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Prevalence and Risk Factors of Coronary Heart Disease in Nawabshah: A Case-Control Study

Yasir Akbar Jamali[1*], Sadia Kazi[2], Mehwish Noor Chandio[3], Sobia Khan Nabeel[4], Ahmed Ali Kanhar[5], Uzma Riaz[6], Jawed Iqbal[7], Ahmed Hussian Suhag[8] and Ijaz Aziz[9]

[1]Department of Physiology, University of Sindh, Karachi, Pakistan
[2]Department of Pharmacology, Isra University, Hyderabad, Pakistan
[3]Institute of Public Health, Peoples University of Medical and Health Sciences, Nawabshah, Pakistan
[4]Department of Physiology, Baqai Medical University, Karachi, Pakistan
[5]Syed Abdullah Shah Institute of Medical and Health Sciences, Sehwan, Pakistan
[6]University of Health Sciences Lahore, Lahore, Pakistan
[7]Bilawal Medical College, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan
[8]Department of Physiology, Mekran Medical College, Turbat, Pakistan
[9]Department of Forensic Medicine, Mekran Medical College, Turbat, Pakistan

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Corresponding Author:
Yasir Akbar Jamali
Department of Physiology, University of Sindh, Karachi, Pakistan
yasirakbar021@gmail.com

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ABSTRACT

One of the top causes of mortality globally was Coronary Heart Disease (CHD), and South Asian nations were exhibiting a particular trend in this regard. **Objective:** To determine the prevalence and identify its associated risk factors in the Nawabshah population. **Methods:** For ten months, from October 5, 2023, to May 27, 2024, this case-control research was carried out at the Peoples University of Medical and Health Sciences Hospital in Nawabshah. The participants underwent a complete clinical assessment, including laboratory testing, physical examination, and medical history review. Based on known diagnostic criteria such as Electrocardiogram (ECG) analyses, cardiac enzyme levels, and imaging examinations, the attending physicians diagnosed Coronary Heart Disease (CHD). **Results:** In the study population, 52.5% of the cases were classified as obese, and 64.3% had hyperlipidaemia. Additionally, 31.1% of the patients in the case group had diabetes, 66.4% were smokers, and 73.5% had hypertension. Physical inactivity was prevalent in 55.5% of the patients in the case group. According to the sex distribution, there were more women in the case group (53.4% versus 45.0%). **Conclusions:** The high prevalence of hypertension, hyperlipidaemia, obesity, and smoking in Nawabshah is one of the modifiable risk factors for coronary heart disease that this research emphasizes. Public health measures that aim to improve people's lifestyles and prevent diseases should be implemented immediately considering these results.

INTRODUCTION

Although there are strategies to prevent and cure heart issues, heart disease still ranks as the leading cause of mortality in industrialized countries. Common cardiac disorders include coronary artery disease, commonly called coronary heart disease. Coronary arteries are the main blood vessels that provide oxygen-rich blood to the heart. Blood flow blockage occurs when plaque, a build-up of fatty material, affects the coronary arteries. Platelets, cells in the blood that aid in clotting, may adhere to these damaged regions. Ischaemia, in which oxygen cannot reach the heart muscle cells, and myocardial infarction, a heart attack, are possible outcomes [1]. South Asian countries show a trend that affects the worldwide prevalence of Coronary Heart Disease (CHD) in terms of both death and illness. Cardiovascular Disease (CVD) is a crucial public health concern in Pakistan, as reported by

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the Global Burden of Disease [2]. Different Pakistani communities have been studied for Coronary Heart Disease (CHD), although their scope and emphasis vary. The National Institute of Cardiovascular Diseases in Hyderabad found that hypertension (70%), obesity (36.2%), and diabetes mellitus (36.9%) were substantial risk factors for Coronary Artery Disease (CAD) among 130 patients. However, this study did not analyse Nawabshah-specific risk variables [3]. The Sindh sociodemographic study that examined the high rate of Coronary Heart Disease (CHD) focused on demographics rather than individual risk factors, both modifiable and non-modifiable [4].

The present study aimed to determine the prevalence and risk factors of coronary heart disease in Nawabshah.

METHODS

This case-control study was conducted in Nawabshah city to determine CHD's prevalence and risk factors of CHD. The study was conducted at the People University of Medical and Health Sciences Hospital in Nawabshah city for ten months, from 5th October 2023 to 27th May 2024. Patients fulfilling the inclusion criteria were enrolled after obtaining written informed consent from them or their relatives. During the study period, 845 patients were admitted to Medical Units I, II, and III. The study excluded patients with valvular issues, primary myocardial disease, congenital cardiac abnormalities, or both (230, 27.2% of the total). In addition, 152 patients (18%) were excluded because of significant CAD. Missing data on risk variables led to the exclusion of 225 patients (26.6%). This study included 238 patients and 238 healthy controls (HCs). The cases included patients with a solid diagnosis of CHD, whereas the controls were individuals of the same age and sex who did not have CHD. Potential biases were addressed, and confounding variables were considered by matching individuals according to age and sex, using a case-control matching approach. A careful selection process was implemented to standardized the data collection procedures for lifestyle variables, including smoking, physical activity, and food intake, to ensure consistency throughout the trial. The goal of this study was to reduce variability and ensure accuracy. Social class and co-occurring diseases were carefully explored to account for confounding effects. After obtaining participants' written consent, a carefully constructed questionnaire was presented, based on previous research methodologies to ensure consistency and reliability [6-8].Stress measured by perceived stress questionnaire. Participants' socioeconomic level, age, and gender were among the demographic variables gathered during the interviews. Laboratory tests and physical examinations were performed to collect clinical data by measuring variables such as lipid profile, Body Mass Index (BMI), and blood pressure. Venous blood samples were collected after overnight fasting. Skilled phlebotomists collected blood and processed it immediately. An automated biochemical analyser (Cobas® 8000 modular analyser, Roche Diagnostics) was used to measure the serum levels of total cholesterol, HDL, and LDL. An immunoturbidimetric test was used to detect C-reactive protein (CRP) levels, whereas a hexokinase-based approach was used to analyse blood glucose levels. A Hitachi® 7600 analyser (Hitachi High-Technologies) was used to perform the liver function tests, which included AST, ALT, and ALP levels. Accuracy and consistency were ensured by performing all tests according to the procedures provided by the manufacturer. In addition, details of the participants' diets, levels of physical activity, and smoking status were recorded. A thorough evaluation of the risk factors linked to CHD in the study population was made possible by meticulous gathering of clinical and lifestyle data. Diagnosing CHD has always relied on the methods proposed by attending doctors. Electrocardiography (ECG) results and imaging studies were diagnostic tools. Excel 365 and SPSS 26.0 were used to analyse the data. The research variables were subjected to descriptive statistical computations such as means, standard deviations, and frequencies. The association between risk variables and CHD was ascertained using the chi-square test and t-test. Statistical significance was set at $P < 0.05$.

RESULTS

Between 5th October 2023 and 27th May 2024, 845 consecutive patients with Coronary Heart Disease (CHD) were hospitalised. Of these, 238 (28.2%) were diagnosed with a heart disease. Of these, 238 (28.2%) met the established inclusion criteria and agreed to participate in the study. The case group had a considerably lower mean age (49.6 ± 5.8 years) than the control group (54.0 ± 14.5 years) ($p < 0.001$). The case and control groups did not vary substantially in terms of the sex ratio (male: 46.6% versus 55.0%, p=0.067; female: 53.4% versus 45.0%, p=0.067). Socioeconomic status differed significantly, with a lower percentage of individuals in the high socioeconomic category in the case group, 2.5%, compared to the control group, with the rate of 10.9%. However, there was a greater percentage of people in the low socioeconomic category among the patients (51.7%) than in the control group (48.3%), which may indicate a link between socioeconomic status and CHD ($p < 0.01$)(Table 1). The control group's mean (SD) BMI of 26.9 ± 5.0 was significantly lower than the case group's mean (SD) BMI of 29.7 ± 2.8 ($p < 0.001$). 37.8% of control group participants were found in normal BMID; the case group had a higher percentage of people who were overweight or obese (54.6% and 45.4%, respectively) (Table 1).

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Table 1: Demographic Characteristics of the Study Population (n=238)

Variables	Case (50.0%) Mean ± SD/ N (%)	Control (50.0%) Mean ± SD/ N (%)	p-Value
Mean Age	49.6 ± 5.8	54.0 ± 14.5	< 0.001
Gender			
Male	111 (46.6%)	131 (55.0%)	0.067
Female	127 (53.4%)	107 (45.0%)	0.067
Mean BMI	29.7 ± 2.8	26.9 ± 5.0	< 0.001
BMI			
Underweight	0	0	< 0.001
Normal	0	90 (37.8%)	-
Overweight	130 (54.6%)	61 (25.6%)	-
Obese	108 (45.4%)	87 (36.6%)	-
Socioeconomic Status			
High	6 (2.5%)	26 (10.9%)	< 0.01
Middle	109 (45.8%)	97 (40.8%)	-
Low	123 (51.7%)	115 (48.3%)	-

The LDL cholesterol mean (SD) values significantly declined in the cases compared to the control (95.7 ± 34.3 versus 131.3 ± 35.2) (p < 0.001). The HDL cholesterol mean (SD) values were 35.2 ± 15.0, also considerably lower as compared to the control group; 56.2 ± 14.0 were markedly lower in the cases than the control participants (p < 0.001) (Table 2). Compared to the control group, the case group had substantially higher blood glucose levels (113.6 ± 22.9 versus 108.5 ± 22.1, p = 0.01). The case group had considerably greater total cholesterol levels compared to the control group (228.6 ± 42.7 versus 270.6 ± 44.0, p < 0.001). In addition, C-Reactive Protein (CRP) levels, an indicator of inflammation and cardiovascular risk, were more significant within cases (3.7 ± 0.7 versus 1.2 ± 0.7, p < 0.001). This indicated that chronic inflammation may have increased the incidence of CD among the patients. The two groups' LFT values did not vary in a way that was statistically significant (Table 2).

Table 2: Comparison of Lipid Profiles and Other Biomarkers between Case and Control Groups in the Study (n=238)

Variables	Case Mean ± SD	Control Mean ± SD	p-Value
LDL	95.7 ± 34.3	131.3 ± 35.2	< 0.001
HDL	35.2 ± 15.0	56.2 ± 14.0	< 0.001
Total Cholesterol	270.6 ± 44.0	228.6 ± 42.7	< 0.001
Blood Glucose Level	270.6 ± 44.0	228.6 ± 42.7	0.01
C Reactive Protein Test	270.6 ± 44.0	228.6 ± 42.7	< 0.001
Liver Function Test	29.2 ±11.4	30.4 ± 11.8	0.3

Table 3 showed that smokers were more common in the case group, with a prevalence of 66.4% compared with 54.6% (p = 0.009). A considerably greater prevalence of hypertension (73.5%) was observed in the patients compared to the control group (46.6%) (P < 0.001). Hyperlipidaemia was higher in 64.3% of cases than in controls (50.0%; p=0.002). Patients had a much-reduced incidence of DM (31.1% versus 45.0% in the control group)(p = 0.03). Obesity was found in 52.5% of CHD patients, which was much higher than the control group's prevalence rate of 36.6% (p = 0.001). Within the poor-diet group, no statistically significant difference was seen between the case and control groups (p = 1). The case group was less likely to have a sedentary lifestyle (48.7% versus 53.4%, P = 0.313). Alcohol consumption was 50.8% and 51.3% in the case and control groups, respectively (p = 0.927). The prevalence rates of chronic renal disease were 49.2% and 48.7 %, respectively (p = 0.927). The case group was more likely to have a history of heart illness in their family (51.3% versus 47.5%, p = 0.409) (Table 3). The frequency of hypercholesterolemia was higher in 49.2% of controls than in 37.0% of cases (p = 0.002). A total of 49.6% and 45.8% of the control group had an equal prevalence of hyperglyceridaemia (p = 0.927). The patients showed less physical activity than control participants (55.5% versus 67.2%) (p = 0.008). There was a significant difference between the case and control groups for the prevalence of normal, low, moderate, and high stress levels (P < 0.05). Case group medication usage was somewhat lower than control group medication use (44.1% versus 45.4%; p = 0.032).

Table 3: Comparison of Risk Factors in Case and Control among Study Population (n=238)

Variables	Case N (%)		Control N (%)		p-Value
	Yes	No	Yes	No	
Smoking	158 (66.4%)	80 (33.6%)	130 (54.6%)	108 (45.4%)	0.009
Hypertension	175 (73.5%)	63 (26.5%)	111 (46.6%)	127 (53.4%)	< 0.001
Hyperlipidaemia	153 (64.3%)	85 (35.7%)	119 (50.0%)	119 (50.0%)	0.002
Diabetes Mellitus	75 (31.1%)	163 (68.5%)	107 (45.0%)	131 (55.0%)	0.003
Obesity	125 (52.5%)	113 (47.5%)	87 (36.6%)	151 (63.4%)	0.001
Poor Diet	124 (52.1%)	114 (47.9%)	124 (52.1%)	114 (47.9%)	1
Sedentary Lifestyle	116 (48.7%)	122 (51.3%)	127 (53.4%)	111 (46.6%)	0.313
Alcohol Consumption	121 (50.8%)	117 (49.2%)	122 (51.3%)	116 (48.7%)	0.927
Chronic Kidney Disease	117 (49.2%)	121 (50.8%)	116 (48.7%)	122 (51.3%)	0.927
Family History of Cardiac disease	122 (51.3%)	116 (48.7%)	113 (47.5%)	125 (52.5%)	0.409
Hypercholesterolemia	150 (63.0%)	88 (37.0%)	117 (49.2%)	121 (50.8%)	0.002
Hyperglyceridaemia	118 (49.6%)	120 (50.4%)	109 (45.8%)	129 (54.2%)	0.927
Physical Activity	132 (55.5%)	106 (44.5%)	160 (67.2%)	78 (32.8%)	0.008
Stress Level					
Normal	53 (22.3%)	185 (77.7%)	126 (52.9%)	112 (47.1%)	< 0.001
Low	60 (25.2%)	178 (74.8%)	35 (14.7%)	203 (85.3%)	0.004

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Moderate	45 (18.9%)	193 (81.1%)	20 (8.4%)	218 (91.6%)	0.001
High	80 (33.6%)	158 (66.4%)	57 (23.9%)	181 (76.1%)	0.02
Medication	105 (44.1%)	178 (74.8%)	35 (14.7%)	203 (85.3%)	0.032

DISCUSSION

In this study, the frequency of coronary heart disease was 238 (28.2%). Ren C *et al.*, reported a prevalence of CAD in 1,332 (16.8%) out of 7,932 patients, which was lower than this study [9]. A cohort analysis revealed a greater incidence of CAD, with obstructive epicardial coronary artery disease observed in 51% of individuals, endothelium-independent coronary microvascular dysfunction in 66%, and endothelium-dependent coronary microvascular dysfunction in 24% [10]. A greater percentage of women (53.4%) were part of the case group compared to the group of controls (45.0%). This was in contrast to two previous studies that reported higher CHDs in men [11, 12]. In the present study, the high rates of overweight (54.6%) and obese (45.4%) individuals in the case group were alarming. In Pakistan, 70.3% of the 318 patients with CHD were overweight or obese, according to Aziz KU *et al*. These results emphasised the need for weight control for CHD prevention and therapy [13]. Additionally, Khuwaja AK *et al.*, Pakistanis were at high risk for cardiovascular illnesses due to hypertension, diabetes, and dyslipidaemia [14]. In this study, a larger number of participants among the cases (66.4%) reported smoking than the controls (54.6%) (P = 0.009). According to the World Health Organization (WHO), smoking was a modifiable risk factor with considerable impact, accounting for 20 percent of the global mortality due to CHD [15]. According to the literature published in Universa Medicina, smoking systolic blood pressure was a significant risk factor for adult-onset CHD [16]. This research found a significant difference in hypertension prevalence between the case (73.5%) and control (46.6%) groups (P<0.001). Iran had 1772 MINOCA patients, 47.5% of whom had hypertension. Hyperlipidaemia was more prevalent in the case group (64.3%) (p = 0.002). Previous research accord with this result [17]. Case group 31.1% exhibited a statistically significant lower prevalence of DM than control group 45.0 % (P= 0.003). This study contradicts previous results. According to Denpasar's research, diabetes considerably increases CHD risk, according to the Denpasar research [18, 19]. Ghaddar F *et al.*, showed that DM was an independent risk factor [20]. The prevalence of obesity differed significantly between the case (52.5% obesity rate) and control (36.6% obesity rate) groups (P = 0.001). Obesity raises the risk of many cardiovascular diseases, including CAD, hypertension, metabolic syndrome, type 2 diabetes, and dyslipidaemia [21]. The case group exhibited a substantially lower prevalence of physical activity (55.5% versus 67.2%, P=0.0084) than the control group. Higher levels of physical activity were shown to be related with a decreased risk of coronary heart disease in a research done in Lebanon [21]. Alsaleh and Baniyasin in 2023, found that 74% of Coronary Heart Disease (CHD) patients did not exercise [22]. Compared to the control group, the case group had substantially greater levels of normal, mild, moderate, and high stress (P < 0.05). Social isolation, marital life, and stressful jobs were only a few types of psychological stress that Alsaleh E *et al.*, in 2020 found to increase the risk of cardiovascular disease. Elendu C *et al.*, in 2024, discovered a significant positive correlation between stress indicators such as c-reactive protein and interleukin-6 and the chance of developing CHD [22]. Some limitations exist in this investigation. As the research sample was limited to a single metropolitan area in Nawabshah, these findings may not be applicable to other places with different socioeconomic and cultural characteristics. A comprehensive data was collected on several risk variables, but self-reported lifestyle habits, such as nutrition, physical activity, and smoking status, may have been affected by recall or social desirability bias. Even with careful accounting for confounding factors, residual confounding cannot be eliminated, especially for complex variables, such as stress and depression. Longitudinal studies should include heterogeneous groups to confirm and expand their results.

CONCLUSIONS

The high prevalence of hypertension, hyperlipidaemia, obesity, and smoking in Nawabshah is one of the modifiable risk factors for coronary heart disease that this research emphasizes. Public health measures that aim to improve people's lifestyles and prevent diseases should be implemented immediately considering these results.

Authors Contribution

Conceptualization: YAJ, AHS
Methodology: SK, JI
Formal analysis: MNC, SKN, IA
Writing, review and editing: AAK, UR

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

All the authors declare no conflict of interest.

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