Patient Preference and Adherence

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ORIGINAL RESEARCH

# Perceptions and Knowledge of Cholesterol and Lipid-Lowering Medications Among Treatment-Naive Individuals: A Cross-Sectional Study

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**Purpose:** The literature often includes studies on cholesterol perception and lipid-lowering medication (LLM) use with patients who have used or discontinued LLM for primary or secondary prevention. With the exponential rise in patients needing LLM each year, understanding their knowledge and perceptions of cholesterol and these drugs is crucial. For this reasons, we aimed to determine the perception and knowledge of treatment-naive participants about cholesterol and LLM.

**Patients and Methods:** This cross-sectional study was conducted in Turkey between August 2020 and August 2022. A self-designed online survey developed from literature sources was used to determine the level of knowledge and perception of cholesterol, LLM and influencing factors.

**Results:** A total of 2062 respondents completed the survey, which was sent to the participants via an online link. The most common sources of information about cholesterol and lipid-lowering medications were medical staff (71%) media (58.4%) and scientific publications (33.3%). The most three common factors affecting the participants' perception of cholesterol and LLM were medical staff (49.6%), media (23.7%), and scientific publications (15.6%).

**Conclusion:** Our study revealed that participants have some inaccurate and incomplete information about cholesterol and LLM. Medical staff and the media emerged as the primary sources of information and crucial influences on most participants' perceptions of cholesterol and LLM.

**Keywords:** hypercholesterolemia, lipid-lowering medication, statins, medication adherence, non-compliance, illness perception

## Introduction

High levels of serum low-density lipoprotein cholesterol (LDL-C) are closely linked to a heightened risk of cardiovascular disease (CVD) morbidity and mortality.[1] Hyperlipidemia is a modifiable risk factor for CVD. Reducing LDL-C levels is associated with a lower risk of atherosclerotic plaque progression and the prevention of related complications. HMG-CoA reductase inhibitors, commonly known as statins, are considered the first-line treatment for all elevated cholesterol conditions. Evidence has demonstrated their efficacy in reducing the incidence of coronary heart disease (CHD), ischemic cerebrovascular events, and mortality in individuals with severe dyslipidemia.[2,3]

Globally, elevated cholesterol levels are responsible for approximately one-third of ischemic heart disease cases. It is estimated that high cholesterol contributes to 2.6 million deaths annually, accounting for 4.5% of total global mortality.[4] CHD has also been identified as a leading cause of mortality and disability in Turkey.[5] In 2023, CVD accounted for 42.4% of all deaths in Turkey, compared to 32% in European Union countries.[6,7] Moreover, Turkey ranked highest among European countries in CHD-related deaths among individuals under 50 years of age, with CHD manifesting approximately 10 years earlier than in other European nations.[8]

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Although highly effective lipid-lowering medications (LLMs), such as statins, are widely prescribed, a significant portion of the population continues to have LDL-C levels exceeding the recommended targets.[9] Globally, adherence to statin therapy remains a significant challenge. Research by Chaudhry and McDermott revealed that adherence rates to statin treatment were only 50% after six months and decreased even further after one year.[10] In Turkey, only 8.3% of patients have the targeted LDL-C level.[11] Moreover, in Turkey, a more pronounced decline in the utilization of LLMs during follow-up was observed compared to other European nations.[12] The underlying reasons for such a low rate of LDL target attainment and adherence to statins are not exactly known. Many studies have been conducted on the cause of non-adherence to LLM, but almost all of these studies have been conducted with patients using or discontinuing LLM for primary or secondary prevention. The number of patients requiring lipid-lowering drugs is rising rapidly each year. Assessing patients' knowledge and perceptions of cholesterol and LLM may enhance treatment adherence and effectiveness through early interventions at both community and individual levels. To the best of our knowledge, this will be the first study to determine the perception and level of knowledge of treatment-naive participants about cholesterol and LLM.

# Materials and Methods

## Research Design

This was a cross-sectional descriptive study. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist. Our study was approved by the Ethics Committee of the University of Health Sciences, Antalya Training and Research Hospital (Date: 23.07.2020, No: 11/23). This study complied with the current version of the Declaration of Helsinki. All patients who participated online gave informed consent.

## Participants

This cross-sectional study was conducted across all seven regions of Turkey from August 2020 to August 2022. To assess the representativeness of the sample across Turkey's seven geographical regions, the distribution of participants was examined in comparison to the national population percentages. The final sample of 2062 individuals was proportionally drawn from each region using convenience sampling. The regional distribution of the participants is as follows: Marmara (n=673, 32.6%), Aegean (n=298, 14.4%), Mediterranean (n=272, 13.2%), Central Anatolia (n=307, 14.8%), Southeastern Anatolia (n=177, 8.6%), Eastern Anatolia (n=161, 7.8%), and Black Sea (n=174, 8.4%).

According to the most recent data published by the Turkish Statistical Institute (TÜİK), the regional population proportions are: Marmara (28.5%), Aegean (13.1%), Mediterranean (12.0%), Central Anatolia (15.6%), Southeastern Anatolia (10.4%), Eastern Anatolia (8.6%), and Black Sea (11.8%). While the sample closely approximates the national regional distribution, Marmara, Aegean, and Mediterranean regions were slightly overrepresented, whereas Central Anatolia, Southeastern Anatolia, Eastern Anatolia, and the Black Sea regions were somewhat underrepresented.

Inclusion criteria required participants to be over 18 years old and willing to participate. Exclusion criteria included being under 18, lacking the ability to complete the online survey, current use of LLMs, mental disorders, cancer history, kidney or liver disease, myopathy, pregnancy or postpartum within six months. To minimize selection bias, individuals employed or studying in the medical or pharmaceutical fields were excluded.

## Data Collection Instrument

A self-designed questionnaire was developed based on a literature review to collect data for this study. Sources from PubMed, Medscape, and the Cochrane Database (January 2000–April 2020) informed its creation, ensuring a comprehensive assessment of the study topic. The questionnaire was divided into three sections: (1) socio-demographic and clinical characteristics, (2) knowledge and information sources about cholesterol and lipid-lowering medications (LLM), and (3) perceptions of high cholesterol and LLM, including influencing factors.

The first section gathered participants' socio-demographic and clinical data through self-reports verified by laboratory results in Turkey's e-Pulse system—a personal health record platform of the Ministry of Health. This included recent total cholesterol, LDL-C, HDL-C, triglycerides, fasting glucose, and creatinine levels. Participants were categorized into

four groups: (1) secondary prevention (patients with cardiovascular disease), (2) primary prevention (high/very high-risk individuals), (3) those with family history of cardiovascular disease, and (4) others.

The second section featured 15 questions assessing cholesterol and LLM knowledge and information sources, while the third included 8 questions on perceptions and influencing factors. A pilot study with 30 participants was conducted to refine the questionnaire, ensuring clarity and effectiveness. Adjustments were made based on feedback, and the final version is outlined in Table 1.

**Table 1** The Perception of High Cholesterol Statin Treatment-Naive Population and Influencing Factors Survey

| **1. Socio-demographic and clinical features** | |
|---|---|
| Demographic information | Gender |
| | Age |
| | Marital Status |
| | Region of residence |
| | Place of residence (Town center, countryside etc.) |
| | Education level |
| | Occupation |
| Medical history | CV comorbidities |
| | Cardiac operations/procedures |
| | Stroke |
| | Concomitant diseases |
| | CV risk factors (smoking, hypertension etc.) |
| Family history | Ischemic vascular disease-related death in family or loved ones |
| Self-reporting laboratory results | Total cholesterol |
| | LDL-Cholesterol |
| | HDL-cholesterol |
| | Triglycerides |
| **2. The level of knowledge and sources of information about cholesterol** | |
| What do you think cholesterol is? | |
| Is cholesterol an essential nutrient for the body? | |
| Are there different types of cholesterol? What types of cholesterol do you know? | |
| For which disease/diseases do you think high cholesterol is a risk factor? | |
| Which of the following statements might make you think that your cholesterol level is high ? | |
| What do you think are the reasons for high cholesterol levels in humans? | |
| What are your ways of obtaining information about cholesterol and cholesterol lowering medications ? | |
| What treatment options do you use or know of to lower cholesterol levels? | |
| Which of the following statements might make you think that your cholesterol level is high ? | |

(*Continued*)

**Table 1** (Continued).

| |
|---|
| What do you think are the reasons for high cholesterol levels in humans? |
| What are your ways of obtaining information about cholesterol and cholesterol- lowering medications ? |
| What treatment options do you use or know of to lower cholesterol levels? |
| **3. Perception of high cholesterol and cholesterol-lowering medications** |
| Do you know your cholesterol level? |
| How do you find cholesterol level? |
| Do you have your cholesterol level measured regularly? |
| In particular, do you go to a health centre to have your cholesterol level measured? |
| Are you worried about your cholesterol level? |
| What is your reason for having your cholesterol level measured? |
| Which factor most influences your perception/opinion about cholesterol and cholesterol-lowering medications? |
| If your doctor prescribes a cholesterol-lowering medications, do you take it regularly? |
| What is your reason for refusing to take cholesterol-lowering medications? |

## Data Collection

Data were collected between January 2020 and April 2022 after the participants were informed of the content of the study and the measurement instruments. Before administering the survey, participants were presented with an informed consent form online, providing them with the choice to either approve it by selecting "I agree" or decline by selecting "I do not accept participation in the study". An online survey link was sent to participants via social networks. Participants submitted their responses anonymously. It took each participant approximately 15–20 min to complete the self-reported data collection form.

## Data Analysis

IBM SPSS Statistics for Windows (Version 23 Armonk, NY: IBM Corp) was used for data analysis. The frequency, percentage, mean and standard deviation were used to describe demographic variables. In 2×2 chi-square analyses, if the expected value is greater than 25, Pearson chi-square is used, in case it is 5–25, Yates chi-square is used, in rxc chi-square analyses, if the expected cell number is less than 5 and equal to 20%, Pearson chi-square is used, and in case it is greater, exact probability value is used.

# Results

## Socio-Demographic and Clinical Features of Participants

A total of 2062 participants were included in the study. Table 2 presents the participants' sociodemographic and clinical characteristics. The average age was 36.53 ± 11.12 years, with 65.5% being female and 66% married.

Regional distribution was based on population density, Marmara (32.6%), Central Anatolia (14.8%), and Aegean (14.4%), Mediterranean (13.2%), Southeastern Anatolia (8.6%), Black Sea (8.4%) and Eastern Anatolia (7.8%) regions. Additionally, 77.9% resided in urban areas, and 60% held a bachelor's degree. Participants were categorized into three age groups (<29, 30–49, >50). Of the participants, 26% were under 29 years, 58.6% were between 30 and 49 years, and 15.4% were over 50 years. Participants were classified by educational level, with 13.5% having postgraduate education, 60% holding an undergraduate degree, 19.4% completing high school, and 6.9% attaining primary school education.

**Table 2** Demographic Characteristics of Participants

| Variable | Subgroup | n, % |
|---|---|---|
| Gender, n (%) | Female<br>Male | 1351 (65.5)<br>711 (34.5) |
| Age (years), $(\overline{X} \pm SD)$ | 36.53 ±11.12 | |
| Height (cm), $(\overline{X} \pm SD)$<br>Weight (kg), $(\overline{X} \pm SD)$ | 166.92 ±10.75<br>69.93 ±16.05 | 1361 (66.0)<br>701 (34.0) |
| Marital Status, n (%) | Married<br>Single | 1361 (66.0)<br>701 (34.0) |
| Region of Turkey, n (%) | Mediterranean<br>Eastern Anatolia<br>Aegean<br>Southeastern Anatolia<br>Central Anatolia<br>Black Sea<br>Marmara | 272 (13.2)<br>161 (7.8)<br>298 (14.4)<br>177 (8.6)<br>307 (14.8)<br>174 (8.4)<br>673 (32.6) |
| Place of residence, n (%) | City centre<br>District<br>Village | 1606 (77.9)<br>386 (18.7)<br>70 (3.4) |
| Educational Status, n (%) | Primary education and below<br>High school<br>Undergraduate<br>Postgraduate | 142 (6.9)<br>401 (19.4)<br>1240 (60.1)<br>279 (13.5) |
| Smoking Status, n (%) | Never used<br>Leaving<br>Currently using<br>Social smoker | 955 (46.3)<br>305 (14.8)<br>575 (27.8)<br>227 (11.0) |
| Known Disease Status, n (%) | Cardiovascular disease<br>Heart failure<br>Diabetes<br>Hypertension<br>Other<br>No disease | 79 (3.8)<br>3 (0.1)<br>112 (5.4)<br>148 (7.2)<br>444 (21.5)<br>823 (39.9) |
| Losing a Family Member Due to Cholesterol | Yes<br>No | 246 (11.9)<br>1816 (88.1) |

Participants were divided into four groups as outlined in the methods section: 80 (3.9%) were in the secondary prevention (SP) group (Group 1), 135 (6.5%) in the very high or high-risk primary prevention (PP) group (Group 2), 211 (10.2%) had a family history of coronary artery disease (CAD) (Group 3), and 1636 (79.3%) were classified in the other group (Group 4).

## The Level of Knowledge and Sources of Information About Cholesterol

Table 3 summarizes participants' knowledge of cholesterol and their information sources. While 68.8% of participants recognized high cholesterol as harmful, only 15.5% believed cholesterol is essential for the body. Additionally, 69.8% (n=1440) were aware of "good" and "bad" cholesterol types. Participants primarily linked high cholesterol to

**Table 3** Questions Regarding Participants' Cholesterol Knowledge Level and Information Sources

| Question | Answer* | n % |
|---|---|---|
| What do you think about cholesterol is?* | It is a necessary nutrient for the body | 319 (15.5) |
| | High cholesterol levels are harmful for health | 1418 (68.8) |
| | Cholesterol is harmful for health at every level | 78 (3.8) |
| | All types of cholesterol are harmful | 91 (4.4) |
| | All types of cholesterol are beneficial | 6 (0.3) |
| | There are good and bad types of cholesterol | 1440 (69.8) |
| For which disease/diseases do you think high cholesterol is a risk factor?* | Cardiovascular Diseases | 1823 (88.4) |
| | Liver diseases | 910 (44.1) |
| | Occlusion of cerebral vessels | 907 (44.0) |
| | Obesity | 984 (47.7) |
| | Kidney Diseases | 445 (21.6) |
| | Dementia | 135 (6.5) |
| | Cancer | 199 (9.7) |
| | None | 10 (0.5) |
| Which of the following statements might make you think your cholesterol level is high?* | Headache | 733 (35.7) |
| | Nausea-Vomiting | 165 (8.0) |
| | High Blood Pressure | 746 (36.2) |
| | Dry Mouth | 285 (13.8) |
| | High sugar | 354 (17.2) |
| | Yellow coloured sebaceous glands around the face and eyes | 588 (28.6) |
| | Burning in feet and legs | 441 (21.4) |
| | Feeling of heaviness and sweating in the back of the neck | 0 (0,0) |
| | None | 140 (6.8) |
| | Other | 19 (0.9) |
| What do you think are the reasons for high cholesterol levels in humans?* | Malnutrition | 1865 (90.4) |
| | Obesity | 1196 (58.0) |
| | Genetics (Familial) | 1211 (58.7) |
| | Sedentary life | 1570 (76.1) |
| | Diseases | 594 (28.8) |
| | Medications used | 502 (24.3) |
| What are your ways of obtaining information about cholesterol and cholesterol-lowering medications ?* | Written and visual press | 654 (31.7) |
| | Websites\social media | 999 (48.4) |
| | Scientific publications | 686 (33.3) |
| | Medical staff \Doctor | 1463 (71.0) |
| | My relatives | 441 (21.4) |
| Which methods do you know are more effective in lowering cholesterol?* | Medication | 944 (45.8) |
| | Exercise | 1392 (67.5) |
| | Diet | 1540 (74.7) |
| | Food supplements | 158 (7.7) |
| | Herbal mixtures | 292 (14.2) |
| | None | 62 (3.0) |
| Is there a certain limit for starting cholesterol-lowering medications? | It needs to be treated at all levels | 78 (3.8) |
| | Treatment is never necessary | 8 (0,4) |
| | Above a certain level should be treated | 1975 (95.8) |

(*Continued*)

**Table 3** (Continued).

| Question | Answer* | n % |
|---|---|---|
| Which side effects of cholesterol lowering medications do you know about?* | Muscle pain | 568 (27.5) |
| | Harmful effects on the liver | 1347 (65.3) |
| | Sexual disorders | 232 (11.2) |
| | Cancer | 79 (3.8) |
| | Dementia | 103 (5) |
| | High sugar | 321 (15.5) |
| | I do not know | 263 (12.7) |

**Note**: *Multiple answers can be given.

cardiovascular diseases (88.4%), obesity (47.7%), and liver diseases (40.1%). Commonly reported symptoms included headaches (35.7%), high blood pressure (36.2%), and yellow skin deposits (28.6%).

The main perceived causes of high cholesterol were poor diet (90.4%), a sedentary lifestyle (76.1%), and genetics (58.7%). The leading information sources were healthcare professionals (71%), social media (58.4%), and traditional media (33.3%). Diet and exercise were considered more effective than lipid-lowering medications (74.7%, 67.5%, and 45.8%). Additionally, 95.8% believed LLM is necessary only above certain cholesterol levels, while 3.8% supported treatment at all levels. Reported LLM side effects included hepatitis (65.3%), muscle pain (27.5%), and high blood sugar (15.5%).

## Perception of High Cholesterol and Cholesterol-Lowering Medications

Table 4 presents participants' perceptions of cholesterol and lipid-lowering medications (LLM). Only 34% knew their cholesterol levels from the past six months, and 17.9% believed their levels were high. While 42.6% regularly checked their cholesterol, 37.1% expressed concern about high cholesterol. Notably, participants with elevated cholesterol were

**Table 4** Participants' Perceptions Towards High Cholesterol and Cholesterol-Lowering Medications

| Question | Answer* | n (%) |
|---|---|---|
| Do you know your cholesterol level? | No | 1361 (66.0) |
| | Yes | 701 (34.0) |
| How do you find cholesterol level? | High | 370 (17.9) |
| | Normal | 1692 (82.1) |
| Do you have your cholesterol level measured regularly? | Yes | 879 (42.6) |
| | No | 1183 (57.4) |
| In particular, do you go to a health centre to have your cholesterol level measured? | Yes | 879 (42.6) |
| | No | 1183 (57.4) |
| Are you worried about your cholesterol level? | I am worried | 764 (37.1) |
| | I am not worried | 1298 (62.9) |
| What is your reason for having your cholesterol level measured? | Request for medical staff and doctors | 844 (41.0) |
| | Recommendation from my relatives | 95 (4,6) |
| | Scanning (for control purposes) | 1126 (54.7) |
| | Worried about my high cholesterol level | 193 (9,4) |
| | Dietician recommendation | 177 (8,6) |
| | I am influenced by television and social media | 55 (2,7) |
| | Other | 140 (6,8) |

(*Continued*)


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**Table 4** (Continued).

| Question | Answer* | n (%) |
|---|---|---|
| Which factor most influences your perception/opinion about cholesterol and cholesterol-lowering medications ? | Written and visual press | 199 (9.7) |
| | Websites\social media | 291 (14.2) |
| | Scientific publications | 318 (15.6) |
| | Medical staff \ Doctor | 1014 (49.6) |
| | My relatives | 223 (10.9) |
| If your doctor prescribes a cholesterol-lowering medications, would you take it regularly? | No | 377 (18.3) |
| | Yes | 1685 (81.7) |
| What is your reason for refusing to take cholesterol-lowering medications?* | It does more harm than good | 106 (28.1) |
| | Belief in reducing cholesterol levels with non-medications therapies | 202 (53.6) |
| | Concern about lifelong medication use | 43 (11.4) |
| | High cholesterol is not harmful | 26 (3.9) |

**Note**: *Multiple answers can be given.

less likely to monitor their levels and showed less concern ($p < 0.001$). Common reasons for testing included routine check-ups (54.7%), physician advice (41%), and personal concern (9.4%).

Medical staff (49.6%), media (23.7%), and scientific publications (15.6%) most influenced participants' views on cholesterol and LLM. If prescribed, 81.7% would regularly take LLM. However, 53.6% preferred non-drug methods, 28.1% feared medication risks, and 11.4% were concerned about lifelong use.

Gender analysis showed women had better knowledge and were more willing to take LLM than men (83.6% vs 78.2%, $p = 0.003$). Age analysis revealed that social media influenced younger participants more, while older individuals were more concerned about cholesterol but less willing to take medications. Higher education correlated with better knowledge and greater reliance on scientific sources, while lower education groups were more influenced by media.

At-risk groups (Groups 1 and 2) were more aware of and monitored their cholesterol more frequently but also showed higher resistance to LLM. Concerned participants were more likely to monitor cholesterol and adhere to medications ($p < 0.001$).

## Discussion

This current study is one of the most comprehensive studies assessing the knowledge and perceptions of Turkish participants who are not taking LLM regarding cholesterol and these types of medications. Our study revealed that participants have also some inaccurate and incomplete information about cholesterol and LLM, but they generally had an adequate level of knowledge. Medical staff, social media platforms and traditional media outlets, including written and visual press, emerged as the primary sources of information and greatest influence on the perception of cholesterol and LLM for most participants. The most common reason for refusal was the belief in the efficacy of non-pharmacological treatments for lowering cholesterol levels.

Studies have demonstrated that certain demographic factors influence knowledge, perception and adherence to LLM.[13,14] In a study of 11,000 adult patients with dyslipidemia in Hong Kong, Wong et al found that factors contributing to optimal medication adherence included older age, the presence of more comorbidities, and regular physician follow-up.[15] Chan et al found higher rates of adherence in the male gender and at older ages.[16] A systematic review of determinants of nonadherence to statin therapy by Mann et al showed that female patients were less adherent to medication.[17] In a review by Bates et al poor literacy was associated with lower medication compliance.[18] Unlike these studies, in this current study, we also examined knowledge and perceptions about cholesterol. In general, although the level of knowledge was similar in men and women, we found that women had higher rates of correct answers. Similarly, while the majority of respondents from both genders expressed willingness to regularly take LLM if advised, this proportion was notably higher among women. However, the rate of those who said they would take medication if prescribed decreased with age. Concern about cholesterol levels was higher in women and older people. Consistent with

findings from previous research, rates of correct responses and participants expressing willingness to use medications increased in line with increasing levels of education. Research indicates that patients tend to exhibit greater adherence to treatment regimens following the occurrence of severe complications related to CVD, potentially attributed to an enhanced comprehension of the significance of managing risk factors.[9] Benner et al identified comorbid conditions such as CVD and a prior history of stroke as notable predictors of treatment adherence.[19] Additionally, in their examination of statin-naive patients, Ellis et al observed a markedly higher rate of treatment discontinuation among participants receiving primary prevention compared to those undergoing secondary prevention.[20] In this current study, we evaluated primary and secondary prevention groups as well as those who lost a loved one due to high cholesterol as a separate group. The percentages of participants who were aware of their cholesterol levels and consistently monitored them were higher in these three groups compared to others, with the secondary prevention group having the highest. The proportion of participants who expressed a willingness to take medication was found to be higher in all groups. However, unexpectedly, rates of resistance to taking medication were detected higher in the primary prevention and secondary prevention groups.

Identifying patients' information sources and perceptions about cholesterol, LLM and developing strategies for this may improve treatment adherence. Matthews et al sought to investigate treatment discontinuation in the aftermath.[21] Their analysis revealed that the rates of treatment cessation following misleading information were notably elevated among both primary and secondary prevention patients. The EPHESUS study identified exposure to negative information regarding statin therapy in the media as the leading cause of treatment discontinuation.[8] Numerous studies have also indicated that physicians play a crucial role in influencing patients' knowledge, perception, and adherence to medication.[13,22] For instance, in the study by Kon et al, patients primarily obtained information about lipid-LLM from physicians, followed by the media and family members.[23] Moreover, studies have shown that the quality of clinical communication is related to positive health outcomes.[22,24] Our research revealed that the primary sources of information for participants and the factors influencing their perceptions were predominantly medical staff and media. While the influence of health professionals alone was significant, the combined impact of various media channels (including social media and press) was notably stronger.

Evidence suggests that inadequate knowledge about cholesterol or statin therapy is prevalent among LLM users.[14] The initiation of statin therapy is a specific decision made within the clinician-patient relationship. However, adherence to long-term treatment is subject to ongoing evaluation outside the clinical environment and is often shaped by external influences. Patients commonly consult family and friends for health-related advice, while the media plays a vital role in shaping public perceptions and health-related decisions. In addition to setting healthcare agendas, the way the media presents and reports information significantly affects how individuals understand and discuss this topic.[25] In fact, two large-scale studies have demonstrated that adherence to medication declines as patients are increasingly exposed to negative media coverage about LLMs.[21,26] Physicians may also contribute to poor patient adherence by failing to sufficiently explain the benefits and potential side effects of medications, overlooking patients' lifestyles or financial constraints, and maintaining weak therapeutic relationships with their patients.[9] Given that media and physicians are the two primary factors influencing patients' knowledge and perception, minimizing misinformation, promoting trustworthy information sources, and fostering effective physician-patient communication may enhance adherence to drug therapy.[24,27] For instance, highlighting the harmful effects of high cholesterol on overall health, explaining the benefits of statin therapy, and discussing potential side effects, including their frequency and severity, during the prescribing process may help patients rely less on external sources and improve compliance.[9] Indeed, in a study conducted by Pupilin et al, patients participated in a six-month outpatient telemedicine-based lifestyle modification program designed to enhance health knowledge and behavior to achieve goals related to exercise, diet, cholesterol, blood pressure, diabetes, and smoking cessation. Upon completing the program, patients exhibited increased perceived knowledge and awareness of statins.[28]

Patients' inclination towards dietary control rather than pharmacotherapy presents a potential obstacle to medication adherence. Mann et al demonstrated that nearly 40% of 71 participants initiating statin therapy preferred relying on dietary measures beforehand, with 70% of these patients believing that dietary adjustments alone could fully address their dyslipidemia.[17] Our study revealed that the majority of participants believed that diet and exercise were more efficacious

than medication. Additionally, we found that the predominant reason for declining medication when prescribed was the conviction that cholesterol could be reduced through non-pharmacological interventions. This perception may be partly attributed to a dislike of taking medication, hearing about potential unpleasant side effects of LLM from family and friends, and exposure to negative media influence, such as television and the media.

Statins have been linked to various symptomatic dose-independent side effects, such as headache, nausea, rash, and decreased libido, occurring at an incidence rate of approximately 10%. Conversely, dose-related side effects include myopathy, rhabdomyolysis, and increased aminotransferases.[29] However, muscular symptoms related to standard dosage statin therapy occur more frequently than reported in clinical trials and have a more significant impact on patients' lives than commonly perceived.[30] As mentioned earlier, the side effects of statins experienced by patients are also an important cause of non-adherence.[9] There are many studies supporting this in the literature.[13,31] For instance, Uçar et al proposed that myalgia contributes to as much as 25% of all adverse events associated with statin use, resulting in diminished patient adherence and heightened rates of statin discontinuation.[31] In a comprehensive survey involving French participants, muscular symptoms were reported by 10% of participants undergoing statin treatment, prompting discontinuation in 30% of those experiencing symptoms.[30] In our study, we discovered that myalgia was the most prevalent side effect following hepatitis. Moreover, the most common reason for refusal of medication was concern about side effects after the belief in cholesterol lowering with non-pharmacologic therapies.

Our study has several limitations. This is a cross-sectional and self-report survey, consequently, a low level of evidence. An online survey and self-reported data can cause potential biases The total sample size might not be representative of the whole population. Most of the participants were relatively young (more than 50% were between 30 and 50 years old) and had undergraduate or postgraduate education. This may have led to bias. The fact that the survey questions were answered online platform and the answer options offered to the questions may have affected the subjectivity of the responses. Given cross-country differences in culture and healthcare provision in Turkey, these results may not easily be extrapolated to other countries.

## Conclusion

Our study revealed that participants have some inaccurate and incomplete information about cholesterol and LLM. Social media platforms and traditional media outlets, including written and visual press, emerged as the primary sources of information for most participants. The medical staff especially physicians and media had the greatest influence on the perception and opinion about cholesterol and LLM. Additionally, the most common reason for refusing to use LLM is the belief in lowering cholesterol through non-pharmacological methods. To our knowledge, this is the first comprehensive study to determine the perceptions and knowledge of treatment-naive patients about cholesterol and LLM in Turkey. Most of the studies in the literature have been conducted on specific risk groups who have been prescribed or have used LLM. Considering the findings of this study, implementing early interventions at both the community and individual levels may improve medication adherence and treatment effectiveness in patients who will need to use LLM in the future.

## Abbreviations

LLM, Lipid-Lowering Medication; LDL-C, Low-Density Lipoprotein Cholesterol; CVD, Cardiovascular Disease; CHD, Coronary Heart Disease.

## Data Sharing Statement

All data generated or analysed during this study are included in this published article.

## Ethics Statement

Our study was approved by the Ethics Committee of the University of Health Sciences, Antalya Training and Research Hospital (Date: 23.07.2020, No: 11/23). This study complied with the current version of the Declaration of Helsinki. All patients who participated online gave informed consent.

## Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. The person(s) providing consent have been shown the article contents to be published.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors report no conflicts of interest in this work.

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