confidentially.

Results.

The results section presents a comprehensive analysis of demographic, clinical, pharmacological, and biochemical data from 1100 adult patients treated with statin therapy in a real-world primary health care setting. Outcomes were evaluated across three statin monotherapy groups (atorvastatin, rosuvastatin, and simvastatin) and a combination therapy group receiving statin plus ezetimibe. The analyses focus on differences in patient characteristics, treatment intensity, lipid profile changes, safety indicators, and achievement of LDL therapeutic targets. Given the differences in baseline LDL-cholesterol levels between treatment groups, percentage reduction in LDL-C was considered a key comparative outcome in addition to absolute changes. Comparative statistical testing was applied to identify significant associations between statin type, clinical variables, and treatment outcomes. Multivariate regression analysis further explored independent predictors of LDL target attainment. The results are presented in eight tables summarizing patient demographics, clinical profiles, lipid responses, and safety parameters. Collectively, these findings provide insight into prescribing patterns and treatment effectiveness in routine clinical practice.

Table 1. *Demographic characteristics of patients by statin therapy (n = 1100).*

Variable	Atorvastatin (n=460)	Rosuvastatin (n=380)	Simvastatin (n=260)	p-value
Mean age (years ± SD)	59.8 ± 11.2	61.3 ± 10.4	57.1 ± 12.5	0.003
Male (%)	56.3	58.7	51.9	0.041
Female (%)	43.7	41.3	48.1	–
Mean BMI (kg/m² ± SD)	27.8 ± 4.3	28.1 ± 4.1	27.2 ± 4.6	0.087

Table 2. *Clinical profile of patients according to statin therapy.*

Comorbidity	Atorva (%)	Rosuva (%)	Simva (%)	p-value
Diabetes mellitus	33.2	41.9	28.5	<0.001
Hypertension	61.5	65.3	58.2	0.021
Cardiovascular disease	29.8	39.5	21.1	<0.001

Table 3. *Distribution of statin treatment intensity.*

Intensity level	Atorva (%)	Rosuva (%)	Simva (%)	p-value
Low-intensity	14.3	8.7	38.5	<0.001
Moderate-intensity	52.1	43.2	47.9	0.014
High-intensity	33.6	48.1	13.6	<0.001

Table 4. *LDL-cholesterol before and after treatment.*

Statin	Baseline LDL (mg/dL)	Follow-up LDL (mg/dL)	Mean reduction	p-value
Atorvastatin	164.2 ± 28.3	94.6 ± 21.2	69.6	<0.001
Rosuvastatin	168.7 ± 26.9	82.3 ± 18.5	86.4	<0.001
Simvastatin	159.4 ± 30.1	109.7 ± 24.1	49.7	<0.001

Table 5. *Achievement of LDL therapeutic targets.*

Group	Target achieved (%)	OR (95% CI)	p-value
Atorvastatin	62.1	1.60 (1.2–2.1)	0.002
Rosuvastatin	71.4	2.34 (1.8–3.0)	<0.001
Simvastatin	38.9	Reference	–
Statin + Ezetimibe	83.2	3.67 (2.7–5.0)	<0.001

Table 6. *Changes in secondary lipid parameters.*

Parameter	Atorva	Rosuva	Simva	p
Increase in HDL (%)	+6.2	+7.4	+4.1	0.013
Reduction in triglycerides (%)	−18.6	−22.3	−14.7	0.002

Table 7. *Safety indicators (ALT, AST, CK elevation).*

Parameter	Atorva (%)	Rosuva (%)	Simva (%)	p
ALT elevation	7.1	6.5	5.3	0.42
AST elevation	6.4	6.9	4.9	0.38
CK elevation	3.4	3.8	2.6	0.51

Table 8. *Multivariate logistic regression for LDL target achievement.*

Variable	OR (95% CI)	p-value
Rosuvastatin	2.34 (1.8–3.0)	<0.001
Atorvastatin	1.60 (1.2–2.1)	0.002
Combination therapy	3.67 (2.7–5.0)	<0.001
Age (per year)	1.01 (1.00–1.03)	0.041
Diabetes	0.74 (0.60–0.91)	0.005
High-intensity therapy	1.89 (1.4–2.5)	<0.001

Significant differences in age and sex distribution were observed across treatment groups. Patients receiving rosuvastatin were older on average, suggesting preferential use in higher-risk populations. Simvastatin was more commonly prescribed among younger patients. No statistically significant difference in BMI was noted. These findings indicate that age and clinical risk profile, rather than body mass index, influence statin selection.

A significantly higher proportion of diabetes and cardiovascular disease was observed among rosuvastatin users. Simvastatin-treated patients had the lowest disease burden. These data suggest that rosuvastatin is preferentially prescribed to patients with higher cardiovascular risk profiles. The distribution reflects real-world risk-based clinical decision-making.

Rosuvastatin was significantly more frequently prescribed at high intensity, reflecting its higher lipid-lowering potency. Simvastatin was mainly used in low-intensity regimens. These patterns indicate adherence to guideline-based prescribing, where more potent statins are used for patients at higher risk.

Rosuvastatin produced the greatest absolute LDL reduction, followed by atorvastatin. Simvastatin showed significantly lower effectiveness. These differences were statistically significant and clinically relevant, confirming the superiority of high-potency statins in achieving lipid control.

Combination therapy significantly increased target achievement. Rosuvastatin also outperformed atorvastatin and simvastatin. The odds ratios demonstrate a strong additive effect when ezetimibe is combined with statins. These findings support therapeutic escalation when monotherapy is insufficient.

Rosuvastatin showed superior effects on HDL elevation and triglyceride lowering. Atorvastatin demonstrated moderate efficacy, while simvastatin had the lowest impact. These differences may influence statin selection when dyslipidaemia extends beyond isolated LDL elevation.

No statistically significant differences were observed in laboratory safety parameters. All statins demonstrated comparable safety profiles. Adverse effects were infrequent, supporting tolerability in routine primary care.

Combination therapy was the strongest independent predictor of LDL target achievement. High-intensity statin therapy significantly improved outcomes. Diabetes negatively affected target attainment, emphasizing the need for aggressive lipid management in this subgroup.

Discussion.

This study provides real-world evidence on the comparative effectiveness of atorvastatin, rosuvastatin, and simvastatin in lowering LDL-cholesterol within a primary health care setting and evaluates the impact of combination therapy with ezetimibe on achieving therapeutic targets. The findings indicate that rosuvastatin was associated with the greatest LDL-C reduction, followed by atorvastatin, whereas simvastatin demonstrated lower effectiveness. Because baseline LDL-C levels differed across treatment groups, percentage LDL-C reduction represents a more appropriate metric for comparative interpretation than absolute change alone and was therefore emphasized in the analysis. These findings are consistent with international literature describing rosuvastatin and atorvastatin as more potent statins with greater LDL-lowering capacity [5,6,9].

It is important to note that statin selection and dosing in this study reflected routine clinical practice rather than standardized or equipotent dosing regimens. Rosuvastatin was more frequently prescribed to older patients and those with higher cardiovascular risk, which may partially explain the greater absolute LDL-C reductions observed. Therefore, the results should be interpreted in the context of real-world treatment patterns rather than direct pharmacological superiority based on equal-dose comparisons.

The LDL-C reductions observed with rosuvastatin align with contemporary evidence demonstrating that more intensive lipid lowering is associated with proportional reductions in major cardiovascular events [3,4]. The “lower is better” paradigm remains particularly relevant for patients at very high cardiovascular risk, for whom aggressive LDL-C lowering is strongly recommended. European registry data further indicate that achieving very low LDL-C levels is associated with improved cardiovascular outcomes without a clinically meaningful increase in adverse events [12].

Combination therapy with statin and ezetimibe emerged as the strongest independent predictor of LDL-C target attainment in this cohort. Importantly, patients receiving combination therapy were treated with different statins and dose intensities, reflecting therapeutic escalation in individuals who did not achieve LDL-C goals with statin monotherapy. Therefore, the observed benefit of combination therapy likely reflects the additive pharmacological effect of ezetimibe rather than statin potency alone. This finding reinforces current guideline recommendations advocating early treatment intensification when LDL-C targets are not achieved [6,7]. Similar real-world studies across Europe have demonstrated that the addition of ezetimibe substantially increases the likelihood of reaching guideline-recommended LDL-C targets [11].

When compared with data from Western European countries, the overall rate of LDL-C target achievement in this study was comparable to that reported in the EU-wide DA VINCI study, which showed that a considerable proportion of high-risk patients remain above recommended LDL thresholds [11]. Notably, LDL-C goal attainment among patients receiving combination therapy in the present cohort exceeded European averages reported in large registries, suggesting that effective lipid management is achievable even in resource-limited settings when treatment is appropriately intensified [12].

Treatment intensity was a significant determinant of clinical outcomes. High-intensity statin therapy was independently associated with improved LDL-C target achievement, consistent with ESC/EAS recommendations [5,7]. However, patients with diabetes were less likely to reach LDL-C goals, highlighting the persistent challenge of lipid management in this population. Previous studies indicate that patients with diabetes often require combination therapy or higher-intensity regimens to overcome residual cardiovascular risk [6,8].

The safety profile of statins observed in this study was favorable and consistent with previous reports. No clinically significant differences were detected between treatment groups regarding liver enzyme elevations or creatine kinase abnormalities,

supporting the tolerability of statins in routine primary care practice [6,9]. These findings are in line with real-world European data showing low rates of treatment discontinuation due to adverse effects when statins are appropriately prescribed and monitored [8].

From a public health perspective, this study contributes valuable real-world evidence from Southeastern Europe, a region where data on lipid management in routine clinical practice remain limited. Given that much of the existing evidence originates from high-income settings, these findings provide insight into the applicability of international lipid-lowering guidelines across diverse healthcare systems [1,2].

Several limitations should be acknowledged. The retrospective design limits causal inference and does not fully account for potential confounding factors such as medication adherence, lifestyle behaviors, or socioeconomic status. Additionally, statin dosing was not standardized, reflecting real-world practice rather than controlled trial conditions. An important limitation of this study is the potential for selection bias inherent to its retrospective, observational design. Patients treated with rosuvastatin were generally older and had a higher prevalence of diabetes and established cardiovascular disease, suggesting that clinicians preferentially prescribed more potent statins to individuals at higher cardiovascular risk. As a result, simple comparisons between treatment groups may be influenced by baseline differences. Although advanced statistical techniques such as propensity score matching could further reduce confounding, the present analysis aimed to reflect real-world prescribing patterns in routine primary care. This limitation should be considered when interpreting comparative effectiveness results. Nevertheless, the large sample size and use of routine clinical data enhance the external validity and generalisability of the findings.

In conclusion, rosuvastatin and atorvastatin were associated with greater LDL-C reduction compared with simvastatin in routine primary care practice, and combination therapy with ezetimibe significantly improved LDL-C target attainment. These findings support an individualized, risk-based lipid-lowering strategy and emphasize the importance of treatment intensification in alignment with contemporary evidence-based guidelines.

Conclusion.

This study demonstrates that rosuvastatin and atorvastatin were associated with greater LDL-cholesterol reduction compared with simvastatin in a real-world primary health care setting. Rosuvastatin was linked to the largest LDL-C reductions, particularly among patients at higher cardiovascular risk, reflecting its frequent use in individuals requiring more intensive lipid-lowering therapy.

A key finding of this study is the strong impact of combination therapy with ezetimibe, which emerged as the most important determinant of achieving guideline-recommended LDL-C targets. This underscores the importance of early treatment intensification when statin monotherapy fails to achieve adequate lipid control and supports broader implementation of combination strategies in routine clinical practice.

Furthermore, the results highlight the critical role of treatment intensity and individualized pharmacotherapy, especially in patients with diabetes mellitus and established cardiovascular disease, who often require more aggressive and structured lipid-lowering approaches to effectively reduce residual cardiovascular risk.

From a public health perspective, these findings provide valuable real-world evidence from a setting where data on dyslipidaemia remain limited and demonstrate that effective lipid control is achievable even in resource-constrained health systems when international guideline recommendations are appropriately applied.

In addition, the study supports the integration of structured lipid monitoring programs within primary care and emphasizes the importance of continuous professional education focused on cardiovascular risk management. Improved access to combination therapy and consistent follow-up may further enhance long-term population-level outcomes.

Finally, these findings may inform clinical decision-making and local health policy development by encouraging greater adherence to evidence-based lipid management protocols. Future multicentre and prospective studies are warranted to confirm these observations and to evaluate long-term cardiovascular outcomes associated with different lipid-lowering strategies.

Author Contributions.

All authors contributed substantially to the conception and design of the study. Data collection and clinical validation were performed by the authors involved in patient management at the study site. Statistical analysis and data interpretation were conducted collaboratively by the research team. The manuscript was drafted and critically revised for important intellectual content by all authors. All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Conflict of Interest.

The authors declare that there is no conflict of interest regarding the publication of this article.

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Ethical Approval and Consent to Participate.

This study was conducted in accordance with the Declaration of Helsinki and was approved by the institutional authorities of the Main Family Medicine Center in Ferizaj. As this was a retrospective study based on anonymized patient data, informed consent was waived in accordance with institutional and national regulations.

Data Availability.

The datasets generated and/or analyzed during the current study are not publicly available due to institutional data protection policies but are available from the corresponding author on reasonable request.

Publishing Statement (Originality Declaration).

The authors confirm that this manuscript has not been published previously and is not under consideration for publication elsewhere.

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