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Original Article

Dietary and Lifestyle Factors Associated with Premature Myocardial Infarction: A Case-Control Study

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Abstract

Objectives: Unhealthy lifestyle habits and low levels of physical activity are well-established contributors to coronary artery disease (CAD). However, there is limited research on the association of premature myocardial infarction (MI) with the traditional diet and lifestyle of the Pakistani population. This study aims to identify the dietary and lifestyle risk factors most prominently associated with premature MI in this population.

Methodology: The study included 221 patients diagnosed with MI and 221 age-matched controls without MI. Detailed demographic profiles and dietary habits of all participants were recorded using a food frequency questionnaire specifically tailored to traditional Pakistani dietary patterns. Statistical analysis included the Chi-square test for categorical variables, Pearson correlation for associations, and independent sample t-tests for comparing means between the two groups. A p-value of <0.05 was considered statistically significant.

Results: Hypertension and hypercholesterolemia emerged as the most prevalent risk factors for MI. In the disease group, a lack of formal exercise, higher waist circumference, and elevated BMI were significantly associated with disease prevalence. Diet-related risk factors included frequent consumption of vegetable ghee, processed wheat, and red meat. Interestingly, no significant differences were observed between the two groups in the consumption of whole milk, rice, desi ghee, or butter.

Conclusion: This study highlights the urgent need for preventive strategies to address the rising burden of ischemic heart disease in Pakistan. It highlights the role of dietary modifications, increased physical activity, and preventive cardiology services to curb the epidemic of CAD. Lifestyle interventions targeting young populations, Specifically focusing on the risk factors, are critical to mitigating the growing prevalence of cardiovascular disorders in the region.

Keywords: Premature myocardial infarction, coronary artery disease, dietary risk factors, lifestyle modification, hypertension, hypercholesterolemia, traditional Pakistani diet, preventive cardiology

INTRODUCTION

Coronary Artery Disease (CAD) remains a leading global health challenge, accounting for nearly half of all cardiovascular-related deaths worldwide [1]. In some developing nations, mortality from CAD constitutes up to 50% of all annual deaths, underscoring its critical impact on public health. Multiple well-established risk factors, such as hypertension, diabetes mellitus, dyslipidemia, smoking, obesity, and a family history of ischemic heart disease, have been implicated in the development and progression of CAD through complex pathophysiological pathways [2].

Early-onset myocardial infarction (MI) is defined as an event occurring in individuals younger than 45 years, with several studies highlighting notable differences in risk factor profiles and pathophysiology between early-onset MI and MI in older populations. This distinction emphasize the importance of understanding the unique contributors to CAD in younger individuals [3].

Over the past few years, the burden of cardiovascular disease has risen alarmingly in South Asian populations, surpassing trends observed in Western countries [4]. This growing prevalence has prompted researchers to focus on identifying region-specific risk factors contributing to early CAD onset [5]. Among these, unhealthy dietary habits and sedentary lifestyles, characterized by minimal physical activity, high consumption of saturated fats, processed foods, and fried or junk foods, have been well-documented [6]. However, limited evidence exists linking these patterns to the cultural tendencies and lifestyles of patients presenting with premature MI in Pakistan.

The INTERHEART study emphasized that a substantial proportion of early cardiac events could be attributed to poor dietary choices [7]. Yet, dietary habits and cooking practices in South Asia, including Pakistan, differ significantly from those in Western countries, where evidence on cardiovascular risk is more robust [8]. For example, traditional Pakistani diets are rich in saturated fats and carbohydrates, while cultural norms and environmental factors often limit physical activity [9]. Unlike Western populations, where greater awareness, better public transport, access to recreational facilities, and conducive weather conditions encourage healthier lifestyles, the Pakistani population faces unique challenges in adopting such behaviors [10-12].

In light of these differences, this study aims to explore the dietary patterns and lifestyle factors contributing to premature CAD in the Pakistani population. By focusing on the interplay of cultural preferences, unhealthy habits, and traditional risk factors, this research seeks to provide locally relevant insights that can inform targeted prevention strategies.

METHODOLOGY

Study Design: This was a case-control study designed to evaluate the association of lifestyle, dietary patterns, and physical parameters with the development of early-onset coronary artery disease (CAD) in patients aged ≤45 years.

Ethics: Formal approval was obtained from the Ethical Review Committee of the Rawalpindi Institute of Cardiology. Informed consent was secured from all participants before their inclusion in the study. To ensure inclusivity and comprehension, consent forms and questionnaires were translated into Urdu. Confidentiality and anonymity of participants' data were strictly maintained throughout the study.

Setting: The study was conducted at the Rawalpindi Institute of Cardiology, a specialized tertiary care cardiology hospital in Rawalpindi, Pakistan, which operates a 24/7 primary PCI service for cardiac emergencies, including AMI.

Participants: The study included two groups:

- **Cases**: Consecutive patients aged ≤45 years, treated with primary PCI after an established myocardial infarction, with documented coronary anatomy.
- **Controls**: Age-matched individuals randomly selected from the general population.

The study included patients aged ≤45 years with confirmed acute myocardial infarction (AMI) who were treated with primary percutaneous coronary intervention (PCI) as the case group. Age-matched individuals without any prior diagnosis of heart disease were selected for the control group. Exclusion criteria for both groups included individuals with

heart failure or cardiogenic shock, chronic conditions such as renal failure, liver disease, thyroid disorders, malignancies, or psychiatric disorders. Participants with a history of prior heart disease, previous PCI, or coronary artery bypass graft surgery were also excluded. Additionally, individuals unable to provide informed consent were not considered for inclusion.

Variables: The primary variables included a range of demographic, lifestyle, and biochemical factors. Demographic data encompassed age, sex, and socioeconomic status, providing a foundational understanding of the participants' backgrounds. Key risk factors considered were smoking habits, levels of physical activity, family history of coronary artery disease (CAD), and waist circumference, which collectively highlighted potential contributors to cardiovascular health. Dietary patterns were assessed by examining the frequency and type of food items consumed, offering insights into nutritional influences. Additionally, biochemical markers such as serum cholesterol, low-density lipoprotein (LDL), and triglycerides were measured to evaluate lipid profiles and their association with CAD risk.

Data Sources and Measurement: Data were collected through a structured food frequency questionnaire (FFQ) developed specifically for this study. The FFQ was tailored to the dietary habits of the Pakistani population, excluding items like tofu and soya and focusing on local dietary preferences [6, 14-17].

- Dietary intake: Items consumed ≥2 times per week were considered significant, while those consumed <1 time per month were classified as non-consumption. Wheat consumption was quantified based on the weight of an average-sized flatbread (30 grams).
- Physical parameters: Waist circumference and body mass index (BMI) were measured.
- Biochemical markers: Blood samples were analyzed for cholesterol, LDL, and triglycerides.

Bias: To minimize selection bias, cases were enrolled consecutively from the hospital, and controls were randomly selected from the community. Recall bias was addressed by using a standardized and validated FFQ. Observer bias was reduced by training data collectors and maintaining uniform measurement protocols.

Study Size: The sample size was calculated using the WHO sample size calculator based on the following parameters: Confidence interval 95%, Power of the test 80%, Ratio of cases to controls 1:1, Proportion of controls exposed to unhealthy lifestyles 19%, and Proportion of cases exposed to unhealthy lifestyles 36% [13].

The minimum calculated sample size was 79 participants per group. However, to increase precision, all eligible participants who met the inclusion criteria and consented during the six-month study period (July–December 2023) were included.

Quantitative Variables: Quantitative data included waist circumference, BMI, cholesterol, LDL, and triglycerides. These variables were reported as means ± standard deviation.

Statistical Methods: Data were analyzed using SPSS version 26. Descriptive statistics were employed to summarize demographic and clinical characteristics: Quantitative variables were expressed as means ± standard deviation and Qualitative variables were expressed as frequencies and percentages.

Chi-square test was used to evaluate differences between disease and control groups for categorical variables. Independent sample T-test was used to compare mean cholesterol, LDL, and triglyceride levels between the groups. Pearson correlation analysis was used to assess the relationship between waist circumference and BMI across gender.

RESULTS

Participants: A total of 442 participants were included in the study, with 221 in the disease group (cases) and 221 in the control group. The disease group consisted of individuals ≤45 years of age who presented with confirmed acute myocardial infarction and underwent primary PCI, whereas the control group comprised age-matched participants from the general population.

The male-to-female ratio was 82% males and 18% females in the disease group, compared to 76.9% males and 23% females in the control group.

Participant recruitment spanned from July 2023 to December 2023, with all participants meeting the inclusion criteria and providing informed consent.

Table 1: Demographic, Clinical, and Risk Factor Profile of Study Participants

Variable	Disease Group	Control Group	p-Value
Gender			
Male	181 (82%)	170(76.9%)	0.760
Female	40 (18%)	51 (23%)	
Mean Age (years)	40 ± 3.9	40 ± 4	0.850
Socio-economic Group with Income Threshold			
Low (<20,000)	29 (13%)	92 (41%)	
Middle (20,000-40,000)	152 (69%)	91 (41%)	<0.001
Upper Middle and above (>40,000)	40 (18%)	38(17%)	
Comorbidities			
DM	33(15%)	7(3.1%)	0.072
HTN	101 (46%)	33(14.9%)	<0.001
First degree Premenopausal female/ Male≤55yrs)	87 (39.4%)	70 (31.6%)	0.890
Pre-existing Dyslipidemia	64 (29%)	20 (9%)	0.003
Previous CVA	3 (1.4%)	0 (0%)	>0.999
Smoking	62 (28%)	30 (13.5%)	0.090
Mean Pack Years (smoking)	25±14	20±9	0.040
Body mass index (BMI) categories			
Normal BMI (<25)	89 (40%)	197 (89%)	
Overweight (BMI≥25)	113 (51%)	17 (7.7%)	<0.001
Obese (BMI≥30)	19 (8.6%)	7 (3.2%)	
Mean BMI (kg/m^2)	25±4	21±3	<0.001
Mean Waist Circumference (inches)			
Male	40±4	36±5	<0.001
Females	39±5	35±3	<0.001
Waist Circumference with Risk Category			
Low Risk	60(27%)	154 (67%)	
High Risk	139(62.8%)	57(25.7%)	<0.001
Very High Risk	22(9.95%)	10 (4.5%)	
Mean Lipid levels			
Cholesterol (mg/dl)	215±47	189±41	<0.001
Triglyceride (mg/dl)	169±103	107±4	<0.001
HDL (mg/dl)	41±7	40±5	>0.999
LDL (mg/dl)	147±8	110±9	0.03

Descriptive Data: Baseline demographic, socioeconomic, and risk factor profiles of the study participants are detailed in Table 1. A higher proportion of the control group (41%) belonged to the low-income category (<20,000 PKR/month) compared to 13% in the disease group. Conversely, 69% of the disease group were in the middle-income category, significantly higher than 41% in the control group.

Hypertension (46%) and pre-existing dyslipidemia (29%) were notably higher in the disease group compared to the control group (14.9% and 9%, respectively). Smoking prevalence was higher in the disease group (28%) than in the control group (13.5%), with a significant difference in mean pack-years (25±14 vs. 20±9). The disease group showed a higher proportion of overweight (51%) and obese participants (8.6%) compared to the control group (7.7% and 3.2%, respectively).

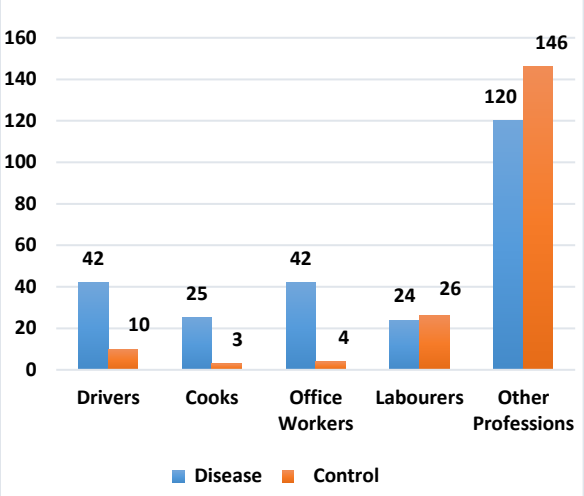

Figure 1: Distribution of Occupational Sedentary Behavior among Study Participants

Outcome Data: Key cardiovascular risk factors, including lipid profiles, waist circumference, and dietary patterns, were compared between the groups. Mean cholesterol (215±47 mg/dL vs. 189±41 mg/dL), triglyceride (169±103 mg/dL vs. 107±40 mg/dL), and LDL levels (147±8 mg/dL vs. 110±9 mg/dL) were significantly higher in the disease group. HDL levels were similar between groups (41±7 mg/dL vs. 40±5 mg/dL).

Both males and females in the disease group had significantly higher mean waist circumferences compared to controls. For males, it was 40±4 inches versus 36±5 inches, and for females, it was 39±5 inches versus 35±3 inches.

Main Results: A sedentary lifestyle was strongly associated with coronary artery disease, with only 17% of the disease group performing regular formal exercise compared to 47% in the control group.

High consumption of processed wheat, hydrogenated vegetable oil, and red meat was significantly more common in the disease group, while protective dietary factors such as fish, whole grains, and dry fruits were less frequently consumed (Table 2). For example, 63% of the disease group consumed red meat more than twice a week compared to 21% in the control group (p<0.000).

Among the dietary variables, mean daily consumption of wheat (one Roti: 30 g of wheat consumed) was 185±64 grams per day in disease group whereas it was 101±26 grams in control group with a P value of <0.001.

Late dinner timings (after 8 PM) were reported in 64% of the disease group compared to 31% of the control group (p<0.000). The majority of participants in both groups consumed two main meals per day, with no significant difference observed.

Table 2: Dietary Consumption Patterns and Their Association with Coronary Artery Disease Risk

	Disease Group	Control Group	p Value
>2 times per week			
Processed Wheat	157 (71%)	86 (39%)	<0.001
Cooked Vegetables	172(78%)	179 (81%)	0.502
Rice	88 (40%)	95 (43%)	0.124
Milk	65 (29%)	68 (31%)	0.196
Desi ghee	33 (15%)	38 (17%)	0.366
Banaspati	138 (64%)	64 (29%)	<0.001
Yogurt	40 (18%)	46 (21%)	1.391
Chicken	20 (9%)	16 (7.4%)	1.054
Red Meet	139 (63%)	46 (21%)	<0.001
Fast food and Bakery Products	77 (35%)	73 (33%)	0.124
Coffee/ Tea	214 (97%)	205 (93%)	0.23
<2 times per week			
Dry Fruits	190 (86%)	148 (67%)	0.029
Whole grains	184 (83.5%)	102 (46%)	<0.001
Raw Vegetables	20 (9%)	73 (33%)	<0.001
Fresh Fruits	31 (14%)	29 (13%)	0.029
Fish	201 (91%)	124 (56%)	0.003

DISCUSSION

Our study identified key dietary and lifestyle risk factors significantly associated with the increased incidence of premature myocardial infarction (MI). Lifestyle risk factors often stem from dietary habits, highlighting the importance of targeting both diet and physical activity to address hypertension, cardiovascular disease, and obesity.

A similar study conducted in Pakistan reported comparable findings, though with some variations [6]. For instance, it observed an association between premature coronary artery disease (CAD) and chicken and yogurt, which our study did not confirm as significant contributors. Recent data from the Cardiac Registry of Pakistan (CROP) provided insights into risk factors for premature and extremely premature CAD [7]. However, large-scale, local studies focusing specifically on premature MI remain scarce. A few studies in South Asia have examined premature CAD, but investigations specific to MI have been limited in recent years. Historical research has reported nine risk factors associated with premature CAD in the South Asian population, emphasizing the need for continued exploration in this area [10,11].

One intriguing finding from our study is the high consumption of processed wheat flour among participants, particularly in the disease group. Tighe et al. demonstrated that wholegrain wheat consumption significantly lowers blood pressure and reduces cardiovascular risk factors, complementing our findings [14]. We calculated the mean daily wheat consumption among participants, revealing a significant difference between the disease and control groups. This highlights the need for further research into the role of excessive carbohydrate consumption—driven by cultural dietary preferences—as a potential risk factor for early CAD [15-18].

Previous studies have implicated increased consumption of animal fat, such as beef and clarified butter (desi ghee), in harmful cardiovascular outcomes. However, our study did not demonstrate a significant association between premature cardiac events and these dietary variables, echoing findings from Nishtar et al., who also reported no significant differences despite higher consumption in cases. These results suggest the need for further research across a broader population [19].

Hydrogenated vegetable oil, commonly used in processed foods, emerged as a prominent dietary risk factor in our study. This ingredient, known to increase LDL and decrease HDL levels, is associated with early diabetes onset and coronary heart disease. While banned in the United States and the European Union, its widespread use persists in Pakistan [17]. Our

findings strongly advocate for regulatory action to restrict hydrogenated fat usage in the country.

Interestingly, 31% of participants in the disease group reported consuming a meal high in saturated fats prior to the cardiac event cardiac event. This finding supports the hypothesis that even a single high-fat meal can precipitate thrombus formation in coronary arteries, warranting further investigation [19,20].

Physical inactivity was another significant finding in our study. Most disease group participants did not engage in formal physical exercise, and sedentary professions—such as driving, office work, and restaurant jobs—were disproportionately represented [21]. This aligns with European Society of Cardiology (ESC) recommendations advocating at least 150 minutes of moderate or 75 minutes of vigorous physical activity weekly for cardiovascular risk reduction [22].

Our study also highlighted socioeconomic disparities, with most participants in the disease group belonging to the middle-income bracket (Rs 20,000–40,000). This contrasts with control group participants, where low- and middle-income classes were equally represented [23]. Studies like Rosengren et al. have shown that middle-income groups often exhibit worse cardiovascular risk profiles due to stress, poor diet quality, and insufficient physical activity, a phenomenon requiring further exploration [24].

Pre-existing dyslipidemia, characterized by elevated LDL and total cholesterol, emerged as a significant contributor to premature MI in our study. Interestingly, both disease and control groups exhibited lower-than-threshold HDL levels, consistent with findings in other South Asian populations. Elevated triglycerides and non-HDL cholesterol further compounded the risk, as reported in similar Indian studies.

Study Limitations: Our study has several limitations. The reliance on self-reported data may have introduced recall bias, particularly regarding dietary variables. However, we minimized this risk by using a focused questionnaire, avoiding leading questions, and providing ample recall time for participants. Additionally, we did not account for caloric content and portion sizes due to the complexity of information, which should be considered when interpreting our findings. Further research is warranted to analyze specific dietary components in greater detail.

CONCLUSION

This study emphasizes that several modifiable risk factors, including processed wheat consumption, hydrogenated vegetable fats, late meals, and increased red meat intake, contribute significantly to premature CAD. In addition, lifestyle factors such as increased BMI, hypertension, diabetes, dyslipidemia, and physical inactivity play pivotal roles in the early onset of cardiac events. Early interventions targeting these factors—through both primary prevention and public health strategies—are critical to improving cardiovascular outcomes in at-risk and healthy populations.

AUTHORS' CONTRIBUTION

SA, AS, MASA, GeRW, AJ, and MTBN: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. SA, AS, MASA, GeRW, AJ, and MTBN: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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