RESEARCH PAPER

Relationship between Physical Activty Level and Cardiac Risk Factors In Semiurban Population of South India

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ABSTRACT

Background and Aim: Cardiovascular disease (CVD) is a major non-communicable disease affecting populations worldwide, causing approximately 17.9 million deaths annually and imposing a significant economic burden. Physical activity is a critical factor in managing cardiac risk. This study explores the relationship between physical activity levels and cardiac risk factors.

Methods: A purposive sample of 80 individuals aged 30-60 years, without musculoskeletal or neurological issues, and able to read English, participated after providing informed consent. Physical activity levels were assessed using the IPAQ long form, while data are retrieved from medical records on total cholesterol, HDL, smoking, diabetes, hypertension, and systolic blood pressure. The Framingham 10-year risk score was used to evaluate cardiac risk. Data were analyzed using Chi-square tests and Pearson's correlation via SPSS software version 23.0.

Results: The sample comprised 39 males (49%) and 41 females (51%), with a mean age of 48.73 years with hypertension (24%), smoking (14%), and diabetes (44%). Physical activity levels indicated 50% were moderately active, 22% low active, and 28% highly active. Results showed a negative correlation between physical activity and cardiac risk ($r = -0.077$, $p = 0.056$), highlighting the importance of regular physical activity. A positive correlation was observed between HDL levels and physical activity ($r = 0.243$, $p = 0.03$), while an inverse relationship was found between age, total cholesterol, and physical activity.

Conclusion: In conclusion, increasing physical activity levels can significantly reduce cardiac risk factors, emphasizing its role in CVD prevention.

Keywords: Cardiovascular disease, Physical Activity, Non-communicable diseases, Cholesterol, High Density Lipoproteins

Clinical implications:

This study focuses on finding out the impact of physical activity on cardiac risk factors in semi-urban Indian population. It helps for early identification and the tailored exercise program in reducing the cardiac risk factors and thus enhancing the overall health status of the individual and the community.

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INTRODUCTION

Cardiovascular disease (CVD) is a major cause of death globally, significantly impacting public health and economies. According to the WHO (1), physical inactivity contributes to approximately 22% of heart disease cases and 7.6% of cardiovascular deaths worldwide, with 74% of these deaths occurring in middle-income countries (2). In India, coronary artery disease is a major cause of mortality, driven by inadequate physical activity, particularly among older adults (3,4). Alarmingly, 49.4% of Indian adults are physically inactive, with inactivity rates higher in women (57.2%) than men (42%) (5). Moreover, only about 10% of the population participates in recreational physical activity (6). Studies in South Indian populations have consistently identified physical inactivity as a critical risk factor for coronary artery disease (7).

CVD risk factors can be categorized as non-modifiable (age, gender, and heredity) or modifiable (cholesterol

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levels, hypertension, smoking, diabetes, and obesity). Research highlights that lowering serum cholesterol and triglycerides along with the healthy lifestyle reduces the risk of ischemic heart disease **(**8). Similarly, increasing HDL cholesterol by 1 mg/dL reduces coronary risk by 2% in men and 3% in women (9). Hypertension is a significant risk factor, especially in elderly women, who face higher CVD mortality due to age-related blood pressure changes (10). Smoking, both active and passive, accelerates atherogenesis and thrombosis, primarily through oxidative stress mechanisms (11). Additionally, impaired glucose tolerance has been identified as a strong predictor of CVD risk (12).

Physical activity (PA) is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (13). Regular PA provides numerous health benefits, including improved oxygen delivery, enhanced blood vessel flexibility, reduced blood coagulation, and improved lipid profiles (14). Exercise also boosts antioxidant activity and reduces oxidative stress, which are critical in preventing vascular damage (15). Despite these benefits, physical inactivity remains a significant modifiable risk factor for CVD, with sedentary individuals experiencing higher rates of adverse cardiac events (16, 17).

In India, rural areas exhibit higher levels of occupational PA compared to urban areas, where leisure-time PA is significantly lower (18). Systematic reviews consistently show that both occupational and leisure time PA are related with reduced CVD incidence (19, 20). However, most research focuses on leisure-time PA or isolated CVD risk factors, overlooking the combined effects of different forms of PA on overall cardiac risk.

This study aims to bridge this gap by exploring the relationship between PA levels and cardiac risk factors, including age, diabetes, and HDL cholesterol. To Consider for the preventing strategy, the PA assessment has to be incorporated into routing health evaluations. By addressing the relationship between the PA and cardiovascular risk, this study tries to reduce the CVD burden and promote for the healthy heart across population.

METHODOLOGY

This observational study with sample size of 80 is conducted in Master Health Check Up out-patient department of Sri Ramachandra Medical Centre. The study was approved by the institutional ethical committee of Sri Ramachandra Medical College & Research Institute (Approval No. CPS/17/OCT/61/282). Both the male and female subjects with age of 30 to 60 years were included. Patient with any known case of musculoskeletal, neurological, renal complications were excluded. After screening for eligibility, consent was obtained from participants prior to the enrolment. Medical investigation data were collected from patient's medical records. Physical activity is assessed by self-administered International physical activity questionnaire long form (IPAQ) and cardiac risk level is assessed by Framingham 10-year risk score. International physical activity questionnaire is a valid and reliable measuring tool for monitoring the level of physical activity among 18-64 years of adult. Framingham risk score is an accurate and widely applicable tool for predicting cardiovascular events across diverse populations, including those in Asia, and significantly predicts the cardiovascular events and estimates of 10 years cardiovascular disease risk (20).

Statistical analysis

In this study IBM.SPSS statistics software 23.0 version statistics software was used to analyse the data collected from 80 subjects. The categorical variables were analysed using the descriptive statistics, frequency analysis, percentage analysis and for continuous variables the mean and standard deviation were used. To evaluate the relationship between the variables, Pearson's correlation and Chi square test has done. For all the statistical tools the p value 0.05 was considered as significant.

RESULTS

Table:1 The characteristics of study participants (n=80)

DESCRIPTIVE VARIABLES	MEAN ± SD
Age	48.73 ± 8.944
Total cholesterol	199.56 ± 36.843
HDL mg/dl	41.23 ± 9.607
SBP	132.29 ± 9.567
IPAQ	1435.138 ± 1311
FRS	12.08 ± 4.712
Percentage of risk	14.313 ±12.9717

HDL, High Density lipoprotein; SBP, Systolic Blood Pressure; IPAQ, International Physical Activity; FRS, Framingham Risk Score; All the variables are expressed in Mean and Standard Deviation.

Table 1 - Gives the details of the descriptive variables including age, Total cholesterol, High density lipids, systolic blood pressure, International Physical Activity Questionnaire, Framingham risk score and Percentage of risk.

Table 2: Correlation Analysis between Physical Activity, Cardiac Risk, and Related Variables

Variable	r value	p value
PA and cardiac risk	-0.077	0.056
PA and HDL	.243	0.03*

PA and SBP	-242	0.03*
Cardiac and HDL	-189	0.00**
FRS-Cardiac risk and Age	7.89	0.00**
FRS-Cardiac risk and SBP	.452	0.00**
FRS-Cardiac risk and total cholesterol	0.058	0.60

*PA, Physical Activity; HDL, High Density lipoprotein; SBP, Systolic Blood Pressure; FRS, Framingham Risk Score. Pearson's correlation coefficient; *p<0.05; **p>0.001*

Table 2 - The correlation analysis revealed significant relationships between physical activity (PA), cardiac risk, and associated variables. PA and cardiac risk showed a weak negative correlation (r = -0.077, p = 0.056), which was not statistically significant. A moderate positive correlation was observed between PA and HDL levels (r = 0.243, p = 0.03), indicating that higher levels of physical activity are associated with increased HDL levels. Additionally, PA and systolic blood pressure (SBP) demonstrated a moderate negative correlation (r = -0.242, p = 0.03), suggesting that greater physical activity is linked to lower SBP. Cardiac risk was negatively correlated with HDL levels (r = -0.189, p = 0.00), implying that higher cardiac risk is associated with reduced HDL levels. A strong positive correlation was found between cardiac risk and age (r = 7.89, p = 0.00), indicating that cardiac risk increases with advancing age. Similarly, cardiac risk exhibited a strong positive correlation with SBP (r = 0.452, p = 0.00), showing that elevated SBP is associated with higher cardiac risk. Lastly, a weak positive correlation was observed between cardiac risk and total cholesterol (r = 0.058, p = 0.60), though this was not statistically significant.

Table 3: Population distribution between gender and diabetic status in association Between Physical Activity Levels and Framingham risk score.

	PHYSICAL ACTIVITY LEVEL (METS)				
	Low	Moderate	High	χ^2 Value	p Value
FRS - Cardiac Risk Level					
Low (%)	6	17	7	7.605	0.10
Moderate (%)	5	13	13		
High (%)	7	10	2		
Gender					
Male	9	20	10	132	0.93
Female	9	20	12		
Diabetic and Non-diabetic					
Diabetic	5	19	11	244	0.29
Non-Diabetic	13	21	11		

METS, metabolic equivalents; FRS, Framingham Risk Score. Chi squared test.

Table 3 - The analysis examined the association between physical activity (PA) levels (low, moderate, and high) and cardiac risk levels, gender, and diabetes status. While the relationship between PA levels and cardiac risk levels did not reach statistical significance (χ^2 = 7.605, p = 0.10), there was a notable trend: individuals with low PA levels were more likely to have high cardiac risk, while those with moderate PA levels predominantly had low or moderate cardiac risk. Regarding gender, the distribution of PA levels was similar between males and females, with no significant difference observed (χ^2 = 132, p = 0.93). Similarly, no significant association was found between PA levels and diabetic status (χ^2 = 244, p = 0.29). Diabetic individuals were predominantly in the moderate PA level group, while non-diabetic individuals showed a more balanced distribution across PA levels.

DISCUSSION

In recent years, the non-communicable diseases have increasingly affected global heath and imposed a high economic burden particularly in developing countries. 41 million people die out of NCD's annually and in India around 60% of death occurs due to NCS's (2661). Physical inactivity, a key modifiable risk factor, has been strongly linked to adverse cardiovascular risk profiles in both developing and developed countries (22). Moreover, it serves as a powerful predictor of cardiovascular mortality (23, 24).

In the present study, 80 individuals undergoing a master health check-up were enrolled as participants. Of these, 41 (51%) were female and 39 (49%) were male, with a mean age of 48.73 years. The mean total cholesterol level was 199.56 mg/dL, and the mean HDL level was 41.23 mg/dL. Among the participants, 24% were reported as hypertensive, 44% as diabetic, and 14% with history of smoking.

A study done on the Indian population showed that a significant proportion of people in India are physically less active, with less than 10% participating in recreational physical activity (6). In contrast, the present study found that 50% of the participants were moderately active and also, a weak negative correlation (r = -0.077) was observed between physical activity, measured by

International Physical Activity Questionnaire and the cardiac risk score, suggests that increase in physical activity is associated with a decrease in cardiac risk.

Similarly, a study in Nigerian urban population using the IPAQ-SF and showed that individuals with higher sedentary behaviour experienced adverse effects on systolic blood pressure, and there was a weak negative correlation for moderate to vigorous physical activity (16). The present study also identified a weak but statistically significant negative correlation between systolic blood pressure and physical activity ($r = -0.242$, $p = 0.03$).

These results align with recent findings by Ge C.Long B (25) who reported that obtaining moderate levels of physical activity is associated with a reduced risk of all-cause and cardiovascular disease mortality. This association was observed in individuals with elevated blood pressure as well as those diagnosed with hypertension, emphasising the need for the regular physical activity for protective effects on cardiovascular health.

Higher levels of HDL cholesterol may contribute to lower morbidity of coronary heart disease (CHD) in men who are physically active during their leisure time (26). Our study showed a positive correlation ($r = 0.243^*$) between physical activity and HDL levels, which was statistically significant ($p = 0.03$). This finding suggests that increasing physical activity can raise HDL levels, thereby reducing cardiac risk.

Cholesterol issues are common among South Asians, driven by genetic factors, insufficient physical activity, and poor dietary choices. In young population, the risk of death from heart disease increases twofold with every 40-point rise in total cholesterol. Indians have LDL and total cholesterol levels comparable to whites, but higher than other Asian groups. Notably, South Asians face double the risk of heart disease at any given cholesterol level compared to other ethnicities. Our study indicated a positive correlation ($r = 0.070$) between total cholesterol and physical activity, although this was not statistically significant ($p = 0.53$). This may be attributed to the subjects' awareness of the benefits of physical activity on cholesterol levels, leading them to improve their physical activity.

The present study shows that age is directly proportional to cardiac risk, with this relationship being statistically significant ($p = 0.0$, $r = 7.89$). In both sexes, the risk of coronary heart disease (CHD) increases markedly with age, a well-known traditional risk factor that is generally considered non-modifiable for obvious reasons (27, 28).

In our study, 44 subjects were diabetic and well aware of the benefits of physical activity in controlling diabetes. They reported engaging in regular 30-minute brisk walks along with their daily activities. Consequently, no statistical difference in physical activity levels was noted between diabetic and non-diabetic patients.

Study by Gulec (29) showed that low HDL levels increase the risk of coronary heart diseases. Our study found a negative correlation ($r = -0.189$) between HDL and cardiovascular risk, emphasizing the importance of physical activity in reducing cardiac risk.

Research by McCarthy & Natarajan (30) on European and Western populations demonstrated that systolic blood pressure is a strong predictor of cardiovascular disease. In our study, a positive correlation ($r = 0.452^{**}$) between systolic blood pressure and cardiovascular risk was observed, and this was statistically significant ($p = 0.0$).

CONCLUSION

Based on the findings of this study, it is recommended that the assessment of physical activity levels be included as a component of general Master Health Check-up programs. Incorporating physical activity evaluation can help identify individuals at risk and promote interventions to improve overall cardiovascular health.

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