

## ORIGINAL ARTICLE

## PREVALENCE OF RISK FACTORS FOR ATHEROSCLEROSIS: A SOCIOECONOMIC COMPARISON

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**Objectives:** Atherosclerosis, the key pathology for cardiovascular disease, is thought to be a disease of affluent people. This study was designed to estimate risk factor prevalence of atherosclerosis in different socioeconomic classes.

**Methodology:** Questionnaire-based data was obtained from 395 subjects, divided into three socioeconomic classes according to monthly income (high income, HI: > 100,000 PKR; Middle income, MI: 50,000 – 100,000 PKR; Low income, LI: < 20,000 PKR). Data was collected with regard to hypertension, diabetes, hypercholesterolemia, obesity, smoking, tobacco use, physical inactivity, and dietary habits.

**Results:** Number of participants was: HI – 115; MI – 119; LI – 161. Mean age of cohort was  $35.81 \pm 14.29$ . The three classes showed no significant difference with regard to age and body mass index, BMI ( $p = 0.055$ ,  $0.222$  respectively). A statistically significant difference was present with regard to lack of exercise, hypercholesterolemia, hypertension (HTN) and tobacco use ( $p < 0.001$ ,  $p = 0.025$ ,  $p = 0.005$ ,  $p < 0.001$  respectively). No significant difference was observed with regard to smoking and diabetes ( $p = 0.326$ ,  $.424$  respectively). Prevalence of  $\geq 3$  risk factors was: HI – 12.17%; MI – 14.28%; LI – 11.17%.

**Conclusion:** Low, middle and high socioeconomic classes showed HTN, lack of exercise and hypercholesterolemia as the most prevalent risk factors respectively. Middle class showed most clustering of risk factors followed by high and low classes. Lack of exercise was the most prevalent risk factor overall, most pronounced in middle class.

**Keywords:** atherosclerosis, risk factors, socioeconomic class, Pakistan

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## INTRODUCTION

Atherosclerosis, (“athere” - soft, fatty, gruel-like; “scler” - hard) is an ancient disease. Its root words are illustrative of the lipid deposits – yellow plaques – on the tunica intima of large and medium sized arteries, causing narrowing of the lumen. The focal lesions progress to atherosclerotic plaques (atheromas), which are complicated by erosion, rupture, thrombosis, fibrosis and calcification.

The Framingham Heart Study has defined high blood pressure, dyslipidemia, cigarette smoking and obesity as primary risk factors for atherosclerosis and diabetes mellitus, lack of exercise, and tobacco use as secondary risk factors.<sup>1</sup>

The burden of risk factors for atherosclerosis tends to increase with age. It is increasingly vital nowadays to improve knowledge about these so as to slow disease progression and, if possible, prevent its development. However, the societal milieu of this country is currently not congenial to this endeavor due to the prevalence of high illiteracy rates, scarce access to healthcare, and more pressing concerns (such as infectious and nutritional diseases) taking precedence.

The 2018 Physical Activity Guidelines Advisory Committee Report concluded that regular involvement in moderate-to-vigorous physical activity is inversely associated with progression of hypertension.<sup>2</sup>

Total cholesterol  $\geq 200$  mg/dL or low-density cholesterol (LDL-C) values  $\geq 130$  mg/dL is considered diagnostic of dyslipidemia.<sup>3</sup> According to American Heart Association, hypertension is defined as blood pressure (BP)  $> 130/80$  mmHg.<sup>4</sup> Systemic hypertension is associated with an increased incidence of CVD. Afrose Liaquat et al., in their study of 1,629 subjects, found a high correlation between cigarette smoking and raised blood pressure and total cholesterol along with decreased high-density cholesterol (HDL-C), which have been highlighted as atherosclerotic risk factors.<sup>5</sup>

The American Diabetic Association defines diabetes as fasting plasma glucose  $> 126$  mg/dL, or 2-hour plasma glucose  $> 200$  mg/dL, or hemoglobin A1C (HbA1C)  $> 6.5\%$ , or random plasma glucose (in a person with classic symptoms of hyperglycemia or hyperglycemic crisis)  $\geq 200$  mg/dL.<sup>6</sup>

Diabetes mellitus has been highlighted as a major risk factor for cardiovascular disease (CVD) and enhances the effects of other risk factors such as smoking, hypertension and dyslipidemia.<sup>7</sup>

Obesity is defined by the World Health Organization (WHO) as an “abnormal or excessive fat accumulation that presents a risk to health,” commonly classified by BMI  $\geq 30.0$  kg/m<sup>2</sup>.<sup>8</sup> It is significantly associated with a high incidence of atherosclerosis and is a common cause of adverse outcomes in adult life.<sup>9</sup>

It is a common misperception that atherosclerotic risk factors are more abundant in the high socioeconomic class. The aim of this study was to perform a comparative analysis of the prevalence of multiple cardiovascular risk factors in different socioeconomic strata of our society. No study that has systematically evaluated these risk factors with their prevalence amongst various socioeconomic classes in our population has been performed previously.

**METHODOLOGY**

To determine the prevalence of cardiovascular risk factors amongst different socioeconomic groups in Karachi (Goolbanoo and Dr. Burjor Anklesaria Nursing Home), we performed a cross-sectional study over 6 months (April 2020 – September 2020). The study included randomly selected subjects from general population of Karachi aged 18-75 years (n = 395, 197 males, 198 females). Pregnant women and mentally-handicapped individuals were excluded. Raosoft sample size calculator was used. A 5% margin of error and a 95% confidence level were used. Response distribution was kept at 50% and population size was taken to be 14.91 million, which is the population of Karachi. The calculated sample size thus came out to be 385. Keeping in mind wastage of 2.5%, sample size was then calculated to be 395. The population was divided into three socioeconomic classes according to monthly income (high income, HI: > 100,000 PKR; Middle income, MI: 50,000 – 100,000 PKR; Low income, LI: < 20,000 PKR). Study approval was obtained from Ziauddin University Undergraduate Ethical Review Committee Office, IRB protocol reference number 0101021HIY4. Informed consent was obtained from all participants.

Data was collected using a structured self-administered questionnaire. Responses were kept anonymous to maintain confidentiality. The questionnaire was based on WHO guidelines for non-communicable diseases risk factors field surveys and included demographic variables (age, gender, height and weight) and presence of atherosclerotic risk

factors (physical activity level, smoking status, diet, and pre-existing medical conditions such as hypertension, diabetes and hypercholesterolemia).<sup>10</sup> Dietary habits evaluation included the amount of daily consumption of proteins, carbohydrates, fats, vegetables and fruits, and physical exercise evaluation included type of exercise and estimation of number of hours of exercise/week. Smoking status was evaluated according to history of smoking (smoker, non-smoker) and the number of pack years in the case of smokers.

Data was analyzed on SPSS version 22. Continuous data was expressed as means  $\pm$  2 SD. Categorical data was expressed as proportions and percentages. The differences between the groups was calculated by one-way ANOVA. P-value < 0.05 was deemed significant.

**RESULTS**

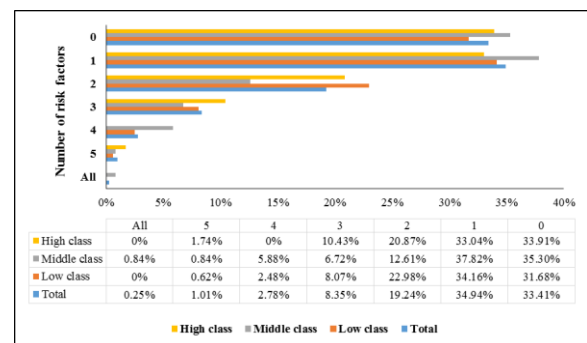
The groups did not show any statistically significant difference with regard to age and BMI but showed a significant difference with regard to weight and height, as shown in Table 1.

**Table 1: Frequency distribution of demographic factors**

	Total	Low class	Middle class	High class	P-value
<b>Gender</b>					
Male	197	85	60	52	0.48
Female	198	76	59	63	
Age	14.3	13.7	14	15.3	0.055
Weight	64.68	61.99	68.04	65.08	0.004
Height	165.51	163.48	167.52	166.32	0.002
BMI	23.58	23.19	24.22	23.5	0.222

BMI=body mass index

The frequency distribution of the modifiable risk factors with regard to each socioeconomic class is given in Figure 1



**Figure 1: Frequency distribution of number of risk factors**

Middle socioeconomic class showed highest prevalence (14.28%) for  $\geq 3$  risk factors, followed by high (12.17%) and low (11.17%) classes. Distribution of individual risk factors is shown in Table 2.

**Table 2: Frequency distribution of primary and secondary risk factors**

	Total	Low class	Middle class	High class	P-value
<b>Primary risk factors</b>					
Lack of exercise	26.3% (104)	18% (29)	35.3% (42)	28.7% (33)	<0.001
Hypercholesterolemia	24.5% (39)	17.4% (8)	21.8% (12)	32.8% (19)	0.025
Hypertension (HTN)	24.3% (96)	32.3% (52)	16% (19)	21.7% (25)	0.005
Tobacco	19.8% (78)	27.4% (44)	18.5% (22)	10.4% (12)	<0.001
Smoking	13.4% (53)	14.3% (23)	16% (19)	9.6% (11)	0.326
Diabetes	8.6% (34)	9.3% (15)	5.9% (7)	10.4% (12)	0.424
Obesity	8.1% (32)	11.2% (18)	6.7% (8)	5.2% (6)	0.027
<b>Secondary risk factors</b>					
Poor dietary habits	85% (336)	82% (132)	91.6% (109)	82.6% (95)	<0.001
Treatment adherence for diabetes	82.3% (28)	80% (12)	100% (7)	75% (9)	0.229
Treatment adherence for HTN	68.8% (66)	61.5% (32)	78.9% (15)	76% (19)	0.138
Treatment adherence for hypercholesterolemia	11.9% (19)	10.9% (5)	16.4% (9)	8.6% (5)	0.081

No difference was noted with regard to smoking and diabetes. However, significant difference was found for lack of exercise, hypercholesterolemia, HTN, and tobacco use. The proportions for individual risk factors are shown in Table 3.

**Table 3: Proportions of primary risk factors**

Risk factor	Class with highest prevalence	Proportion
Lack of exercise	Middle	35.3% (42)
Hypercholesterolemia	High	32.8% (19)
Hypertension	Low	32.3% (52)
Tobacco	Low	27.4% (44)
Smoking	Middle	16% (19)
Diabetes	High	10.4% (12)
Obesity	Low	11.2% (18)

There was a statistically significant difference with regard to poor dietary habits amongst the three socioeconomic classes, with the unhealthiest eating habits noted in middle class. Interestingly, the three groups showed no statistically significant difference with regard to treatment adherence for the control of diabetes, HTN, and hypercholesterolemia (Table 2).

## DISCUSSION

This cross-sectional survey was conducted to see differences in the number of modifiable risk factors for atherosclerosis prevalent in the three socioeconomic classes of Pakistan, i.e. hypertension, diabetes mellitus, hypercholesterolemia, smoking, sedentary lifestyle, tobacco usage and obesity.

Lack of exercise was the most common risk factor overall (26.3%), mostly in the middle socioeconomic class (35.3%). This is a unique finding as in most previous studies, dyslipidemia has predominated.<sup>11</sup> Morris et al. showed that middle-aged men who participated in vigorous physical activity were found to have a one third less likelihood of CAD than their

inactive contemporaries.<sup>12</sup> Regular physical activity has been found to be a major contributor to the prevention of high blood pressure.<sup>13</sup>

Hypercholesterolemia prevailed as the second most common risk factor (24.5%), mostly in high socioeconomic class (32.8%). Comparatively, its prevalence in low (17.4%) and middle (21.8%) classes was significantly lower. Our calculated prevalence of hypercholesterolemia was found to be significantly higher compared to the 11.4% prevalence observed in another Pakistani study.<sup>14</sup>

Prevalence of hypertension (24.3% overall) was highest in low socioeconomic class (32.3%). This is comparable to a study by Mansour et al. in which they reported a prevalence of 26.1%.<sup>15</sup>

Prevalence of tobacco use (smoking and chewable forms) was 19.8%, most common in low socioeconomic class (27.4%). Rajeev Gupta et al. also noted highest prevalence of tobacco use in low-income schools in Indian urban and rural areas.<sup>16</sup>

Cigarette smoking (13.4% prevalence) was most prevalent in middle socioeconomic class (16%). This is significantly low compared to a study performed by Gijs F.N. Berkelmans et al. in which smoking was prevalent in 25% of the population.<sup>17</sup>

Diabetes Mellitus, another major risk factor for increased carotid intima-media thickness and carotid plaque, was most prevalent in high socioeconomic class (10.4%) with its prevalence in low class (9.3%) coming a close second.<sup>18</sup> Overall, its prevalence (8.6%) was significantly higher as compared to a study by Ibrahim Al Alwan et al. (4%).<sup>19</sup>

Obesity (BMI  $\geq$  30 kg/m<sup>2</sup>) is a problem that predisposes to the development of hypertension, insulin resistance and lipid abnormalities, was calculated to be prevalent in 8.1%, notably in low

socioeconomic class (11.2%), comparable to a study by Wardle et al. in which highest prevalence was found in low socioeconomic class.<sup>20,21</sup>

Unhealthy eating habits were the most prevalent secondary risk factor (85.1%), highlighted most in middle socioeconomic class (91.6%). The American Heart Association recommends  $\geq 5$  servings of fruits and vegetables be incorporated into an individual's daily diet.<sup>22</sup> Victoria Miller et al., in their study, found an 11% decreased risk of major cardiovascular disease for people with the highest consumption of fruit compared with those with the lowest.<sup>23</sup>

When analyzing the study participants for treatment adherence for management of diabetes, blood pressure, and hypercholesterolemia, we found the lowest adherence for the use of anti-hypercholesterolemia drugs (11.9%). This was a striking difference as compared to the use of anti-diabetic drugs (82.3%) and anti-hypertensives (68.8%). The middle socioeconomic class was most compliant with the use of anti-diabetic drugs (100%). This poses a distinct contrast to the use of lipid-lowering medications (19%) and anti-hypertensives (33%) observed in a study performed by Peter Ueda et al. in 2018.<sup>24</sup>

Most study participants had at least one risk factor (34.94%) and 12.39% had  $\geq 3$  risk factors. Middle socioeconomic class had highest prevalence of  $\geq 3$  risk factors followed by high and low classes respectively. In a study performed by Michelle H. Leppert et al., most individuals were found to have at least 0 or 1 risk factor, with few having  $> 3$  risk factors (0.6% – 1.3%).<sup>25</sup>

Efforts should be targeted to increase awareness about risk factors and thus slow progression of atherosclerotic complications.

**Limitations of the study:** The prevalence estimates of risk factors were observed in the population of Karachi only so there might be some differences compared to the true estimates of the overall population of Pakistan. However, Karachi is colloquially referred to as a “mini-Pakistan” since it houses people of all ethnicities. Thus, data gathered from its population can be safely assumed to be a fitting representation of the Pakistani population.

We employed a self-administered questionnaire for our data collection. Thus, the potential of recall bias cannot be ignored

## CONCLUSION

The risk factor exhibiting the most pronounced proclivity for atherosclerosis development was a sedentary lifestyle, most highlighted in middle socioeconomic class. The three socioeconomic classes displayed a significant difference with regard to prevalence of a sedentary lifestyle, hypercholesterolemia, HTN and tobacco use. No significant difference was observed with regard to prevalence of smoking and diabetes amongst the three groups. Middle socioeconomic class showed highest number of risk factors. To complement the results of this study, it is suggested that more studies of larger size are to be done in the future.

## AUTHORS' CONTRIBUTION

HI and IH: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. HT, SK, and MZ: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

**Conflict of interest:** Authors declared no conflict of interest.

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## REFERENCES

1. Cybulska B, Klosiewicz-Latoszek L. Landmark studies in coronary heart disease epidemiology. The Framingham Heart Study after 70 years and the Seven Countries Study after 60 years. *Kardiologia Polska*. 2019;77(2):173-80.
2. Pate R. The Report of the US Physical Activity Guidelines Advisory Committee: Important Findings for Employers. *Am J Health Promot*. 2019;33(2):313-4.
3. Rhee EJ, Kim HC, Kim JH, Lee EY, Kim BJ, Kim EM, et al. 2018 Guidelines for the management of dyslipidemia in Korea. *J lipid atheroscler*. 2019;8(2):78-131.
4. Whelton P, Carey R, Aronow W, Casey D, Collins K, Dennison Himmelfarb C, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APHA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: Executive Summary. *J Am Coll Cardiol*. 2018;71(19):2199-269.
5. Liaquat A, Javed Q. Current trends of cardiovascular risk determinants in Pakistan. *Cureus*. 2018;10(10):e3409.
6. American Diabetes Association; 2. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes—2020. *Diabetes Care*. 2020;43 (Supplement\_1):S14–S31.
7. Zahidullah M, Aasim M, Khan I, Muhammadzai HZ, Shah MA, Ali N, et al. Evaluation of patients with coronary artery disease for major modifiable risk factors for ischemic heart disease. *J Ayub Med Coll Abbottabad*. 2012;24(2):102-5.
8. Obesity [Internet]. Who.int. 2022 [cited 8 August 2022]. Available from: [https://www.who.int/health-topics/obesity#tab=tab\\_1](https://www.who.int/health-topics/obesity#tab=tab_1).
9. Raza SA, Ali SS, Ali KB, Ali CA, Riaz A, Hussain I, et al. Metabesity: expert panel recommendation for taking up the challenge by a multidisciplinary approach. *J Pak Med Assoc*. 2020;70(8):1418-24.
10. Pakistan Health Research Council. Non-communicable diseases risk factors survey – Pakistan. Islamabad; 2016.

11. Kim H, Kim S, Han S, Rane PP, Fox KM, Qian Y, et al. Prevalence and incidence of atherosclerotic cardiovascular disease and its risk factors in Korea: a nationwide population-based study. *BMC Public Health*. 2019;19(1):10.1186/s12889-019-7439-0.
12. Morris JN, Chave SP, Adam C, Sirey C, Epstein L, Sheehan DJ. Vigorous exercise in leisure-time and the incidence of coronary heart-disease. *Lancet*. 1973;1(7799):333-9.
13. Krawczyk M, Czarniak P, Szcześniak P, Król E, Pakalska A, Kusiak A, et al. The prevalence of risk factors for atherosclerosis among middle school students in Sopot, Poland: results of the SOPKARD 15 programme. *Kardio Pol*. 2011;69(6):540-5.
14. Ashraf T, Aamir KF, Achakzai AS, Mengal N, Karim MT. Burden of atherosclerosis risk among different ethnicity: a hidden health challenge. *J Ayub Med Coll Abbottabad*. 2016;28(4):788-92.
15. Al-Nozha MM, Abdullah M, Arafah MR, Khalil MZ, Khan NB, Al-Mazrou YY, et al. Hypertension in Saudi Arabia. *Saudi Med J*. 2007;28(1):77-84.
16. Gupta R, Rastogi R, Arora S. Low obesity and high undernutrition prevalence in lower socioeconomic status school girls: a double jeopardy. *Hum Ecol*. 2006;14:65-70.
17. Berkelmans G, van der Graaf Y, Dorresteyn J, de Borst G, Cramer M, Kappelle L, et al. Decline in risk of recurrent cardiovascular events in the period 1996 to 2014 partly explained by better treatment of risk factors and less subclinical atherosclerosis. *Int J Cardio*. 2018;251:96-102.
18. Song P, Fang Z, Wang H, Cai Y, Rahimi K, Zhu Y, et al. Global and regional prevalence, burden, and risk factors for carotid atherosclerosis: a systematic review, meta-analysis, and modelling study. *Lancet Glob Health*. 2020;8(5):e721-e9.
19. Al Alwan I, Badri M, Al-Ghamdi M, Aljarbou A, Alotaibi H, Tamim H. Prevalence of self-reported cardiovascular risk factors among Saudi physicians: a Comparative Study. *Int J Health Sci (Qassim)*. 2013;7(1):3-13.
20. Krawczyk M, Czarniak P, Szcześniak P, Król E, Pakalska A, Kusiak A, et al. The prevalence of risk factors for atherosclerosis among middle school students in Sopot, Poland: results of the SOPKARD 15 programme. *Kardiologia Polska (Polish Heart Journal)*. 2011;69(6):540-5.
21. Wardle J, Brodersen NH, Cole TJ, Jarvis MJ, Boniface DR. Development of adiposity in adolescence: five year longitudinal study of an ethnically and socioeconomically diverse sample of young people in Britain. *BMJ*. 2006;332(7550):1130-5.
22. Al Hazzaa HM. Prevalence of physical inactivity in Saudi Arabia: a brief review. *East Mediterr Health J*. 2004;10(4-5):663-70.
23. Miller V, Mente A, Dehghan M, Rangarajan S, Zhang X, Swaminathan S, Dagenais G, et al. Fruit, vegetable, and legume intake, and cardiovascular disease and deaths in 18 countries (PURE): a prospective cohort study. *Lancet*. 2017;390(10107):2037-49.
24. Ueda P, Gulayin P, Danaei G. Long-term moderately elevated LDL-cholesterol and blood pressure and risk of coronary heart disease. *PLoS One*. 2018;13(7):e0200017.
25. Leppert MH, Poisson SN, Sillau SH, Campbell JD, Ho PM, Burke JF. Is prevalence of atherosclerotic risk factors increasing among young adults? It depends on how you ask. *J Am Heart Assoc*. 2019;8(6):e010883.

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