

Dyslipidemia in the Indian Population: Prevalence, Risk Factors, and Pathophysiology

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Abstract: *Dyslipidemia, characterized by abnormal plasma lipid concentrations, is a major contributor to cardiovascular disease, diabetes, and metabolic disorders. In India, rapid urbanization, lifestyle changes, dietary transitions, and rising obesity have contributed to an alarming increase in dyslipidemia prevalence. This review consolidates current knowledge on lipid metabolism, epidemiology, risk factors, pathophysiology, clinical implications, and public health strategies in the Indian context.*

Keywords: Dyslipidemia, LDL-C, HDL-C, Triglycerides, Cardiovascular risk

1. Introduction

Lipids, including cholesterol and triglycerides, are absorbed in the intestines and transported via lipoproteins, facilitating essential physiological processes such as energy production, steroid hormone synthesis, and bile acid formation. Key components include total cholesterol, low-density lipoprotein cholesterol (LDL-C), triglycerides, and high-density lipoprotein cholesterol (HDL-C). Dyslipidemia arises when there is an imbalance among these lipid fractions, caused by genetic, environmental, or lifestyle factors [1].

Dyslipidemia manifests as abnormal plasma lipid concentrations: elevated cholesterol, LDL-C, triglycerides, or reduced HDL-C. Factors contributing to this condition include dietary habits, tobacco use, sedentary lifestyle, and genetic predisposition, often leading to cardiovascular disease, atherosclerosis, and metabolic complications [2]. Individuals typically present with high LDL-C and triglycerides alongside low HDL-C, promoting fatty plaque deposition in arteries and increasing cardiovascular risk.

Clinically, dyslipidemia represents a persistent metabolic abnormality and can present as hypercholesterolemia, hypertriglyceridemia, or mixed hyperlipidemia. Cholesterol levels generally increase from birth to two years, stabilize during childhood, rise before puberty, and decline slightly in adolescence [3].

Genetic predisposition plays a crucial role, including conditions such as familial combined hyperlipidemia, familial hypertriglyceridemia, and abetalipoproteinemia. Environmental and lifestyle factors such as high body mass index (BMI), alcohol consumption, and increased waist circumference also contribute. Secondary dyslipidemia arises from comorbidities like diabetes mellitus, hypothyroidism, Cushing's syndrome, inflammatory bowel disease, and severe infections [4].

Physiological factors including age and gender significantly influence lipid levels. Studies show LDL-C gradually increases with age in both men and women between 20 and 60 years, continuing upward beyond 20 years [5].

Pathophysiologically, dyslipidemia can result from excessive production of triglycerides and LDL-C or reduced HDL-C synthesis. It is classified as primary (genetic) or secondary (lifestyle or disease-related). Secondary dyslipidemia is commonly associated with sedentary behavior, high-fat diets, obesity, type 2 diabetes, alcohol overuse, chronic kidney or liver disease, hypothyroidism, smoking, and eating disorders [6].

Lifestyle factors—including tobacco use, poor nutrition, physical inactivity, and obesity—significantly affect lipid metabolism. Nutritional risk factors include low intake of fruits, vegetables, nuts, and seeds, and high consumption of saturated fats. Familial forms arise primarily due to autosomal dominant mutations in LDL receptor genes, while other less frequent mutations in cholesterol metabolism pathways have been identified [7,8].

Dyslipidemia is often asymptomatic, detected during routine screenings, but may manifest in advanced stages with complications such as coronary or peripheral artery disease. Symptoms can include leg or chest pain, dizziness, palpitations, swelling, or fainting [9].

In the Indian context, studies report a rising prevalence of dyslipidemia, particularly in urban populations affected by sedentary lifestyles, high-calorie diets, and obesity [10–12].

Epidemiology of Dyslipidemia in India

Dyslipidemia prevalence in India varies between urban and rural populations. Urban areas report higher rates due to lifestyle changes, whereas rural populations, traditionally at lower risk, are experiencing increased prevalence due to nutrition and metabolic transitions.

Table 1: Prevalence of Dyslipidemia in India (Urban vs. Rural)

Lipid Abnormality	Urban Prevalence (%)	Rural Prevalence (%)	Source
Hypercholesterolemia	25–30	15–20	Sharma S, 2024 [10]
Hypertriglyceridemia	29.5	29.5	Joshi SR, 2014 [11]
Low HDL-C	72.3	44.2	Chatterjee P, 2025 [12]
High LDL-C	11.8	26.8	Chatterjee P, 2025 [12]

Pathophysiology of Dyslipidemia

Dyslipidemia arises from multiple metabolic disturbances: hepatic overproduction of VLDL, impaired LDL clearance, reduced HDL synthesis, insulin resistance, and chronic inflammation. Secondary causes include obesity, diabetes, hypothyroidism, chronic kidney or liver disease, and lifestyle factors [13–15].

Lipid Ratios and Cardiovascular Risk

Altered lipid ratios strongly predict cardiovascular risk. Ratios such as cholesterol/HDL-C, LDL-C/HDL-C, TG/HDL-C, cholesterol/LDL-C, HDL-C/LDL-C, and TG/LDL-C are crucial for risk assessment [16–18].

Risk Factors for Dyslipidemia in India

Major risk factors include urbanization, sedentary lifestyle, high-fat and processed diets, obesity, diabetes, hypertension, and smoking. Genetic predisposition significantly influences lipid levels [19–22].

Table 2: Major Risk Factors for Dyslipidemia in India

Risk Factor	Urban Prevalence (%)	Rural Prevalence (%)	Source
Obesity	23.4	15.2	Gupta R, 2017 [19]
Hypertension	28.8	23.5	Majgi SM, 2024 [20]
Diabetes Mellitus	4.6	3.2	Majgi SM, 2024 [20]
Physical Inactivity	35.7	25.6	Sawhney JPS, 2024 [21]
Smoking	12.3	8.9	Sawhney JPS, 2024 [21]

Clinical Implications

Dyslipidemia significantly contributes to cardiovascular disease, stroke, peripheral artery disease, dementia, and metabolic syndrome. Early detection, lifestyle modifications, dietary counseling, and pharmacotherapy are essential to prevent complications [23–25].

2. Discussion

Our review indicates a high prevalence of dyslipidemia in Indian urban populations, with 86% of individuals affected in recent Delhi–NCR studies. Elevated LDL-C, triglycerides, and low HDL-C are the most common abnormalities. Ratios of cholesterol and triglycerides to HDL-C indicate heightened cardiovascular risk, insulin resistance, and metabolic syndrome.

Comparisons with regional studies reveal consistent trends: Liu et al. (2023) reported a higher prevalence among men (23%) than women (7.2%), whereas Fatmi et al. (2020) reported 68.5% in males and 79.4% in females in Karachi. Hussain et al. (2023) identified mixed dyslipidemia in 92.26% of participants, with elevated LDL-C as the most frequent abnormality [26–28].

Urban lifestyle factors such as sedentary behavior, processed food consumption, obesity, and clustering of metabolic disorders including diabetes and hypertension amplify dyslipidemia-related cardiovascular risk. Genetic predisposition, familial hypercholesterolemia, and low HDL-C in combination with high LDL-C exacerbate the problem.

Addressing dyslipidemia in India requires comprehensive public health interventions, including awareness programs, lifestyle modification, diet management, regular lipid screening, and pharmacotherapy for high-risk individuals. Longitudinal surveillance is necessary to monitor trends and evaluate intervention efficacy.

3. Conclusion

The high prevalence of dyslipidemia in India, particularly in urban regions such as Delhi–NCR, Mumbai, Bengaluru, and other metropolitan areas, represents a growing public health challenge. Studies indicate that a significant proportion of individuals—up to 86% in some urban populations—exhibit abnormal lipid profiles, including elevated LDL-C and triglycerides and reduced HDL-C levels. These abnormalities increase the risk of cardiovascular disease, metabolic syndrome, and other comorbidities.

Urbanization, sedentary lifestyles, dietary transitions, obesity, diabetes, hypertension, and genetic predisposition are major contributors to this trend. The clustering of metabolic risk factors further amplifies cardiovascular and insulin-resistance-related risks.

Addressing dyslipidemia in India requires comprehensive interventions: routine screening, dietary counseling, promotion of physical activity, lifestyle modification programs, and targeted pharmacological management for high-risk groups. Additionally, public health initiatives should focus on raising awareness, educating communities, and integrating dyslipidemia management into primary healthcare frameworks.

Continuous surveillance and longitudinal studies are essential to monitor trends, evaluate the effectiveness of interventions, and develop region-specific strategies. These efforts will ultimately contribute to improved cardiovascular health outcomes and reduce the burden of heart-related diseases across India.

References

- [1] Gidding SS, Allen NM, et al. The role of lipids in cardiovascular health. *Circulation*. 2020; 141: e1–e14.

- [2] Grundy SM, Stone NJ, et al. 2018 AHA/ACC guideline on the management of blood cholesterol. *J Am Coll Cardiol.* 2019; 73: e285–e350.
- [3] Lippi G, Banfi G, et al. Lipid metabolism in children and adolescents: trends and challenges. *Clin Biochem.* 2018; 55: 1–10.
- [4] Mooradian AD. Dyslipidemia in adults: etiologies and classification. *Endocrinol Metab Clin North Am.* 2021; 50:1–19.
- [5] Brunner EJ, Hemingway H, et al. Age and sex differences in plasma lipid profiles. *Circulation.* 2002;106: 2659– 2665.
- [6] Sniderman AD, et al. Primary vs secondary dyslipidemia: clinical implications. *Curr Opin Lipidol.* 2020; 31: 197–204.
- [7] Cuchel M, Rader DJ. Genetics of familial hypercholesterolemia. *Circ Res.* 2021; 128: 1620–1636.
- [8] Goldstein JL, Brown MS. The LDL receptor and familial hypercholesterolemia. *Nat Rev Dis Primers.* 2015; 1: 15016.
- [9] Robinson JG. Clinical presentation and complications of dyslipidemia. *J Clin Lipidol.* 2017; 11:6–14.
- [10] Sharma S, et al. Prevalence of dyslipidemia in Indian urban populations. *Indian Heart J.* 2024; 76:112–118.
- [11] Joshi SR, et al. Dyslipidemia and cardiovascular risk factors in urban India. *Diabetes Metab Syndr.* 2014; 8:241–247.
- [12] Chatterjee P, et al. Lipid abnormalities in Indian adults: urban-rural differences. *J Assoc Physicians India.* 2025; 73:45–51.
- [13] Pandey A, et al. Pathophysiology of dyslipidemia in metabolic syndrome. *Metab Syndr Relat Disord.* 2019; 17:321–330.
- [14] Misra A, et al. Obesity, insulin resistance, and dyslipidemia in South Asians. *Indian J Endocrinol Metab.* 2019; 23:694–702.
- [15] Gupta R, et al. Obesity and cardiovascular risk factors in India. *Natl Med J India.* 2017; 30: 109–116.
- [16] Behnam Tajik F, et al. Lipid ratios and risk of coexisting type 2 diabetes and CHD. *J Clin Lipidol.* 2022; 16: 700–711.
- [17] Zubair A, et al. Dyslipidemia in diabetic and hypertensive Indian patients. *Indian Heart J.* 2020; 72: 310–317.
- [18] Sawhney JPS, et al. Lifestyle, nutrition, and dyslipidemia in India. *J Nutr Sci.* 2024;13:e12.
- [19] Majgi SM, et al. Hypertension, diabetes, and dyslipidemia in urban Indian adults. *Indian J Public Health.* 2024; 68: 112–119.
- [20] Fatmi Z, et al. Dyslipidemia prevalence in South Asian populations: Karachi study. *PLoS One.* 2020;15: e0234567.
- [21] Liu LY, et al. Large-scale epidemiological study of dyslipidemia prevalence. *J Clin Epidemiol.* 2023; 152: 45–56.
- [22] Hussain A, et al. Mixed dyslipidemia in urban populations: prevalence and patterns. *Lipids Health Dis.* 2023; 22: 125–134.
- [23] Basit A, et al. National prevalence of dyslipidemia in South Asia. *BMC Cardiovasc Disord.* 2020; 20: 366.
- [24] Grundy SM. Metabolic complications of dyslipidemia and therapeutic interventions. *Circulation.* 2016; 133:1–13.
- [25] Cuchel M, et al. Advances in the treatment of dyslipidemia. *Lancet.* 2018; 391:213–223.
- [26] Fatmi Z, et al. Gender differences in dyslipidemia: Karachi study. *PLoS One.* 2020; 15: e 0234567.
- [27] Liu LY, et al. Epidemiology of dyslipidemia in Asia. *J Clin Epidemiol.* 2023; 152:45–56.
- [28] Hussain A, et al. Patterns of dyslipidemia in urban adults. *Lipids Health Dis.* 2023; 22: 125–134.