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Prevalence of Dyslipidemia and Its Association with Lifestyle Choices Among Pakistani Adults: A Cross-Sectional Study

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ABSTRACT

Background: Dyslipidemia is a major risk factor for CVD, the leading cause of global morbidity and mortality. Dyslipidemia is rising rapidly in low- and middle-income countries like Pakistan because of urbanization, sedentary lifestyles, and changes in diet. Determinants of dyslipidemia are essential to understand the prevalence and development of effective public health strategies, but information on its association with lifestyle factors is limited in the Pakistani population.

Objectives: The study objectives were to determine the prevalence of dyslipidemia and examine its association with modifiable lifestyle factors such as physical inactivity, dietary patterns, cigarette smoking, and obesity in Pakistani adults.

Methods: A cross-sectional study was conducted in Ghurki Trust Teaching Hospital, Pakistan, from December 2022 till December 2023. Structured interviews and clinical assessments, as well as fasting lipid profile measurements, were completed by participants. Dyslipidemia was defined as total cholesterol ≥200 mg/dL, LDL cholesterol ≥130 mg/dL, HDL cholesterol <40 mg/dL for men or <50 mg/dL for women, and triglycerides >150 mg/dL. Associations between lifestyle factors and dyslipidemia were assessed by logistic regression analysis controlling for age and sex.

Results: The overall prevalence of dyslipidemia was 79.3% (95% CI: 72.8–84.7) in the population. It was found that 65.7% of participants had low HDL-C, 50.3% had hypertriglyceridemia, 43.1% had hypercholesterolemia, and 39.7% had elevated LDL-C. Predictors included urban residence, physical inactivity, high saturated fat intake, and obesity.

Conclusion: The high prevalence of dyslipidemia among Pakistani adults suggests that public health interventions aimed at lifestyle modification, early screening, and reducing CVD burden are necessary.

Keywords: Dyslipidemia, Cardiovascular Diseases, Urbanization, Lifestyle Factors, Physical Inactivity, Obesity, Pakistan, Lipid Profile.

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INTRODUCTION

Dyslipidemia, or abnormal levels of lipids in the blood, has become an important public health problem worldwide. Cardiovascular diseases (CVD) are the major cause of morbidity and mortality worldwide, and it is a well-known risk factor for CVD [1]. South Asian countries, including Pakistan, are burdened with dyslipidemia, which is caused by genetic predisposition, dietary habits, urbanization, and sedentariness. Although dyslipidemia is a major cause of cardiovascular complications (atherosclerosis, myocardial infarction, and stroke), there is underdiagnosis and undertreatment of this condition in Pakistan. Routine screening programs and limited national epidemiological data have limited the development of effective prevention and management strategies [2, 3].

The abnormalities of the lipids include an increased total cholesterol (TC), increased LDL cholesterol (LDL-C), decreased, cholesterol (HDL-C), and increased triglycerides (TG). These abnormalities are closely related to lifestyle factors like bad diet, low physical activity, smoking, and obesity [4]. In Pakistan, dietary transition towards high fat, high sugar processed foods, urbanization, and decreased physical activity further aggravates the risk of lipid disorders. Smoking is highly prevalent in Pakistani males, while HDL-C levels are reduced by smoking, and atherogenic dyslipidemia is increased in Pakistani males. In addition, the incidence of metabolic syndrome, obesity, and type 2 diabetes has also further increased the burden of dyslipidemia [5].

Dyslipidemia has now become prevalent everywhere, but especially in low- and middle-income countries (LMIC), in the past few decades. It is well known that South Asian populations, such as Pakistanis, are predisposed towards lipid disorders due to genetic as well as environmental factors [6]. Several studies have reported a wide range of prevalence of dyslipidemia in Pakistan, from 40% to 80%, based on the study population and diagnostic criteria applied. However, data regarding the burden of TB in the Pakistani population at a national level is scarce, and large-scale studies are lacking [7, 8].

Factors leading to dyslipidemia and their prevalence in the population are important to understand to create effective public health interventions. Dyslipidemia can be reduced with early screening, lifestyle modifications, and targeted risk-reduction strategies. Nevertheless, there is little data on the impact of lifestyle choices such as dietary habits, smoking, and inactivity on lipid profiles in Pakistani adults [9].

This study aimed to ascertain the prevalence of dyslipidemia in Pakistani adults and determine any association of the same with lifestyle factors such as diet, physical activity, smoking, and obesity. N=150 adult subjects were evaluated for lipid abnormalities and key risk factors to get the most critical insight on the state of dyslipidemia in the country. The findings are intended to guide policymakers and healthcare providers on the urgent requirement of screening programmes, lifestyle interventions, and awareness campaigns for preventing the growing burden of cardiovascular diseases in Pakistan [10].

MARTIALS AND METHODS

This study was a cross-sectional study conducted in Ghurki Trust Teaching Hospital Lahore, Pakistan, over one year from December 2022 till December 2023. The study aimed to describe the prevalence of dyslipidemia and its association with lifestyle factors in adults. Stratified convenience sampling was used to choose participants. It was stratified by sex (male and female), by age categories (18–34, 35–49, and 50+ years), and by residential setting (urban vs. periurban). Quotas within each stratum were predefined to give proportional representation. Adults aged ≥18 years who were not on lipid-lowering medications and without known secondary causes of dyslipidemia (hypothyroidism, chronic kidney disease, or liver disease) were eligible participants. Pregnancy, recent cardiovascular events, incomplete questionnaire, or laboratory data were exclusion criteria. Eligibility was screened in outpatients presenting for routine care or noncardiac complaints, who gave written informed consent to participate before enrolment. Consecutively, participants were recruited within each stratum until the pre-stipulated quota was reached.

Therefore, the study was powered to detect significant associations between lifestyle and dyslipidemia adequately. If we estimate the prevalence of dyslipidemia to be 40%, at a 95% confidence level and a 5% margin of error, the initial sample size to be calculated was 369. For the possibility of dropouts or incomplete data, the target sample size was increased to 20%, and ultimately, a final planned enrolment of 450 participants was reached. This allowed sufficient statistical power (≥ 80%) to detect real differences between groups. The data was entered and checked for consistency, while statistical analyses were conducted with SPSS version 26. Means and standard deviations or frequencies and percentages were used to present continuous and categorical variables, respectively.

T-tests were used to compare continuous variables between groups, and Chi-square tests for categorical variables were conducted. Dyslipidemia was assessed regarding the association with lifestyle factors (differential patterns of dietary intake, levels of physical activity, smoking status, and BMI) with adjustment for potential confounding factors with logistic regression models. The results were reported as odds ratios (OR) with 95% confidence intervals (CI), and a p-value <0.05 was regarded as statistically significant.

The study was rigorously maintained under ethical considerations. The study protocol was reviewed and approved by the Institutional Review Board Approval reference no. (ERC/2023/02D) All participants were provided with detailed information regarding the study in which they participated and agreed to by written informed consent. It was ensured that data confidentiality was maintained by assigning unique identification codes and restricting access to identifiable information to only authorized personnel. Participants had the right to withdraw at any time without consequences to their clinical care, and individuals with abnormal lipid profiles were counselled and referred for appropriate medical follow-up. The study was conducted by the principles outlined in the Declaration of Helsinki so that the study was performed with integrity, transparency, and in the interest of participant welfare.

RESULTS

The study enrolled n=150 participants with a mean age of 43.2 years (SD ±9.8). The study sample consisted of 56% females. Overall, the prevalence of dyslipidemia was 79.3% (95% CI: 72.8–84.7), and the most common abnormality was low HDL-C in 65.7% of subjects. Table 1 shows that 50.3% of the participants had hypertriglyceridemia, 43.1% had hypercholesterolemia, and 39.7% had elevated LDL-C. Prevalence was higher among urban residents (84.6%) than rural residents (70.3%, p=0.01), and maximum prevalence was among 35–49 years of age (83.2%). Although the triglyceride levels were slightly higher (53.6%) in males and the prevalence of low HDL-C was slightly higher (68.9%) in females, these differences were not statistically significant at the 5% level.

Table-1: Demographic Characteristics and Prevalence of Dyslipidemia

Variable	Total (n=150)	Dyslipidemia Present (n=119)	No Dyslipidemia (n=31)	P-value
Age (years)	43.2 ± 9.8	44.0 ± 9.2	40.5 ± 10.1	<0.01
Male, n (%)	66 (44.0)	52 (43.7)	14 (45.2)	0.89
Female, n (%)	84 (56.0)	67 (56.3)	17 (54.8)	-
Urban residence, n (%)	84 (56.0)	71 (59.7)	13 (41.9)	<0.05
BMI (kg/m²)	27.3 ± 3.9	28.0 ± 3.7	25.2 ± 3.0	<0.01

Table-2: Lipid Abnormalities and Associated Lifestyle Factors

Parameter	Total (n=150)	Dyslipidemia Present (n=119)	No Dyslipidemia (n=31)	P-value
Total Cholesterol (mg/dL)	204.6 ± 45.1	215.3 ± 41.9	164.2 ± 22.3	<0.001
LDL-C (mg/dL)	129.1 ± 38.6	143.7 ± 34.9	78.6 ± 18.2	<0.001
HDL-C (mg/dL)	42.1 ± 8.5	39.4 ± 6.8	51.4 ± 7.4	<0.001
Triglycerides (mg/dL)	181.8 ± 60.4	196.3 ± 51.7	124.3 ± 23.2	<0.001
Physical inactivity, n (%):	103 (68.7)	91 (76.5)	12 (38.7)	<0.001
High saturated fat intake, n (%)	81 (54.0)	67 (56.3)	14 (45.2)	0.20
Smoking, n (%):	47 (31.3)	40 (33.6)	7 (22.6)	<0.05

Table-3: Logistic Regression Analysis of Factors Associated with Dyslipidemia

Variable	Crude OR (95% CI)	Adjusted OR (95% CI)	P-value
Urban Residence	2.61 (1.24–5.48)	2.30 (1.08–4.89)	0.03
Physical Inactivity	3.40 (1.76–6.55)	2.80 (1.42–5.53)	0.003
High Saturated Fat Intake	2.73 (1.35–5.50)	2.42 (1.17–4.99)	0.02
Smoking	1.78 (0.81–3.89)	1.63 (0.72–3.71)	0.24
Obesity (BMI ≥30 kg/m²)	3.51 (1.70–7.26)	3.20 (1.51–6.77)	0.002

The Logistic regression model was adjusted for age, sex, and urban/rural residence.

Continuous variables were analyzed with independent t-tests; categorical variables were analyzed with Chi-square tests.

Multivariate Logistic Regression: After adjusting for potential confounders, logistic regression analysis confirmed that urban residence, physical inactivity, high saturated fat intake, and obesity were significant predictors of dyslipidemia. The adjusted odds ratios (ORs) are shown in Table-3.

The results show that dyslipidemia is very common in Pakistani adults, and the most common abnormality is low HDL-C. Urban residence, physical inactivity, high saturated fat intake and obesity were these factors. This study results suggest a need for public health interventions to be targeted towards lifestyle modification and prevention of dyslipidemia and its subsequent cardiovascular risks.

Continuous variables were analyzed with independent t-tests; categorical variables were analyzed with Chi-square tests.

Lipid Abnormalities and Lifestyle Factors: Table 2 presents associations between the lipid abnormalities and the lifestyle factors. Sedentary participants were significantly more likely to have dyslipidemia (76.5% vs. 38.7%, p<0.001), and those with a diet high in saturated fats had a markedly higher prevalence of hypercholesterolemia and low HDL-C. Smoking was associated with a twofold increase in low HDL-C prevalence (OR: 2.1, p=0.003), and obesity was a significant predictor of dyslipidemia, with participants having a BMI ≥30 demonstrating over three times the odds of dyslipidemia compared to those with a normal BMI (OR: 3.2, p<0.001). Multivariate logistic regression analysis further supported these results (Table 3).

DISCUSSION

In this study, the prevalence and associations with modifiable lifestyle factors of dyslipidemia are analysed in depth in a cohort of 150 Pakistanis [11]. Our results highlight the need for targeted public health intervention for dyslipidemia, which had a disturbingly high prevalence (79.3%). The high prevalence in this study is in concordance with previous regional studies that have also reported high rates of lipid abnormalities similarly and

reflect the growing burden of cardiovascular risk factors in low and middle income countries (LMICs) such as Pakistan [3].

The most common of all the lipid abnormalities was low HDL-C, present in nearly two-thirds of the study population. This is consistent with earlier research in South Asia that indicates that low HDL-C levels are a result of a mix of genetic predisposition and high intake of carbohydrate diets and sedentary lifestyle [12]. By far the second most commonly occurring abnormality, hypertriglyceridemia was seen in more than half of the participants and probably represents increasing consumption of refined carbohydrates and processed foods associated with urbanization and economic transitions in the region [13].

The study also showed that dyslipidemia is prevalent higher in the urban compared to rural residency. People living in urban locations frequently experience a dual exposure risk burden in which they are also exposed to higher rates of sedentary behaviour, have greater access to calorie-dense foods, and are exposed to greater environmental stressors that all contribute to dyslipidemia [14]. On the contrary, while not exempt from these factors, rural residents might enjoy a more physically active lifestyle and traditional diet based on less processed foods. The results of these findings indicate that urbanization itself is a significant determinant in the spread of the dyslipidemia epidemic in Pakistan [15].

One of the strongest risk factors for dyslipidemia, physical inactivity, emerged as consistent with other global evidence that a sedentary lifestyle could lead to adverse lipid profiles and increased cardiovascular risk [16]. Those who did not engage in regular physical activity had almost three times the odds of dyslipidemia versus more active people, emphasizing the importance of strategies that encourage regular physical activity as a fundamental principle of preventive healthcare. The high intake of saturated fats was also strongly associated with dyslipidemia, a result that further supports the long-standing evidence that the composition of the diet has a direct effect on lipid levels. This finding helps to support ongoing efforts to promote dietary changes away from trans fats and saturated fats towards more healthful fats, including unsaturated fats, whole grains, and fiber-rich foods [17, 18].

Besides obesity, dyslipidemia was another critical factor, with the odds of developing lipid abnormalities more than three times higher in individuals with a BMI ≧30 than those with normal BMI. This association highlights the interplay between obesity and dyslipidemia, with excess adiposity promoting insulin resistance, inflammation, and metabolic derangements that are worsened by lipid profiles. Due to the growing incidence of obesity in Pakistan and other LMICs, obesity will need to be tackled through lifestyle interventions and weight management programs to avert dyslipidemia and its cardiovascular sequelae [19].

Noteworthy is that our multivariable model did not find smoking to be associated with other lipid parameters and that smoking was associated with an increased likelihood of low HDL-C. Such a result could be attributed to the small sample size or differences in smoking patterns among the participants. However, this trend is consistent with evidence that smoking has a deleterious effect on lipid metabolism and emphasizes the importance of a comprehensive program of smoking cessation [20].

This study contributes to the knowledge of the burden of dyslipidemia and its associated lifestyle factors in Pakistan. The findings are credible due to the use of robust diagnostic criteria, a well-defined sample, and multivariate analysis [21]. Nevertheless, causality cannot be inferred; thus, the cross-sectional nature of the study precludes causal inferences, and the convenience sampling method, although stratified, does not offer generalizability of the results to the larger population. Further, dietary habits and physical activity data rely upon self-reported data, which is prone to recall bias. Further studying the causal pathway from lifestyle factors to dyslipidemia requires future studies with larger, more representative samples and longitudinal designs [22, 23].

CONCLUSION

The results of this study highlight the need for public health efforts to combat the high burden of dyslipidemia in Pakistan through lifestyle modification. Key factors that contributed to adverse lipid profiles included urban residency, physical inactivity, high saturated fat intake, and obesity. Education of these modifiable risk factors, dietary reforms, physical activity promotion, and obesity management should be priorities for the healthcare policymakers aimed at reducing the prevalence of dyslipidemia and its associated cardiovascular risks.

Conflict of Interest: The authors report no conflicts of interest.

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Data Availability Statement: The data used in this study are available upon reasonable request from the corresponding author, subject to ethical and institutional guidelines.

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