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Original Research Article

Risk factors of cardiovascular diseases in young and middle aged Indian males: a case control study

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ABSTRACT

Background: Cardiovascular diseases (CVDs) are common in India, yet there is a lack of comprehensive studies on the specific risk factors for the Indian population. Our research aimed to identify CVD risk factors in individuals under 50 and compare them with healthy controls, offering insights into preventing CVDs in this younger demographic.
Methods: This study focused on newly diagnosed cases of CVDs in males under 50 and matched controls with same demographic parameters. Data on personal, medical, lifestyle and biochemical parameters was compared to identify and understand the key risk factors associated with CVDs in this specific population group.
Results: Elevated body mass index (BMI) and waist-hip ratio were linked to CVD, with BMI showing a significant association. High triglyceride (TGL) levels (>150 mg/dl) and LDL cholesterol levels (>130 mg/dl) were significantly associated with CVD. The total cholesterol to HDL cholesterol ratio (>4.5) and low HDL cholesterol (<40 mg/dl) were also linked to CVD risk. Diabetes mellitus was strongly associated with CVD (OR-14.04). Stress, as assessed by a stress score >12, was associated with CVD, although the association was not very strong (OR 1.39). Physical exercise was associated with a protective effect against CVD (OR-0.28). These findings emphasize the critical role of lifestyle factors, such as diet, exercise and stress management in CVD prevention and highlight the importance of managing conditions like obesity and diabetes.
Conclusions: This study not only deepens our comprehension of CVD prevention but also provides actionable guidance for fostering heart health, both within the studied population and in broader contexts.

Keywords: Cardiovascular diseases, Cholesterol, Diabetes mellitus, High triglyceride

INTRODUCTION

Over 300 risk factors have been associated with cardiovascular diseases (CVDs).[1] Behavioural and metabolic risk factors namely unhealthy diet (rich in salt, fat and sugars), physical inactivity, harmful use of alcohol and tobacco, raised body mass index and waist hip ratio, hyperglycaemia, hyperlipidaemia and raised blood pressure are well known in causation of CVDs.[2]

Epidemiologic studies have established that multiple risk factors increase the probability of cardiovascular events, since cardiovascular risk factors tend to reinforce each other in their influence on morbidity and mortality.[3]

Although a specific risk factor influences the risk that a person will have cardiovascular disease, risk factors tend to aggregate and usually appear in combination. Furthermore, since clustering of risk factors is evident in childhood and persists into young adulthood, the presence of multiple risk factors could indicate the acceleration of atherosclerosis in young people.[4]

There are limited prospective cardiovascular epidemiological studies that have identified risk factors of importance in India. Multiple case-control studies exist. The largest of these case-control studies is INTERHEART performed on large number cases and controls. This study reported that standard risk factors such as smoking, abnormal lipids, hypertension, diabetes, high waist-hip ratio, sedentary lifestyle, psychosocial stress, and lack of consumption of fruits and vegetables explained more than 90% of acute CHD events in South Asians.[3]

The present study aimed to assess the correlates of cardiovascular diseases among the younger population (less than 50 years of age) and their comparison with healthy controls.

METHODS

A case control study was carried out among newly detected cases of CVDs (male less than 50 years of age) and their age and sex matched controls from July 2018 to June 2019.

Cases

All the newly detected cases of cardiovascular diseases i.e. less than 4 weeks from date of enrollment in the study (Coronary artery disease and hypertension) [congenital heart disease excluded from the list of CVDs].

Controls

Healthy subjects in the same age group with same ethnic background were randomly selected as controls and studied for the same parameters.

Sample size

The sample size was calculated as taking the Odds Ratio (OR) of 2 for the known risk factors and the difference among the cases and controls with respect to risk factors being taken as 40%. The calculated sample size was 116 in each group. However, to strengthen the study findings; control group of double the size of cases was planned to be enrolled. A total of 357 individuals comprising of 121 cases and 236 controls were studied. Sportspersons and persons with existing CVDs (more than 4 weeks since diagnosis) were excluded due to effects of restrictions in diet and physical activity, effects of medications etc. A questionnaire was designed to get details on personal parameters, history of present illness, personal habits like of use of tobacco, alcohol consumption, physical activity, relevant history (past, medical, treatment and family). Anthropometry was recorded. Perceived stress scale was used for stress assessment.[5] The questionnaire was administered to all the cases and controls by the principal worker or co-worker. Blood samples were drawn and tested for various biochemical parameters known to be associated with CVDs subsequently for both the groups. Data was analyzed using appropriate statistical techniques and find out the association if any between the risk factors and occurrence of CVDs.

RESULTS

The mean age in our study of cases was 39.95±5.55 years and of controls was 36.60±6.89 years. The parameters related to demography, socio-economic status, dietary, tobacco and alcohol consumption habits and perceived stress score are given in Table 1.

Table 1: Demographic, socio-economic and dietary parameters.

Parameter/characteristic	Cases, %	Controls, %
Age (yrs)		
Mean±SD	39.95±5.55	36.60±6.89
Marital status		
Married	99.17	95.76
Unmarried	0.83	4.24
Education		
Upto matric	66.11	55.08
Above matric	33.89	44.92
Nativity		
Rural	82.64	79.66
Urban	17.36	20.34
Family size		
Upto 4	49.58	36.21
≥5	50.42	63.79
Family income		

Continued.

Parameter/characteristic	Cases, %	Controls, %
Upto Rs. 50,000	61.97	84.84
>Rs. 50,000	38.03	15.16
Family history of CVDs		
Yes	11.57	13.16
No	88.43	86.84
Diet		
Veg	28.10	28.38
Non-veg	71.90	71.62
Extra ghee/butter consumption		
Yes	48.76	19.49
No	51.24	80.51
Extra salt consumption		
Yes	28.92	7.63
No	71.08	92.37
Performing recommended physical exercise		
Yes	89.26	91.95
No	10.74	8.05
Time spent in work		
Upto 8 hrs	38.84	50.88
≥8 hrs	61.16	49.12
Time spent in relaxation		
Upto 2 hrs	57.85	58.05
≥2 hrs	42.15	41.95
Tobacco consumption		
Current user	14.05	16.95
Past user	8.26	7.63
Never user	77.29	75.42
Alcohol consumption		
Current user	43.80	43.22
Past user	14.05	5.08
Never user	42.15	52.70
Perceived stress score		
Mean±SD	12.96±5.43	12.60±7.12
Mode	14.00	12.00
Median	14.00	9.00

Table 2: Physical and biochemical parameters.

Parameter	Cases (Mean±Std deviation)	Controls (Mean±Std deviation)
Body mass index (BMI)	24.76±2.49	23.93±1.96
Waist hip ratio (WHR)	0.96±0.06	0.94±0.05
Systolic blood pressure (SBP)	155.62±19.56	121.71±16.65
Diastolic blood pressure (DBP)	89.07±8.68	81.06±6.04
Total cholesterol	192.38±17.44	184.97±21.28
HDL	44.12±4.08	46.49±3.07
LDL	126.23±31.90	105.50±19.86
TGL	158.98±27.40	146.86±23.87

The mean±standard deviation BMI of the study participants; cases: 24.76±2.49 and controls: 23.93±1.96. The physical and biochemical parameters w.r.t. cases and controls are described in Table 2.

The association of CVDs with various known factors and perceived stress score studied in the present research is described in Table 3.

Table 3: Association of CVDs with various parameters.

Parameter	Odds ratio	95% Confidence intervals
Body mass index >23	1.67	1.01 – 2.76
Waist hip ratio >0.90	1.26	0.67 – 2.36
Total cholesterol >200 mg/dl	1.47	0.84 – 2.57
Low HDL <40 mg/dl	3.03	1.26 – 7.32
High LDL >130 mg/dl	4.98	2.95 – 8.39
High TGL >150 mg/dl	2.50	1.59 – 3.91
Total cholesterol HDL ratio >4.5	3.04	1.80 – 5.13
Presence of diabetes mellitus	14.35	4.85 – 42.45
Stress score >12	1.39	0.89 – 2.17
Marital status (married vs unmarried)	5.30	0.67 – 41.97
Education (school vs college)	1.59	1.01 – 2.50
Nativity (rural vs urban)	1.21	0.30 – 3.47
Family size >4	1.74	1.12 – 2.72
Income >Rs. 50,000	0.29	0.17 – 0.48
Family history of CVDs	0.80	0.41 – 1.56
Diet (veg vs non-veg)	0.98	0.60 – 1.60
Extra butter/ghee consumption	3.93	2.43 – 6.35
Extra salt consumption	4.92	2.64 – 9.17
Daily vegetable consumption	0.58	0.37 – 0.91
Daily fruit consumption	0.45	0.21 – 0.94
Time spent in work >8 hrs	1.93	1.23 – 3.01
Time spent in Relaxation ≥2hrs	1.01	0.64 – 1.57
Tobacco consumption	0.88	0.52 – 1.97
Alcohol consumption	1.25	0.80 – 1.97
Performing recommended physical exercise (≥30 min/day & 5 times a week)	0.28	0.17 – 0.47

DISCUSSION

Obesity plays a major role in development of CVDs and raised BMI and WHR have been associated with CVDs. The study by Venkatramana et al suggests BMI and waist circumference (WC) as better indicators of CHD risk factors.[6] The INTERHEART case-control study of coronary risk factors in acute myocardial infarction has also recently reported that obesity, especially central obesity, is an important coronary risk factor in most of the developing countries of Asia, Europe, Africa and South America.[3] A recent study of nearly 360,000 participants from 9 European countries showed that both general obesity and abdominal adiposity are associated with risk of death and support the importance of WC or WHR in addition to BMI for assessing mortality risk.[7] The present research lacked strong association between WHR and CVDs (OR-1.26 (95% CI 0.67-2.36)). However, BMI showed significant association with CVD (OR-1.67 (95% CI 1.01-2.76)). In our study, total cholesterol >200 mg/dl was associated with CVD but strength of association was not strong, TGL>150 mg/dl was significantly associated with CVDs (OR-2.50), LDL>130 was significantly associated with CVDs (OR-4.98), total cholesterol HDL ratio >4.5 was significantly associated with the CVD (OR-3.04) and HDL<40 mg/dl (OR-3.03), these findings are consistent with study by Chen et al and Mohan et al which revealed that elevated serum cholesterol concentrations and low serum high-density lipoprotein (HDL) cholesterol concentrations are associated with an increased risk of CVDs.[8,9] The role of LDL has been strongly validated various previous studies like clinical trials by NIH on efficacy of LDL-lowering therapy for reducing risk for CAD, the Multiple Risk Factor Intervention Trial (MRFIT), and the Lipid Research Clinics (LRC).[10-13] High HDL is protective against CVD and vice versa and epidemiological studies have signified that a 1 percent decrease in HDL cholesterol is associated with a 2-3 percent increase in CAD risk and low HDL cholesterol is an independent risk factor for CAD.[14] A focused approach on maintaining a favourable lipid profile with dietary modifications like low consumption of saturated fats, trans fats and lifestyle modifications i.e. following a recommended physical exercise schedule, reduction in stress levels etc. will help in achieving the target lipid profile and preventing & mitigating CVDs and its' effects.

Diabetes mellitus plays an important role in development of CVDs and was found significantly associated with the CVDs (OR-14.04). Synergism between degree of chronic hyperglycemia and CVD development has been

suggested by Lippy et al.[15] The relative risk of CVD in type 2 diabetes compared to the general population is increased two-to four fold.[16] Insulin resistance results in impaired capacity to catabolize chylomicrons and VLDL, as well as excess hepatic triglyceride and VLDL production. Hence, good glycaemic control in patients with diabetes mellitus will help maintain favourable Lipid profile and in turn lowering the CVD risk.

In our study association of perceived stress and CVD was studied and was found that stress score >12 was associated with CVD however strength of association was not strong (OR 1.39). This finding of our study is similar to study by Gabbay et al and Gullette et al who in their Holter monitoring studies, demonstrated that ischemia to be common during periods of low physical exertion but the incidence and duration of these episodes of ischemia is directly related to the intensity of the stress experienced during moderate to high mental and emotional stress.[17,18] Similar study by Strike PC and study by Sheps et al found that, there is consistent evidence that emotional distress, anger and extreme excitement can trigger acute coronary syndrome (ACS) and sudden cardiac death in susceptible individuals with both immediate and long-lasting impact.[19,20] Similar findings had also been Rosengren et al that stressful life events in the year preceding the index MI were more common in cardiac patients compared to the control group.[21] Stressors of study by Theorell T and study by Job PR who found that job strain has been associated with increased CVD prevalence. The work environment has most often been used to study chronic stress as it relates to CAD.[22,23] There is ample evidence that coronary heart disease tends to cluster in families. However, our study found that family history of CVD was protective effect on CVD (OR0.8) it may be due to awareness about the disease, younger age group of our study participants and healthy and active lifestyle. Findings of this study also does not match with other similar studies which found that relative risk for CAD in first degree relatives has been reported to range from two to as high as 12 times that of the general population.[24-26] The present research revealed physical exercise has protective effect on CVD (OR-0.28) which is consistent with findings of other studies. The study by Whelton SP, Khan et al and Redon et al demonstrated that physical exercise reduces blood pressure and thus reduces the risk of CVD.[27-29] Study by Blumenthal JA also found the beneficial effects of exercise on blood pressure and thus have protective effects on CVD.[30] Conversely, physical inactivity favorably modifies several risk factors; Evidence that physical activity can reduce risk for CAD comes from multiple observational studies. Therefore, physical inactivity is widely designated to be a major risk factor for CAD. Our study findings also brought out the same which shows physical inactivity and spending more time in work increases CVD risk. We found in our study that Diet with high saturated fat (OR-3.93) and high salt food (OR-4.92) was associated with increased risk of CVD and daily vegetable intake (OR 0.58) and increased fruit intake (0.45) was found protective effects on CVD. These findings are consistent with universal facts and various studies[31,32]

The risks factors implicated in causation of CVDs globally have been largely found in our research work also. The lifestyle w.r.t. physical activity, harmful use of tobacco and alcohol, dietary patterns and biochemical risks (lipids and hyperglycemia) are important risks identified in the study.

The present research has been conducted in males aged less than 50 years of age and hence the generalisability to wider age groups and female sex is limited. Multicentric studies in different age groups and sexes are recommended to assess CVD correlates in young population in India.

CONCLUSION

The present case control study among newly detected patients of CVDs and age matched controls has concluded that body mass index >23, triglycerides levels 150 mg/dl, low density lipoprotein levels >130 mg/dl, total cholesterol-HDL ratio >4.5, presence of diabetes mellitus, extra butter/ghee and salt consumption and spending >8 hrs in work. Daily vegetable and fruit consumption and performing physical exercise as recommended (150 min/week or 30 min/day for 5 days in a week) were found to be protective against development of CVDs. The modification of lifestyle to maintain healthy weight and lipid levels; performing recommended physical activity and consumption of healthy diet remain the key strategy in prevention and mitigation of CVDs.

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