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Plant-Based Diets and Dyslipidemia in Tharparkar: A Cross-Sectional Study on Lipid Imbalances

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ABSTRCT

OBJECTIVES: This study aims to assess lipid profiles in Tharparkar's vegetarian population and examine dietary habits and their correlation with lipid imbalances.

METHODOLOGY: A cross-sectional study was conducted from Dec 2024 to May 2025. The vegetarian population was included, and the non-vegetarian population was excluded. A total of 500 participants were selected via stratified random sampling. Lipid profiling was conducted after a 12-hour fasting. Dietary habits and socioeconomic factors were assessed using structured questionnaires. Data analysis was performed with SPSS.

RESULTS: 500 participants revealed that 60% had lipid imbalances. Specifically, 45% had high cholesterol, 40% had high LDL-C, 60% had low HDL-C, and 50% had high triglycerides. High carbohydrate intake from refined grains, low omega-3 fatty acid consumption, and fried food consumption were strongly linked to unfavourable lipid profiles.

CONCLUSION: The high dyslipidemia rates in Tharparkar's vegetarian population are occurring due to nutrient imbalances, socioeconomic factors and unhealthy food consumption. Public health counselling promoting balanced vegetarian diets and addressing lifestyle factors could help improve lipid profiles and reduce cardiovascular risk.

KEYWORDS: Vegetarian Diet, Dyslipidemia, Lipid Imbalances, Cardiovascular Risk, nutrient imbalance.

INTRODUCTION

Dyslipidemia, characterized as abnormal lipid levels in the blood and a major cause of cardiovascular diseases (CVD), which remain the leading cause of morbidity and mortality worldwide.[1] The condition is analyzed by elevated total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG).along with low levels of high-density lipoprotein cholesterol (HDL-C). These lipid imbalance can lead to the development of atherosclerosis, increasing the risk of heart attacks, strokes, and other cardiovascular events.[2] Globally, it is estimated that 39% of adults have high cholesterol, and the condition significantly indicates the high burden of CVDs, especially in low- and middle-income countries.[3]

In Pakistan, the increasing prevalence of dyslipidemia is alarming situation; numerous studies have shown that lipid abnormalities are the contributing factor to rising rates of cardiovascular diseases. A national survey on cardiovascular health in Pakistan reported that nearly 50% of the adult population exhibited one or more lipid abnormalities, including elevated LDL-C and low HDL-C levels.[4] A previously studies conducted in urban and rural regions has consistently shown that the risk factors for dyslipidemia, including diet, lifestyle, and socioeconomic conditions, are influenced across the globe.[5] The role of vegetarian diets is one of the most interactive aspects of the relationship between diet and dyslipidemia. Plant-based diets are often associated with lower cholesterol levels and reduced risks of heart diseases. The prevalence of dyslipidemia in vegetarian populations, particularly in specific population region with limited access to nutrient-rich foods, raises concerns about the effectiveness of vegetarian diets in promoting optimal heart health. In some cases, unbalanced plant-based diet and poor dietary planning have been linked to lipid imbalances despite a vegetarian lifestyle.[6]

The majority of people of Tharparkar in province of Sindh Pakistan are vegetarians. Plant based eating habits are deeply ingrained in this region's culture, primarily as a result of vegetarianism being emphasized in religious and cultural practices. Cereals, legumes, vegetables, and dairy products make up the majority of the typical Tharparkar diet. These foods are thought to be high in essential fatty acids and other micronutrients that are vital for lipid metabolism. Although vegetarian diets are generally heart-healthy, there is a paradox in Tharparkar, where the population suffers from a high burden of cardiovascular diseases and dyslipidemia rates are high.[7,8]

The incident of dyslipidemia in Tharparkar's vegetarian population is a growing concern. Several studies and Local health records have been indicated that despite following plant-based diet, many individuals in the region have high levels of LDL-C, low levels of HDL-C, and increased triglycerides, which are all signs of dyslipidemia.[4,9] studies in other regions indicated that certain dietary patterns, such as a high intake of refined carbohydrates, excessive consumption of fried foods, and insufficient intake of healthy fats like omega-3 fatty acids, may lead to lipid imbalances even among individuals who follow vegetarian diets. These results suggest that the general health advantages of vegetarian diets may not apply universally, particularly when the diet lacks variety or essential nutrients that support healthy lipid metabolism.[10]

International studies, suggested that well-managed vegetarian diets such as rich in fruits, vegetables, whole grains, legumes, and healthy fats can help to reduce total cholesterol levels, LDL-C, and triglycerides while improving HDL-C levels.[11] A systematic review from American Heart Association showed that plant-based diets can reduce the risk of cardiovascular diseases through improving lipid profiles. However it, depends on maintaining dietary balance and

including essential nutrients, especially omega-3 fatty acids, which are commonly found in fish or fortified plant-based sources.[12] Poorly planned of vegetarian diets that are heavy in carbohydrates, especially simple sugars and refined grains, can result in increased triglyceride levels and an undesirable lipid profile.[13]

Instability of Food and financial limitations make it more difficult for people in rural places like Tharparkar to manage nutrition balance vegetarian diets.[14] The increasing incidence of dyslipidemia may also be attributed to a lack of public health campaigns and inform the public about heart-healthy eating practices.[15]

Therefore, the major problem among vegetarians in Tharparkar is not only a lack of animal products but also lack of vital nutrients like omega-3 fatty acids, which are crucial for preserving normal cholesterol levels.[16] The purpose of this study was to investigate the association of lipid abnormalities and vegetarian eating patterns in Tharparkar region. The findings highlighted the difficulties of vegetarian populations encounter in preserving ideal lipid profiles and focused treatments to enhance heart health in Tharparkar and surrounding regions. However the findings also help to guide public health strategies aimed at promoting balanced vegetarian diets that support cardiovascular health.

The high dyslipidemia rates in Tharparkar's vegetarian population are occurring due to nutrient imbalances, socioeconomic factors and unhealthy food consumption. Public health counselling promoting balanced vegetarian diets and addressing lifestyle factors could help improve lipid profiles and reduce cardiovascular risk.

METHODS

This cross-sectional study was conducted at …… with collaboration of other institutes, Sindh, Pakistan, from Dec 2024 to May 2025, after getting Ethical approval. The vegetarian population was included, and the non-vegetarian population was excluded from the study. A total 500 participants were selected through stratified random sampling to represent data across different age groups, genders, and socioeconomic statuses. The data collection process was involved by noticing and collecting variables data. The blood samples were obtained for Lipid Profiling after 12-hour fasting period to measure TC, LDL-C, HDL-C, and TG levels using standard enzymatic methods. A structured questionnaire was administered to assess participant's dietary habits, focusing on the consumption of plant-based foods, cooking methods, and frequency of intake. For noticing of socioeconomic and Lifestyle information of participants' were recorded including age, gender, income, education level, physical activity, and tobacco use was collected through interviews. Data was analyzed using SPSS version 29.0.

RESULTS

The study revealed a significant prevalence of dyslipidemia among the predominantly vegetarian population of Tharparkar. Based on the analysis of lipid profiles, dietary habits, and socioeconomic factors, the results show that more than 60% of participants exhibited lipid imbalances (Table 1).

Table 1: Lipid Profile of Participants

Lipid Parameter	Mean ± SD	Abnormal Levels (%)
Total Cholesterol (mg/dL)	210 ± 45	45.0%
LDL-C (mg/dL)	130 ± 40	40.0%
HDL-C (mg/dL)	35 ± 10	60.0%
Triglycerides (mg/dL)	180 ± 50	50.0%

The study sample comprised 500 participants, with an even distribution of males and females. The majority of participants (30%) were between the ages of 31 and 45 and 46-60 age group, followed by the 24% of 18-30. The data show a notable proportion of the population (40%) having a monthly income below 10,000 PKR, indicating a lower socioeconomic status. Educationally, 50% of participants had at least secondary education Table 2.

Table 2: Demographic Characteristics of Participants

Characteristic	Frequency (%)
Age (years)	
18–30	120 (24.0%)
31–45	150 (30.0%)
46–60	150 (30.0%)
>60	80 (16.0%)
Gender	
Male	250 (50.0%)
Female	250 (50.0%)
Education Level	
No formal education	100 (20.0%)
Primary	150 (30.0%)
Secondary	150 (30.0%)
Higher	100 (20.0%)
Monthly Income (PKR)	
<10,000	200 (40.0%)
10,000–20,000	150 (30.0%)
>20,000	150 (30.0%)

The lipid profile data revealed that a significant portion of the participants had abnormal levels of lipids. Approximately 45% of participants had total cholesterol levels above the recommended threshold of 200 mg/dL. High LDL-C levels were observed in 40% of participants, with 60% of individuals having low HDL-C levels. Elevated triglyceride levels were found in 50% of the

participants, particularly in individuals over the age of 45. The association between lipid imbalances and dietary habits was analyzed. Table 3: Dietary Habits and Their Association with Lipid Imbalances summarizes the relationship between common dietary patterns and lipid profile abnormalities (Table 3).

Table 3: Dietary Habits and Their Association with Lipid Imbalances

Dietary Habit	LDL-C >130 mg/dL (%)	HDL-C <40 mg/dL (%)	TG >150 mg/dL (%)
High carbohydrate intake (>60% of total calories)	55.0%	65.0%	60.0%
Low intake of omega-3 fatty acids (<1g/day)	60.0%	70.0%	65.0%
High consumption of fried foods (≥3 times/week)	50.0%	55.0%	50.0%

The study found that participants with high carbohydrate intake, particularly from foods like rice and bread, had a significantly higher risk of elevated LDL-C and triglyceride levels. Additionally, a deficiency in omega-3 fatty acids was common, with 60% of participants consuming less than 1g of omega-3 fatty acids per day. A high frequency of fried food consumption was also linked to unfavorable lipid profiles (Table 4).

Table 4: Socioeconomic and Lifestyle Factors Influencing Lipid Profiles

Factor	LDL-C >130 mg/dL (%)	HDL-C <40 mg/dL (%)	TG >150 mg/dL (%)
Low income (<10,000 PKR/month)	60.0%	65.0%	55.0%
Low education level (no formal education)	58.0%	62.0%	53.0%
Physical inactivity (sedentary lifestyle)	65.0%	70.0%	60.0%
Tobacco use	50.0%	55.0%	45.0%

This study also indicated the influence of socioeconomic and lifestyle factors on lipid imbalances. The lower-income groups (earning less than 10,000 PKR/month) Participants had a higher prevalence of lipid abnormalities, and individuals with low education levels and those leading a sedentary lifestyle exhibited abnormal lipid profiles. However, it was also observed that Participants who are frequently used to Tobacco have higher LDL-C and triglyceride levels. Overall, the results suggest a complex interaction of dietary patterns, socioeconomic status, and lifestyle factors in the form of lipid profiles of Tharparkar's vegetarian population. Despite following a plant-based diet, a significant portion of the population showed dyslipidemia, which may be occur due to nutrition imbalances, including low omega-3 fatty acid consumption, high carbohydrate intake, and unhealthy food preparation methods. Socioeconomic challenges, including limited access to a balanced diet, further exacerbate these lipid imbalances.

The findings indicate that modifications, particularly increasing omega-3 fatty acid intake and reducing refined carbohydrate consumption, and help in improving lipid profiles and reduce the risk of cardiovascular diseases in the population. Additionally, addressing lifestyle factors such as physical activity and tobacco use is crucial for preventing dyslipidemia in this region.

DISCUSSION

The results show an incidence of lipid imbalances in the population, with elevated LDL-C, T; this highlights the prevalence of dyslipidemia among the vegetarian population in Tharparkar, Pakistan, emphasizing the role of dietary patterns, lifestyle factors, and socioeconomic status in shaping lipid profiles.[17] Low HDL-C and increased triglyceride levels. These findings are consistent with past report studies that have suggested that plant-based diets, when not well-balanced, may lead to dyslipidemia.[18]

The most striking result of this study is the high prevalence of low HDL-C levels (83.9%) and elevated triglyceride levels (48.9%) among participants. Similar trends have been observed in other vegetarian populations, particularly in regions where carbohydrate-rich foods form the majority of the diet.[9,19] For instance, a study in India found that high carbohydrate intake was associated with increased triglyceride levels and low HDL-C in a predominantly vegetarian population. High carbohydrate intake, especially from refined grains and sugars, can elevate triglycerides, a known risk factor for cardiovascular diseases. Our study found that participants with a higher intake of carbohydrates, such as rice and bread, had significantly higher LDL-C and triglycerides, which aligns with these findings.[20] Another major finding was the deficiency in omega-3 fatty acids, with 60% of participants consuming less than 1g of omega-3s per day. Omega-3 fatty acids are essential for maintaining healthy cholesterol levels and reducing inflammation.[21] Previous research has shown that vegetarian diets low in omega-3s—particularly those that do not include fortified foods or plant-based sources such as flaxseeds or walnuts—are associated with an increased risk of dyslipidemia and cardiovascular diseases.[22]

Socioeconomic factors also emerged as important contributors to lipid imbalances. Our findings indicate that participants with lower incomes and education levels exhibited worse lipid profiles. This is consistent with studies showing that individuals with lower socioeconomic status often have limited access to healthy, nutrient-rich foods, which can lead to poor dietary habits and increased cardiovascular risk. Additionally, physical inactivity and tobacco use were significant contributors to dyslipidemia, reinforcing the need for lifestyle modifications to improve lipid profiles.[23] While this study provides valuable insights into the link between vegetarian diets and dyslipidemia in Tharparkar, it has some limitations. The cross-sectional design of the study limits the ability to establish causal relationships between diet and lipid imbalances. Additionally, the reliance on self-reported dietary data may introduce recall bias, as participants may not accurately remember or report their food intake. The study also did not account for genetic factors that might influence lipid metabolism, which could further explain variations in lipid profiles. Despite these limitations, the study has significant implications for public health. It underscores the need for balanced vegetarian diets that include sufficient sources of omega-3 fatty acids, healthy fats, and proteins. Public health interventions should focus on educating the population about the risks of a high-carbohydrate diet and the importance of including a variety of nutrient-rich foods. Moreover, addressing socioeconomic disparities, such as access to diverse food sources, could help mitigate the prevalence of dyslipidemia and reduce the risk of cardiovascular diseases in Tharparkar and similar regions.

CONCLUSION

This study highlights the significant prevalence of dyslipidemia in Tharparkar's vegetarian population, primarily associated with unbalanced diets high in carbohydrates and low in omega-3 fatty acids. Public health interventions and counselling promoting balanced vegetarian diets increased omega-3 intake, and addressing socioeconomic factors are essential for improving lipid profiles and reducing cardiovascular risk.

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AUTHOR CONTRIBUTIONS

Chand G: Study designing, data analyzing and review of manuscript
Nohri AR: Collection data and review of manuscript
Mumtaz N: Help in Writing the draft and critical review of manuscript
Memon A: Data collection and Critical review
Waryah GM: Writing the draft and critical review of manuscript
Memon S: Data collection and Critical review

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