World Journal of Current Medical and Pharmaceutical Research
Content available at www.saap.org.in ISSN: 2582-0222

A STUDY TO ASSESS THE STATIN THERAPY ADHERENCE AND ITS IMPACT ON LIPID PROFILE AND CARDIOVASCULAR RISK IN PATIENTS WITH DYSLIPIDEMIA

BUJAGOUNI. SWAPNA[1*], PRATHIKANTAM. BHUVANESHWARI[2], GUNDELA. PAVANI[2], HIFSA LUBNA[2], ASHWINI. SAINATH[2]

[*1]Assistant Professor, Department of Pharmacy Practice, Smt. Sarojini Ramulamma College of Pharmacy, (Palamuru University), Seshadri Nagar, Mahabubnagar District, Telangana State, India.

[2]Pharm. D Intern, Smt. Sarojini Ramulamma College of Pharmacy, (Palamuru University), Seshadri Nagar, Mahabubnagar District, Telangana State, India.

ARTICLE HISTORY

Received on: 16-03-2026
Revised on: 19-04-2026
Accepted on: 26-05-2026

ABSTRACT

Dyslipidemia is a major modifiable risk factor for cardiovascular diseases, and statins are the primary pharmacological agents used for lipid lowering and cardiovascular risk reduction. The effectiveness of statin therapy is largely dependent on patient adherence to medication. This study aimed to evaluate medication adherence to statin therapy and assess its impact on lipid profile parameters and cardiovascular risk among patients with dyslipidemia. A prospective observational study was conducted in a tertiary care hospital involving 100 patients diagnosed with dyslipidemia and receiving statin therapy. Demographic data, comorbidities, and statin dosage were collected using a structured data collection form. Medication adherence was assessed using the Morisky Medication Adherence Scale (MMAS-8), and patients were categorized into high, medium, and low adherence groups. Lipid profile parameters, including total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglycerides (TG), were recorded at baseline, 3 months, and 6 months. Cardiovascular risk was evaluated using ASCVD and Framingham risk scores. Most participants were middle-aged or elderly, with males constituting the majority. Diabetes mellitus and hypertension were common comorbidities, and atorvastatin 40 mg was the most frequently prescribed statin dose. Progressive improvements in lipid parameters were observed throughout the study, with significant reductions in TC, LDL-C, and TG levels and a modest increase in HDL-C. Patients with higher medication adherence demonstrated superior lipid control and greater reductions in cardiovascular risk scores compared to those with lower adherence. The study highlights the critical role of medication adherence in optimizing lipid control and reducing cardiovascular risk, emphasizing the need for adherence monitoring, patient education, and regular follow-up to improve statin therapy outcomes.

Keywords: *Dyslipidemia, Statin adherence, Atorvastatin, Lipid profile, LDL-C, HDL-C, Triglycerides, ASCVD risk score, Framingham risk score.*

***Corresponding Author**
M. Ratna Raju

DOI: https://doi.org/10.37022/wjcmpr.v8i2.399

INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of morbidity and mortality worldwide, accounting for nearly one-third of all global deaths. Dyslipidemia, characterized by elevated levels of total cholesterol, low-density lipoprotein cholesterol (LDL-C), triglycerides, and/or reduced high-density lipoprotein cholesterol (HDL-C), is one of the most significant modifiable risk factors for atherosclerotic cardiovascular disease (ASCVD) [1,2]. In India, the prevalence of dyslipidemia has increased substantially due to rapid urbanization, sedentary lifestyles, unhealthy dietary habits, obesity, and diabetes mellitus, contributing significantly to the growing burden of cardiovascular disease [3,4].

The pathogenesis of dyslipidemia involves abnormalities in lipid metabolism that promote the accumulation of atherogenic lipoproteins within the arterial wall. Oxidized LDL particles trigger endothelial dysfunction, inflammation, foam cell formation, and atherosclerotic plaque development, ultimately increasing the risk of myocardial infarction, stroke, and other cardiovascular events [5,6]. Consequently, effective lipid management remains a key strategy for cardiovascular risk reduction.

Statins are the first-line pharmacological agents for dyslipidemia management and have demonstrated substantial benefits in both primary and secondary prevention of cardiovascular disease. By inhibiting HMG-CoA reductase, statins reduce hepatic cholesterol synthesis, increase LDL receptor expression, and lower circulating LDL-C concentrations [7]. In addition to lipid-lowering effects, statins possess anti-inflammatory and plaque-stabilizing properties that further contribute to cardiovascular protection [8]. Numerous clinical trials have shown that statin therapy significantly reduces the incidence of major adverse cardiovascular events and cardiovascular mortality [9].

Despite their proven efficacy, the clinical benefits of statins largely depend on patient adherence to prescribed therapy. Medication adherence is essential for achieving optimal lipid control and reducing long-term cardiovascular risk. However, poor adherence to statin therapy remains a major challenge in clinical practice and has been associated with inadequate lipid control, increased hospitalization, and higher rates of cardiovascular events and mortality [10-15]. Factors such as adverse effects, polypharmacy, treatment costs, low health literacy, and inadequate awareness of disease severity may negatively influence adherence [16-19].

Although several studies have investigated statin utilization, limited real-world evidence is available regarding the relationship between statin adherence, lipid profile outcomes, and cardiovascular risk among patients with dyslipidemia, particularly in developing countries. Furthermore, the impact of adherence on cardiovascular risk estimation using tools such as the ASCVD Risk Score and Framingham Risk Score has not been extensively evaluated. Therefore, the present study was undertaken to assess adherence to statin therapy and evaluate its impact on lipid profile parameters and cardiovascular risk among patients with dyslipidemia.

MATERIALS AND METHODS

Study Design, Type and Duration

This study was conducted using a prospective observational design among patients diagnosed with dyslipidemia receiving statin therapy. Participants were followed for a period of six months to evaluate medication adherence and its impact on lipid profile parameters and cardiovascular risk. Data collected included demographic details, clinical characteristics, statin therapy information, medication adherence status, lipid profile values, and cardiovascular risk scores.

Study Setting and Source of Data

The study was conducted in the Department of General Medicine and Cardiology at SVS Medical College and Hospital, Mahbubnagar. Data were collected from patient case sheets, laboratory reports, medication records, prescription refill history, and adherence assessment questionnaires.

Sample Size Determination

A total of 100 patients diagnosed with dyslipidemia and receiving statin therapy were included in the study. The sample size was determined based on feasibility and availability of eligible patients during the study period.

Sample Selection Criteria

Inclusion Criteria

- Adults aged ≥18 years diagnosed with dyslipidemia.
- Patients receiving statin therapy.
- Patients with available baseline lipid profile data.
- Patients willing to provide written informed consent.

Exclusion Criteria

- Patients with secondary causes of dyslipidemia.
- Pregnant or lactating women.
- Patients with severe hepatic impairment.
- Patients unwilling to participate in the study.
- Patients with incomplete clinical or laboratory data.

Methodology

This prospective observational study was conducted to evaluate statin medication adherence and its effect on lipid profile parameters and cardiovascular risk among patients with dyslipidemia. Medication adherence was assessed using the Morisky Medication Adherence Scale (MMAS-8), and patients were categorized into high, medium, and low adherence groups.

Lipid profile parameters including Total Cholesterol (TC), Low-Density Lipoprotein Cholesterol (LDL-C), High-Density Lipoprotein Cholesterol (HDL-C), and Triglycerides (TG) were recorded at baseline, 3 months, and 6 months. Cardiovascular risk was assessed using the ASCVD Risk Calculator and Framingham Risk Score. The collected data were analyzed to determine the association between medication adherence, lipid profile improvement, and cardiovascular risk reduction.

Study Procedure

Eligible patients attending the General Medicine and Cardiology departments were identified and screened according to the inclusion and exclusion criteria. After obtaining written informed consent, demographic information, clinical history, comorbidities, medication details, and baseline lipid profile data were collected.

Medication adherence was evaluated using MMAS-8 and patients were categorized based on adherence scores. Follow-up assessments were conducted at 3 months and 6 months to record lipid profile values and reassess adherence status. Cardiovascular risk scores were calculated at baseline and follow-up visits. All collected information was documented in a structured data collection form and analyzed systematically.

Materials, Investigations and Interventions

No additional investigations or interventions beyond routine clinical care were performed. Data collection was limited to patient interviews, adherence assessment, and review of medical records and laboratory reports.

Anticipated Risks and Risk Minimization

The study involved no anticipated physical or psychological risks to participants. Confidentiality and anonymity of patient information were strictly maintained, and participation was entirely voluntary.

Data Analysis Procedure

All collected data were entered into Microsoft Excel and verified for completeness and accuracy. Continuous variables such as age and lipid profile parameters were expressed as mean ± standard deviation, while categorical variables such as gender, comorbidities, statin dose distribution, adherence categories, and cardiovascular risk groups were expressed as frequencies and percentages. Changes in lipid profile parameters and cardiovascular risk scores between baseline, 3 months, and 6 months were evaluated. Results were presented using tables, graphs, and charts for better interpretation.

Statistical Methods

Data were analyzed using appropriate descriptive and inferential statistical methods. Continuous variables were expressed as mean ± standard deviation and categorical variables as frequencies and percentages. Paired t-test, Chi-square test, and Analysis of Variance (ANOVA) were used to assess associations between medication adherence, lipid profile changes, and cardiovascular risk outcomes. A p-value < 0.05 was considered statistically significant.

Statistical Software

Data analysis was performed using Microsoft Excel, GraphPad Prism Version 9, and SPSS Version 23.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee (IEC) of SVS Medical College and Hospital prior to initiation of the study. Reference Number: IEC/DHR-03/(04-8)/2025

RESULTS AND DISCUSSION

Age-wise Distribution of Study Participants

Age is a well-established risk factor for dyslipidemia and cardiovascular disease. In the present study, the majority of participants belonged to the elderly age group, indicating a higher prevalence of dyslipidemia among older adults. Age-related metabolic changes, reduced physical activity, and the presence of multiple comorbidities may contribute to this observation. (Table 1 and Figure 1).These findings emphasize the importance of routine lipid screening and cardiovascular risk assessment in the elderly population.

Table 01: Age-wise distribution of study participants (n = 100)

Age (Years)	Frequency	Percentage
18–39	1	1
40–59	40	40
≥60	59	59
Total	100	100

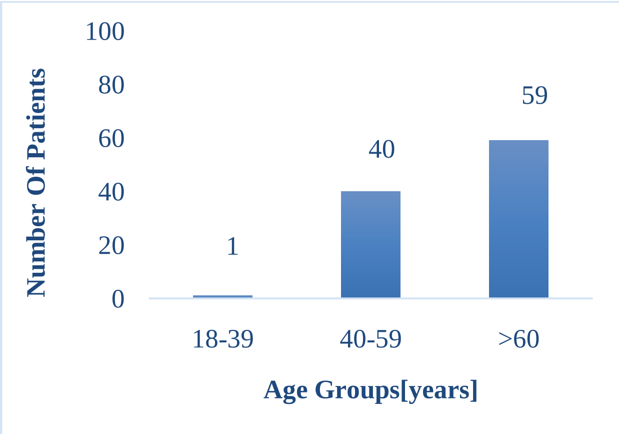

Figure 01: Column graph showing Age wise distribution of study participants (n=100).

Gender-wise Distribution of Study Participants

Gender differences have been reported in the prevalence and management of dyslipidemia. In the current study, male patients constituted a greater proportion of the study population than females. This finding may reflect the higher prevalence of cardiovascular risk factors among men as well as differences in healthcare-seeking behavior(Table 2 and Figure 2). Similar observations have been reported in previous epidemiological studies.

Table 02: Gender-wise distribution of study participants (n = 100)

Gender	Frequency	Percentage
Male	65	65
Female	35	35
Total	100	100

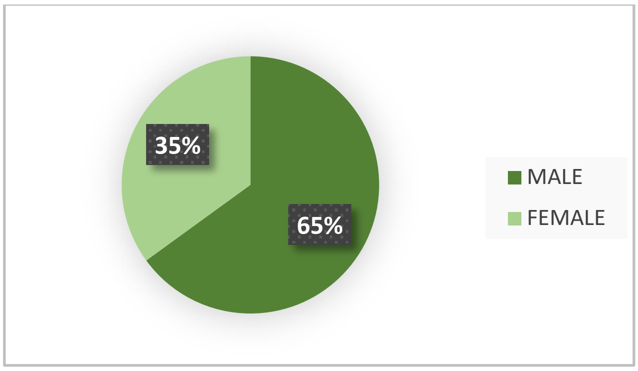

Figure 02: Pie chart showing Gender-wise distribution of study participants (n=100)

DISTRIBUTION OF COMORBIDITIES AMONG STUDY PARTICIPANTS

Comorbid conditions such as diabetes mellitus and hypertension significantly increase cardiovascular risk among patients with dyslipidemia. In the present study, a considerable proportion of participants had one or more comorbid conditions. The coexistence of diabetes and hypertension was particularly common, highlighting the clustering of cardiovascular risk factors in dyslipidemic patients (Table 03 and Figure 03). Effective management of these conditions is essential for reducing long-term cardiovascular complications.

Table 03: Distribution of comorbidities among study participants (n = 100)

Comorbidity	Frequency	Percentage
Diabetes	12	12
Hypertension	14	14
Diabetes + Hypertension	33	33
None	41	41
Total	100	100

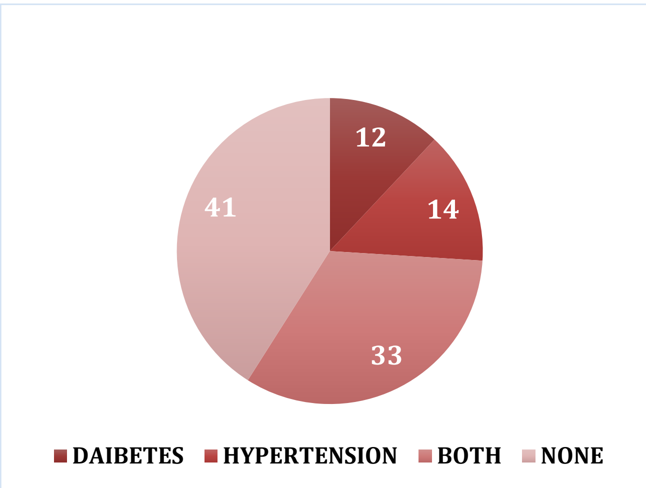

Figure 03: Pie chart showing distribution of comorbidities among study participants (n=100)

Distribution of Prescribed Atorvastatin Doses

The choice of statin dose is influenced by baseline lipid levels, cardiovascular risk, and treatment guidelines. In the present study, atorvastatin 40 mg was the most frequently prescribed dose. This finding indicates a preference for moderate-to-high intensity statin therapy among clinicians (Table 4 & Figure 4). Such prescribing practices are consistent with current recommendations for achieving effective LDL-C reduction and cardiovascular risk management.

Table 04: Distribution of prescribed atorvastatin doses (n = 100)

Dose	Frequency	Percentage
10 mg	23	23
20 mg	11	11
40 mg	60	60
80 mg	6	6
Total	100	100

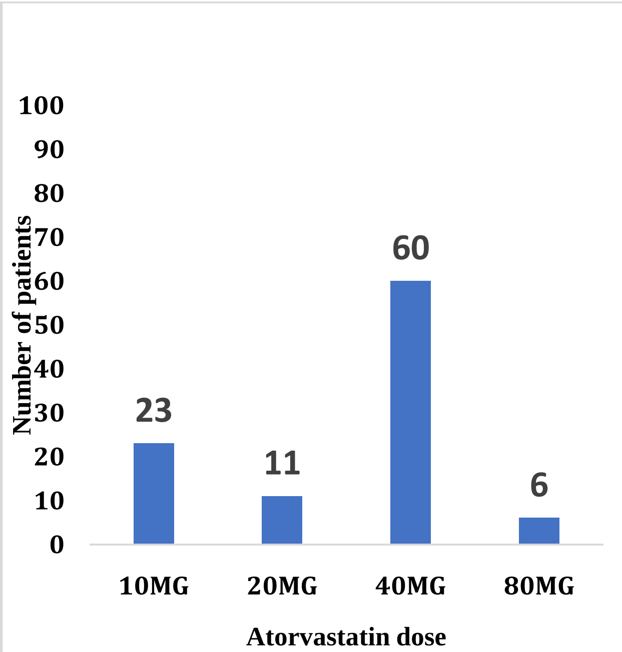

Figure 04: Column graph showing distribution of prescribed atorvastatin doses among study participants (n=100)

Distribution of Patients Based on Statin Medication Adherence Levels

Medication adherence is a key determinant of successful dyslipidemia management. Assessment using the MMAS-8 scale revealed varying levels of adherence among study participants. Although a proportion of patients demonstrated high adherence, a substantial number exhibited medium or low adherence (Table 05). These findings highlight the need for targeted interventions to improve long-term adherence to statin therapy.

Table 05: Distribution of patients based on statin medication adherence levels (n = 100)

Adherence Level	Frequency	Percentage
High	29	29
Medium	36	36
Low	35	35
Total	100	100

Baseline Lipid Profile Across Statin Adherence Categories

Baseline lipid profile assessment was performed to evaluate the initial lipid status of patients before follow-up. The mean values of total cholesterol, LDL-C, HDL-C, and triglycerides were generally comparable across the three adherence groups. These findings suggest that all groups had a similar burden of dyslipidemia at study initiation(Table 6). Therefore, any subsequent differences observed during follow-up may be attributed primarily to variations in medication adherence and treatment response.

Table 06: Baseline mean lipid parameters across statin adherence categories (n = 100)

Adherence Level	TC Mean (mg/dL)	LDL Mean (mg/dL)	HDL Mean (mg/dL)	TG Mean (mg/dL)
High (n=29)	240.72	168.89	37.00	258.89
Medium (n=36)	237.02	160.72	39.38	248.66
Low (n=35)	236.37	161.22	36.60	251.77

Mean Lipid Profile at 3 Months Across Statin Adherence Categories

Evaluation of lipid parameters at the three-month follow-up demonstrated improvement in all adherence groups. However, patients with high medication adherence exhibited greater reductions in total cholesterol, LDL-C, and triglyceride levels compared with those with medium and low adherence. A modest increase in HDL-C levels was also observed. These findings indicate that adherence to statin therapy plays an important role in achieving early lipid-lowering benefits.

Table 07: Mean lipid parameters at 3 months across statin adherence categories (n = 100)

Adherence Level	TC Mean (mg/dL)	LDL Mean (mg/dL)	HDL Mean (mg/dL)	TG Mean (mg/dL)
High (n=29)	216.30	145.70	40.68	230.90
Medium (n=36)	217.54	146.94	39.42	231.98
Low (n=35)	224.61	148.31	38.11	236.74

Mean Lipid Profile at 6 Months Across Statin Adherence Categories

At the six-month follow-up, substantial improvements in lipid profile parameters were observed, particularly among patients with high medication adherence. Greater reductions in total cholesterol, LDL-C, and triglyceride levels, along with higher HDL-C values, were evident in the high-adherence group compared with medium- and low-adherence groups (Table 8). These findings demonstrate the positive influence of consistent statin use on long-term lipid control and cardiovascular risk reduction.

Table 08: Mean lipid parameters at 6 months across statin adherence categories (n = 100)

Adherence Level	TC Mean (mg/dL)	LDL Mean (mg/dL)	HDL Mean (mg/dL)	TG Mean (mg/dL)
High (n=29)	170.69	110.90	43.59	196.90
Medium (n=36)	187.42	116.72	43.58	195.11
Low (n=35)	206.57	135.79	39.29	213.63

Comparison of Mean Lipid Parameters at Baseline, 3 Months, and 6 Months

A progressive improvement in lipid profile parameters was observed throughout the study period. Mean total cholesterol, LDL-C, and triglyceride levels decreased consistently from baseline to six months, while HDL-C levels showed a gradual increase. These findings indicate the effectiveness of statin therapy in improving lipid metabolism and reducing cardiovascular risk (Table 9). The observed improvements were more pronounced with continued treatment and medication adherence.

Table 09: Comparison of mean lipid parameters at baseline, 3 months, and 6 months (n = 100)

Time Period	TC Mean (mg/dL)	LDL Mean (mg/dL)	HDL Mean (mg/dL)	TG Mean (mg/dL)
Baseline	238.00	163.00	37.70	253.00
3 Months	216.30	145.70	40.68	230.90
6 Months	189.27	121.56	42.08	202.11

Comparison of ASCVD Risk Categories at Baseline, 3 Months, and 6 Months

The ASCVD risk score was used to estimate the 10-year risk of future cardiovascular events. Over the study period, a progressive shift of patients from higher-risk categories to lower-risk categories was observed. The proportion of patients classified as high risk decreased considerably, while the number of patients in the low-risk category increased (Table 10). These findings suggest that improved lipid control achieved through statin therapy contributes to meaningful reductions in predicted cardiovascular risk.

Table 10: Comparison of ASCVD risk categories at baseline, 3 months, and 6 months (n = 100)

Risk Category	Baseline n (%)	3 Months n (%)	6 Months n (%)
Low	17 (17%)	37 (37%)	39 (39%)
Moderate	40 (40%)	28 (28%)	36 (36%)
High	43 (43%)	35 (35%)	25 (25%)
Total	100 (100%)	100 (100%)	100 (100%)

Comparison of Framingham Risk Categories at Baseline, 3 Months, and 6 Months

Assessment using the Framingham Risk Score demonstrated a favorable trend in cardiovascular risk reduction over the follow-up period. The proportion of patients classified as low risk increased progressively, whereas moderate- and high-risk categories showed a gradual decline (Table 11). These findings further support the beneficial impact of statin therapy and medication adherence on long-term cardiovascular risk management.

Table 11: Comparison of Framingham risk categories at baseline, 3 months, and 6 months (n = 100)

Risk Category	Baseline n (%)	3 Months n (%)	6 Months n (%)
Low	37 (37%)	48 (48%)	57 (57%)
Moderate	37 (37%)	32 (32%)	27 (27%)
High	26 (26%)	20 (20%)	16 (16%)
Total	100 (100%)	100 (100%)	100 (100%)

CONCLUSION

The present prospective observational study evaluated statin medication adherence and its impact on lipid profile parameters and cardiovascular risk among patients with dyslipidemia over a six-month follow-up period. The findings demonstrated that patients with higher adherence to statin therapy achieved significantly better lipid control, characterized by greater reductions in total cholesterol, LDL-C, and triglyceride levels, along with improvements in HDL-C concentrations. Furthermore, cardiovascular risk assessment using ASCVD and Framingham risk scores showed a progressive shift from higher-risk to lower-risk categories during follow-up.Overall, the study highlights the critical role of medication adherence in maximizing the therapeutic benefits of statin therapy and reducing cardiovascular risk among patients with dyslipidemia. Strategies aimed at improving patient awareness, regular follow-up, adherence monitoring, and pharmacist-led counseling may contribute to better treatment outcomes and enhanced cardiovascular risk reduction in routine clinical practice.

LIMITATIONS AND RECOMMENDATIONS

The present study has certain limitations that should be considered while interpreting the findings. The study was conducted in a single tertiary care hospital with a relatively small sample size of 100 patients, which may limit the generalizability of the results to broader populations. Medication adherence was assessed using the self-reported MMAS-8 questionnaire, which may be subject to recall and reporting bias. In addition, factors such as dietary habits, physical activity, smoking status, socioeconomic conditions, and other lifestyle-related variables were not comprehensively evaluated and may have influenced lipid profile outcomes and cardiovascular risk. Furthermore, the six-month follow-up period may not adequately reflect the long-term effects of statin adherence on cardiovascular morbidity and mortality. Therefore, future multicentre studies with larger sample sizes and longer follow-up periods are recommended to provide more robust evidence. Regular patient education, adherence monitoring, pharmacist-led counseling, and the implementation of reminder-based interventions may help improve medication adherence and optimize lipid control. Early identification and management of associated cardiovascular risk factors, including diabetes mellitus and hypertension, should also be emphasized to achieve better long-term cardiovascular outcomes.

FUNDING

Nil

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

We also thank the patients who consented to participate in this research.

AUTHOR CONTRIBUTIONS

B. Swapna conceived and designed the study, supervised the research work, and drafted the manuscript. P. Bhuvaneshwari, G.Pavani, Hifsa Lubna, A. Sainathcontributed to data collection, analysis, and manuscript preparation. All authors reviewed and approved the final version of the manuscript.

ETHICAL STATEMENT

The ethical committee clearance was obtained from SVS MEDICAL COLLEGE HOSPITAL before initiating the study. Reference number: IEC/DHR-03/ (04-8)/2025

REFERENCES

1. Mensah GA, Roth GA, Fuster V. Global burden of cardiovascular diseases and risks, 1990–2022. J Am Coll Cardiol. 2023;82(25):2350-2370. https://doi.org/10.1016/j.jacc.2023.11.007
2. Prabhakaran D, Jeemon P, Roy A. Cardiovascular diseases in India: current epidemiology and future directions. Lancet Glob Health. 2018;6(12):e1339-e1351. https://doi.org/10.1161/circulationaha.114.008729
3. Kalra A, Prasad S, Bhatia R. Cardiovascular disease epidemic in India: challenges and opportunities. Indian Heart J. 2023;75(4):307-314. https://doi.org/10.1161/circulationaha.114.008729
4. Pappan N, Rehman A. Dyslipidemia. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024. https://www.ncbi.nlm.nih.gov/books/NBK560891/
5. Mach F, Baigent C, Catapano AL, et al. 2023 ESC Guidelines for the management of dyslipidaemias. Eur Heart J. 2023;44(36):3936-4066.
6. https://doi.org/10.1093/eurheartj/ehaf190
7. Berberich AJ, Hegele RA. The complex molecular genetics of familial hypercholesterolaemia. Nat Rev Cardiol. 2019;16(1):9–20.
8. https://doi.org/10.1038/s41569-018-0052-6
9. Borén J, Chapman MJ, Krauss RM, et al. Low-density lipoproteins cause atherosclerotic cardiovascular disease. Eur Heart J. 2020;41(24):2313–2330. https://doi.org/10.1093/eurheartj/ehz962
10. Pirillo A, Casula M, Olmastroni E, et al. Global epidemiology of dyslipidaemias. Nat Rev Cardiol. 2021;18(10):689–700. https://doi.org/10.1038/s41569-021-00541-4
11. Noubiap JJ, Bigna JJ, Nansseu JR, et al. Prevalence of dyslipidaemia in adults worldwide: a systematic review. BMJ Open. 2018;8(5):e019117. https://doi.org/10.1016/s2214-109x(18)30275-4
12. Gidding SS, Allen NB. Cholesterol and atherosclerotic cardiovascular disease: a lifelong problem. J Am Heart Assoc. 2019;8(11):e012924. https://doi.org/10.1161/jaha.119.012924
13. Vergès B. Lipid disorders in type 2 diabetes. Diabetes Metab. 2019;45(6):537–548.: https://doi.org/10.1016/s1262-3636(07)70213-6
14. Lichtenstein AH, Appel LJ, Vadiveloo M, et al. 2021 dietary guidance to improve cardiovascular health. Circulation. 2021;144(23):e472–e487. https://doi.org/10.1161/cir.0000000000001031
15. Vaziri ND. Disorders of lipid metabolism in chronic kidney disease. Nat Rev Nephrol. 2016;12(10):595–606. https://doi.org/10.1159/000488816
16. Feingold KR. Drug-induced dyslipidemia. Endotext [Internet]. 2023. https://www.ncbi.nlm.nih.gov/books/NBK305900/
17. Gaggini M, et al. Lipids in atherosclerosis: pathophysiology and evolution of treatment strategies. Int J Mol Sci. 2022;23(1):420. https://doi.org/10.3390/ijms24010075
18. Patel S, et al. Non-HDL cholesterol in dyslipidemia: state-of-the-art review. Clin Lipidol. 2023;18(3):1–15. https://doi.org/10.1016/j.atherosclerosis.2023.117312
19. Hirano T. Pathophysiology of diabetic dyslipidemia: beyond simple lipid abnormalities. J Atheroscler Thromb. 2018;25(1):34–42. https://doi.org/10.5551/jat.rv17023
20. Peters SAE, Woodward M. Sex differences in the burden and complications of dyslipidemia. Lancet Diabetes Endocrinol.2018;6(7):538–548. https://doi.org/10.1007/s11892-018-1005-5
21. Khera AV, Kathiresan S. Genetics of lipid disorders. Circulation. 2017;136(20):1968–1980. https://doi.org/10.1038/nrg.2016.160