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Original Article

Statistical Insight into CVD Risk Prevalence Among the Cardiac Patients in Jharkhand, India

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ABSTRACT

Background: Cardiovascular Disease (CVD) is the leading cause of mortality and disability globally and is also very much a significant burden in India. This study aimed to identify prevalent risk factors among hospitalized CVD patients at the Rajendra Institute of Medical Science (RIMS) in Ranchi in the year 2023. **Materials and Methods:** Utilizing the WHO's STEP-wise approach; we assessed 516 RIMS patients aged 18 to 69 years with complaints of chest discomfort and breathing difficulties. **Results:** 4 times more male CVD patients were found than females in the total population. Female patients were mostly above 45 years of age indicating the involvement of menopause. Results revealed a high prevalence of dyslipidemia: 85.66% of patients exhibited abnormal High-Density Lipoprotein (HDL) levels, while 71.7% had an elevated Cholesterol Ratio (CR). Obesity (63.76%) and abnormal Mean Arterial Pressure (MAP) (32.75%) were also notable. Females showed significantly lower HDL levels (96%) compared to males (82%), while males had a higher prevalence of elevated Low-Density Lipoprotein (LDL) levels (56.1% vs. 52.9%). **Conclusion:** Though Dyslipidemia has been the major contributor to CVD in Jharkhand, metabolic syndrome was present only in 10.27% of patients. Odds ratio analysis indicated males were 1.86 times more likely to be obese than females. Most of the female patients were of postmenopausal age, though their frequency of occurrence was 4 times less than male patients. These findings highlight the main cause of CVD in the Jharkhand population that needs to be intervened from every level possible.

Keywords: Cardiovascular Disease (CVD), Dyslipidemia, Epidemiology, Obesity, Risk Factors.

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INTRODUCTION

The world's biggest cause of mortality and disability is Cardiovascular Disease (CVD).[1] In 2017, it was the cause of 14.7% of Disability Adjusted Life Years (DALYs) and 31.8% of all deaths worldwide.[2] In India, CVD accounts for the majority of deaths and disabilities too.[3] The CVD epidemic in India is not caused by a single reason, but rather by a complex interaction of several determinants and risk factors.[4] The nation has experienced a swift shift in the epidemiology of infectious to non-communicable diseases throughout the past few decades.[5] A nutritional shift has also been occurring in India, which is marked by a decline in the consumption of fruits, vegetables, pulses, and grains and an increase in the consumption of meat and ready-to-eat energy-dense processed foods that are high in salt.[6,7] Economic and sociocultural shifts have also contributed significantly to the CVD pandemic.[4,8] A recent risk factor for the increased prevalence of disease burden in India has been identified as the country's poor ambient air quality in many areas, as well as ongoing exposure to household air pollution, known as environmental shift.[9,10] These shifts have led to a decrease in physical activity and an increase in the prevalence of sedentary lifestyles.[11,12] While the CVD rampant in India shares many similarities with those of other developing countries, there are certain differences. The increased burden of CVD among Indians can be explained in part by the underlying genetic risk.[13] Physiological disparities have also been identified within the Indian population. Apart from gender differences, many other risk factors also include ethnic disparities. Jharkhand of India, being a state well documented by the high percentage of Aboriginal inhabitants of different tribal castes, may show variations and propensities of several risk factors.[14] Risk factor assessment of CVD patients of the main tertiary care government hospital in Jharkhand will be one of the major predictors of the underlying risk factors prevailing in this state.

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MATERIALS AND METHODS

Study design and setting

This investigation was designed to determine the major risk factors prevalent among hospitalized CVD patients with chest discomfort and breathing trouble. The survey was done in the year 2023 in the cardiology department at the main tertiary care government hospital of Rajendra Institute of Medical Science (RIMS) in Ranchi. The study was conducted following WHO's (World Health Organization) STEP-wise approach to the surveillance of chronic disease risk factors. These steps involve:

STEP 1: Questionnaire

Using a structured questionnaire, the demographic and socio-economic information including age, gender, risk factors for CVD, medical history of co-morbidity, etc. was accessed.

STEP 2: Measurement of Anthropometric parameters

A digital weighing machine of (error+/-0.1 kg) and a non-elastic measuring tape fixed on a wooden board were used to obtain weight and height measurements for calculating Body Mass Index (BMI) calculation.

A manual sphygmomanometer was used to collect the blood pressure measurement of the patient completely at rest after the instrument was tested for reliability. Mean Arterial Pressure (MAP) was calculated by the formula: MAP=DP+1/3 (SP-DP) {Where DP=Diastolic and SP=Systolic Pressure}.

STEP 3: Blood sample

The patient's blood sample was drawn from the antecubital vein (after a 10-12 hr fast) by trained personnel to obtain lipid profiles like High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL), Triglyceride (TG), Total Cholesterol (TC), and Cholesterol Ratio (CR). For the study, high plasma of total cholesterol >200 mg/dL, triglycerides >150 mg/dL, high-density lipoprotein cholesterol ≤40 mg/dL in males and ≤50 mg/dL in females, and low-density lipoprotein cholesterol >130 mg/dL, cholesterol ratio>5 were defined abnormal lipid parameters. Similarly, >25 BMI and >100 MAP values were considered abnormal for non-lipid risk factors. Blood glucose parameters were not checked in this study

Study population and sample size

The target population includes all symptomatic adult males and females aged 18 to 69 years who came to the cardiology department of RIMS, Jharkhand, India for treatment.

In medical research, generalizations about the population are made based on the features of a small sample that is representative of the population. Thus, selecting the sample size is an important consideration in any epidemiological survey. For our study, many coronary-disease risk factors were looked at i.e., dyslipidemia, BMI, and MAP since high proportions of these are considered prevalent in patients. We need to assume some pre-existing population proportion that is evident from previous literature. The margin of error is conveniently chosen as one-fourth or one-fifth of the population proportion.

Proportions for high BMI are around 16% on average, and high MAP is 20%, but these values vary from region to region. For these two values, the sample size comes out as 573 and 384 at a 95% confidence level of z score (1.96) with a 3.1% margin of error. In this light, the sample size for our study was taken around 500, to better understand the effect of several covariate factors on these CVD measures.

Inclusion and Exclusion Criteria

All adults below 70 years came for treatment to the cardiology department of RIMS, Ranchi, with a complaint of chest discomfort and shortness of breath were included. Pregnant females, mentally retarded persons, and those not willing to participate were excluded.

Data collection and statistical interpretation

As per the guidelines of WHO, a questionnaire was prepared and completed by the interviewer taking information from the willing participants. The biochemical parameters like HDL, LDL, TG, TC, CR, MAP, and BMI data were collected from the participants.

The statistical analysis was performed using the program 'R' Studio Server 2023.09.0 Build 463,[15] and each questionnaire was assigned a code. Multivariate Logistic Regression Analysis (MLRA) was performed to compare risk factors within the 516 patients and gender and age-wise change in CVD incidence rate.[16] p-values<0.05 were considered statistically significant.

RESULTS

Out of 516 participants, the mean age was 42.87±6.05 (years), where 408 were males and the rest were females. Regarding dyslipidemia, 85.66%, 71.7%, and 55.43% of patients had bad levels of HDL, Cholesterol ratio, and LDL respectively. Individually HDL levels were deranged among patients, especially in females. 96% of female and 82% of male patients showed abnormal levels of HDL. Almost 55% of patients showed clinically high levels of LDL where the female share (52.9%) was little less than male (56.1%) patients. A fairly high number of patients (71.7%) showed an abnormal cholesterol ratio which is considered recently as one of the principal predictors of CVD. Less than or above 50 years of age patients have little difference in exhibiting abnormal CR values (Figure 1).

63.76% were overweight/obese while only 32.75 were showing abnormal pressure range as per MAP values. BMI values were more in male (65%) than female (58%) patients. Furthermore, 54.63% of females self-announced to have Hypertension (HTN)

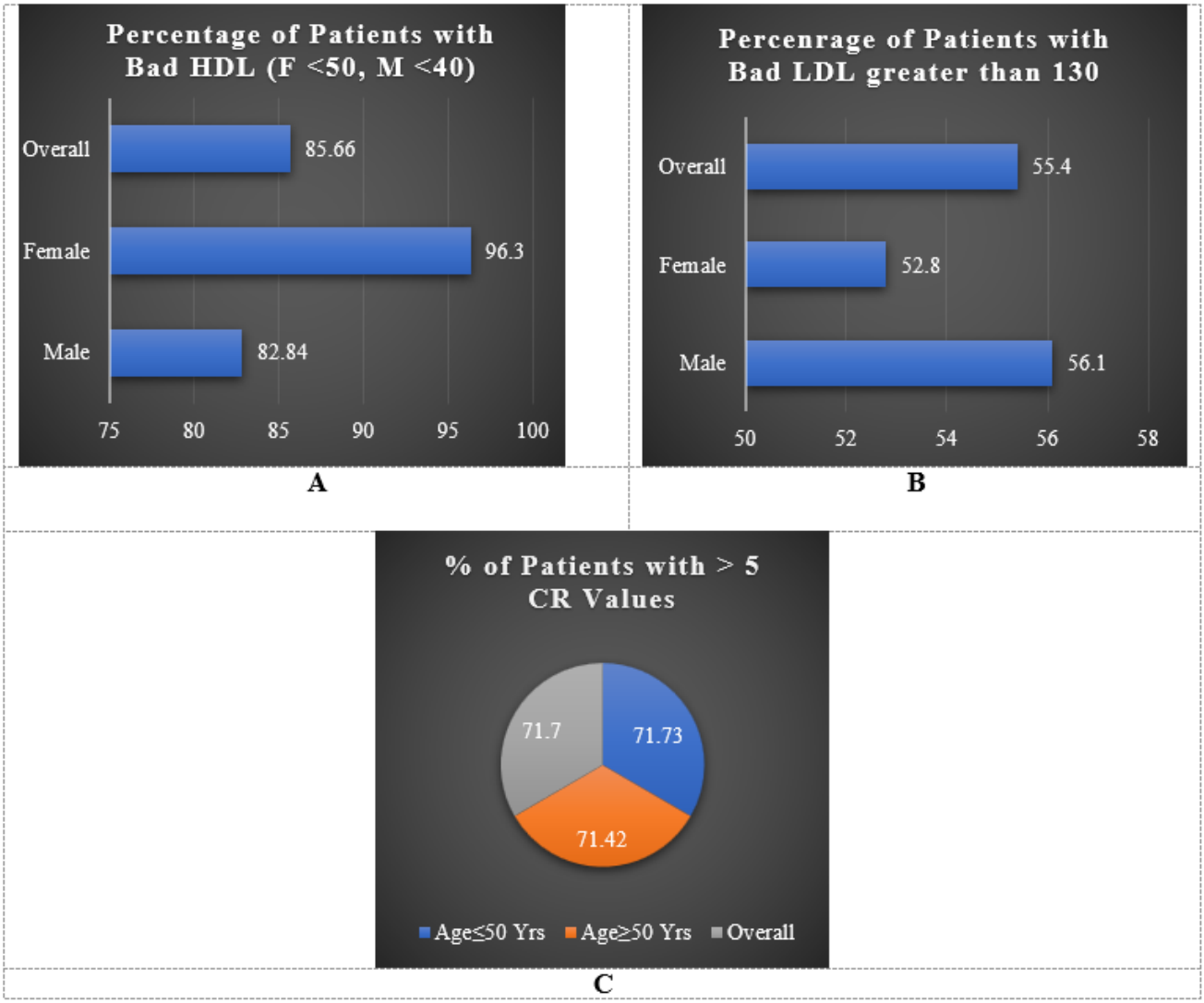

Figure 1: Percentage of patients showing abnormal HDL, LDL, and CR values.

(A) Percentage of patients having abnormal HDL revealed females are mostly affected. (B) LDL abnormality for the overall patients was more than 50% where males showed a little greater proportion than females. (C) Clinical CR values were present in 71% of patients without any age bias.

though spot-checked BP values showed almost 33% of patients with abnormal MAP for both males and females.

If metabolic syndrome based on bad levels of HDL, triglyceride, and blood pressure was considered, only 53 patients showed such combinations making only 10.27% of patients vulnerable (41 males and 12 females out of a total 516). But if blood pressure is not considered then 109 males and 39 females come under this group (28.9%). Total cholesterol, another highlighted risk parameter of CVD, was shown to present in more than 46.7% of patients. Among them, 34.5% showed borderline high values with male share comparatively higher than females. Low HDL and abnormal CR are the primary risk factors of CVD in patients, regardless of age and gender. For males in the 30-40 age range and females in the 40-50 age range, obesity and elevated LDL values are additional risk factors (Table 1).

An Odds Ratio (O.R.) of more than 1.0 indicates that there is a difference in risk (or odds) between the groups being compared. Here we noticed that males are 1.86 times more prone to develop obesity than females and that could have made them more vulnerable to developing CVD (Table 2).

The odds of getting a greater number of male CVD patients than females below the 45 age range were statistically significantly reversed more intensely for over 45 age group patients in the cardiology department of the RIMS hospital (Table 2).

DISCUSSION

A random sampling of patients suffering from heart-related complaints revealed that the gender ratio of affected people was almost 4:1 for males and females. Females were vulnerable to these diseases mainly after the age of 45 years indicating the probable interplay of menopause as the main cause of metabolic

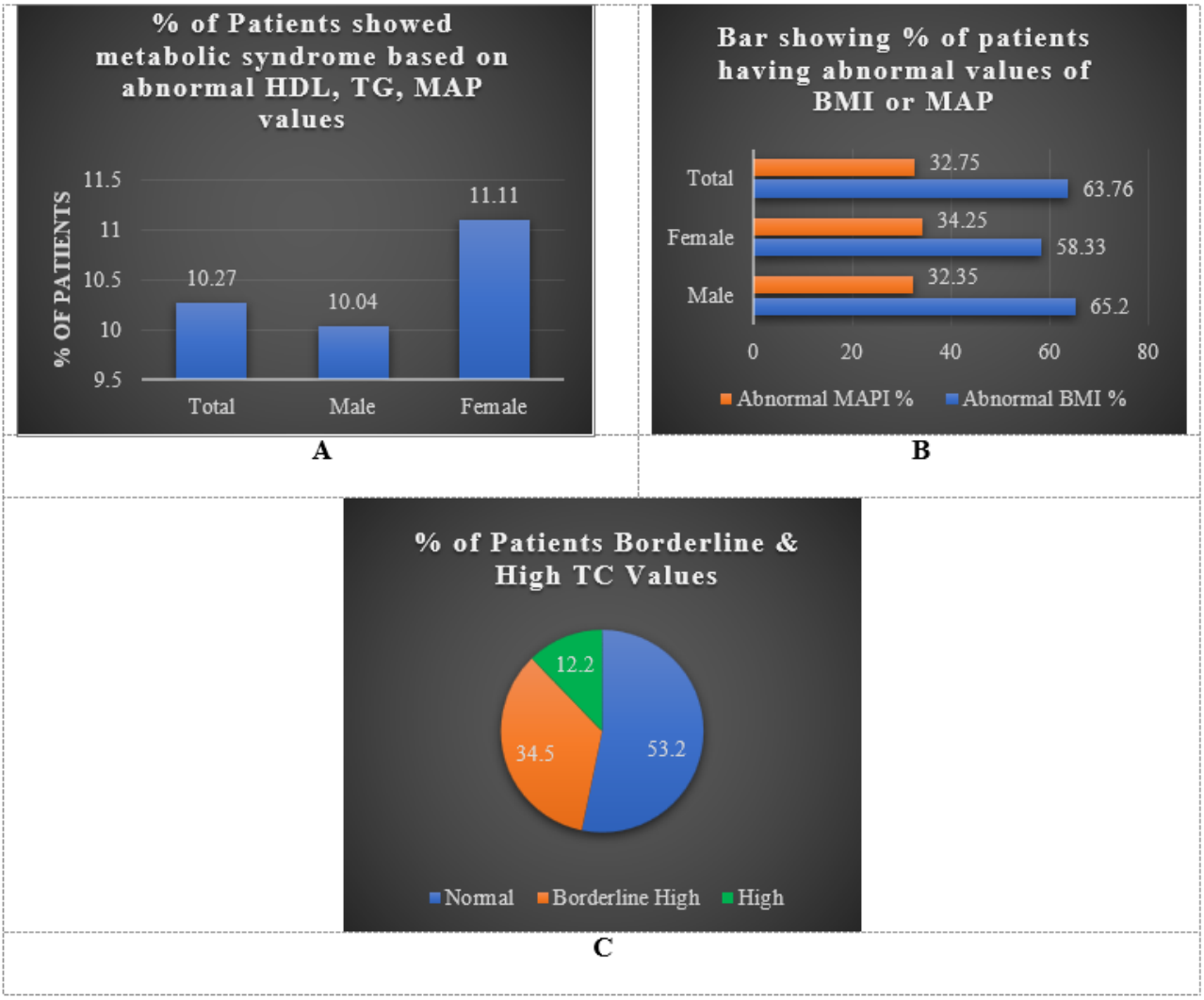

Figure 2: Percentage of patients showing metabolic syndrome and abnormal values of BMI and MAP.

(A) Metabolic syndrome for CVD risk was negligible for the patients of Jharkhand. Females showed a little increased number than males with the overall percentage of affected patients being around 10%. (B) In Jharkhand hypertensive People are comparatively less in number among CVD patients, around 33% also exhibited by people who are not suffering from any CVDs, but obesity has been contributing to cardiovascular abnormalities of nearly 64% of the patients. (C) TC as a diagnostic dyslipidemic parameter of CVD has been contributing to almost 47% of the total patients.

Table 1: Gender-wise number of CVD patients with % (in the parenthesis) and four major risk factors corresponding to different age groups.

Age Group	No of Male (%)	The most prevalent risk factors with no of patients	No. of Female (%)	The most prevalent risk factors with no of patients	Total Patients (%)
Below 30	12 (2.9)	HDL 10, CR 10, TC 8, BMI 7	0	NA	12 (2.3)
30-40	115 (28.2)	HDL-101, CR-88, LDL-69, BMI-60	12 (11.1)	HDL-11, CR-10, TC-7, LDL-7,	127 (24.6)
41-50	257 (63)	HDL-228, CR-180, LDL-135, TC-114,	71 (65.7)	HDL-71, CR-47, BMI 46, LDL-36,	328 (63.6)
51- 69	24 (5.8)	HDL-19, BMI-19, CR-18, LDL-16,	25 (23.15)	HDL-22, CR-17, TC-13, LDL-14,	49 (9.5)
Total	408		108		516

Irrespective of gender and age, the main risk factors of CVD are the derailed values of HDL and Cholesterol ratio among patients. Obesity and high LDL values also contribute as other risk factors to the 30-40 age group of males and 40-50 age group of females.

Table 2: Multiple Logistic Regression Analysis (MLRA) to show the Odds Ratio of gender differences in the number of CVD patients for BMI and 2 age groups.

Subject	Gender	*patients≤45 years*	*patients>45 years*	≥BMI O.R. CI (95%)
CVD Patients of RIMS Hospital	Females	1	5.24 (3.15-8.71)**	1
	Males	1.54 (1.09-2.15)*	1	1.86 (1.45 to 2.37)**

**$p<0.0001$, *$p=0.0129$.
The correlation between MAP values ($p=0.0266$), with gender was statistically significant. There was a moderate negative correlation between age and LDL values ($p=-0.03993$) and also between BMI and HDL values ($p=0.04706$) in patients. There was a positive correlation between age and HDL values but not statistically significant ($p=0.6951$).

degradations as less than the required level of HDL was more widespread (severe) in females (96.3%) than males (85.66), and together these abnormal values were accounted for 82.84% of overall patients. As another risk factor of CVD high levels of LDL were found contributing to disease onset slightly more in males (56.1%) than in females (52.9%).

CR as the most talked about metabolic risk factor related to dyslipidemia was shown to be present in 71.7% of patients above the normal range of 5. Thus, elevated CR values within patients are not affected by the age of the patients (Figure 1C). 46.7% of the total population showed an elevated level of total cholesterol and considered one of the contributors to the diseased state. Here also males showed more vulnerability than females (Figure 2C).

Considering four major risk factors diagnosed in different age groups of patients, it was found that in all age groups, clinically low LDL and high CR were the two major CDV risk modes. Abnormal BMI and elevated LDL levels were the two additional risk factors found in 30-40 age group males and 40-50 age range female patients (Table 1).

Among patients' susceptibility to developing overweight/ obesity in males was more than in females (OR-1.54), this trend is severely reversed with an odds ratio of 5.24 for female over male patients above 45 years of age. This also speaks a lot to mark menopause as a major culprit of CVD in females after attaining certain age range. Few correlations of risk factors were found that may reinforce the vulnerability to developing CVD in Jharkhand. Males are well correlated with elevation of blood pressure as evidenced by increased MAP values. Age especially in male patients was found to be negatively correlated with high LDL levels. Early CVDs of patients are dependent more on elevated LDL and abnormal HDL levels. Low level of HDL was found to be correlated with obesity as evidenced by a negative correlation of HDL and BMI values.

A small (insignificant) share of the total patients (10.27%) showed abnormality of 3 risk factors in combination namely HDL, TG, and MAP values that are considered under the term metabolic syndrome at least in the CVD patients of Jharkhand. Hypertension though considered generally as main risk factor of CVD, but in our study, this feature was only prevalent among ~33% of patients which is normally present in asymptomatic people in Jharkhand and throughout India as shown in previous reports.

CONCLUSION

With a 4:1 male-to-female patient ratio, the age distribution of female patients was mostly over 45, which is associated with post-menopausal metabolic imbalance. Dyslipidemia was the leading cause of CVD, with over 86% of patients having less than the recommended level of HDL. The dyslipidemic risk factors of CVD like obesity and abnormal CR values were present in 72% and 64% of patients, respectively. However, the prevalence of increased LDL values was slightly higher in men than in women.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICAL APPROVAL AND CONSENT FOR PARTICIPATION

The work was conducted within the state of Jharkhand of India under the permission of the Ethical Committee of Rajendra Institute of Medical Science, Ranchi, Jharkhand India (Protocol No. R94/22, IEC Registration No. ECR/769/INST/JH/2015/RR-21). Filled up Consent forms with the signatures of patients were taken.

ABBREVIATIONS

CVD: Cardiovascular diseases; **MAP:** Mean arterial pressure; **BMI:** Body mass index; **CR:** Cholesterol ratio; **TC:** Total Cholesterol; **LDL:** Low-density lipoprotein; **HDL:** High-density lipoprotein; **TG:** Triglycerides; **WHO:** World Health Organization;

KG: Kilogram; **DP:** Diastolic Pressure; **SP:** Systolic pressure; **mg/dL:** Milligram per deciliter.

AUTHORS' CONTRIBUTION

Substantial contributions to the conception and design of the work and acquisition of the data were made by SG, AA & PK. Analysis and interpretation of data were done by SG. SG & PL drafted the manuscript and made critical revisions.

SUMMARY

- The prevalence of risk factors of CVD in the Jharkhand people was surveyed in the cardiology department of RIMS hospital, Ranchi for 516 patients.
- Male outnumbered female patients with a ratio of 4:1, where the age-wise distribution of females was above 45 years, considered as post-menopausal life.
- Dyslipidemia was the major contributor to CVD where nearly 86% of patients had less than the required level of HDL.
- Almost 72% and 64% of patients showed elevated CR values and obesity respectively, as dyslipidemia-associated CVD risk indicators.
- Nonetheless, males had a slightly higher prevalence of elevated LDL levels than females (56.1% vs. 52.9%).

REFERENCES

1. Di Cesare M, Perel P, Taylor S, Kabudula C, Bixby H, Gaziano TA, *et al.* The heart of the world. Global Heart, 2024;19(1):11. https://doi.org/10.5334/gh.1288
2. World Health Organization. Global health estimates: Leading causes of death. 2018. https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death
3. Sreeniwas Kumar A, Sinha N. Cardiovascular disease in India: A 360-degree overview. Medical Journal Armed Forces India, 2020;76(1):1-3. https://doi.org/10.1016/j.mjafi.2019.12.005
4. Kalra A, Jose AP, Prabhakaran P, Kumar A, Agrawal A, Roy A, *et al.* The burgeoning cardiovascular disease epidemic in Indians: Perspectives on contextual factors and potential solutions. 2023, The Lancet Regional Health-Southeast Asia, 12.
5. Yadav S, Arokiasamy P. Understanding epidemiological transition in India. Global Health Action, 2014;7:23248. https://doi.org/10.3402/gha.v7.23248
6. Aleksandrowicz L, Green R, Joy EJM, Harris F, Hillier J, Vetter SH, *et al.* Environmental impacts of dietary shifts in India: A modelling study using nationally-representative data. Environmental International, 2019;126:207-215. https://doi.org/10.1016/j.envint.2019.02.004
7. Alae-Carew C, Bird FA, Choudhury S, Harris F, Aleksandrowicz L, Milner J, *et al.* Future diets in India: A systematic review of food consumption projection studies. Global Food Security, 2019;23:182-90.
8. Kreatsoulas C, Anand SS. The impact of social determinants on cardiovascular disease. Canadian Journal of Cardiology, 2010; 26(Suppl C):8C-13C. https://doi.org/10.1016/s0828-282x(10)71075-8
9. India State-Level Disease Burden Initiative Air Pollution Collaborators. Health and economic impact of air pollution in the states of India: The Global Burden of Disease Study 2019. Lancet Planetary Health, 2021;5(1). https://doi.org/10.1016/S2542-5196(20)30298-9
10. Gordon T, Balakrishnan K, Dey S, Rajagopalan S, Thornburg J, Thurston G, *et al.* Air pollution health research priorities for India: Perspectives of the Indo-U.S. Communities of Researchers. Environmental International, 2018;119:100-8. https://doi.org/10.1016/j.envint.2018.06.013
11. Smith KR. National burden of disease in India from indoor air pollution. Proceedings of the National Academy of Sciences of the United States of America, 2000;97(24):13286-93. https://doi.org/10.1073/pnas.97.24.13286
12. Bischops AC, De Neve JW, Awasthi A, *et al.* A cross-sectional study of cardiovascular disease risk clustering at different socio-geographic levels in India. Nature Communications, 2020;11:5891. https://doi.org/10.1038/s41467-020-19647-3
13. Jayashree S, Arindam M, Vijay KV. Genetic epidemiology of coronary artery disease: An Asian Indian perspective. Journal of Genetics, 2015;94:539-49. https://doi.org/10.1007/s12041-015-0547-4
14. Ghosh-Jerath S, Singh A, Magsumbol MS, Kamboj P, Goldberg G. Exploring the potential of indigenous foods to address hidden hunger: Nutritive value of indigenous foods of Santhal tribal community of Jharkhand, India. Journal of Hunger & Environmental Nutrition, 2016;11(4):548-68. https://doi.org/10.1080/19320248.2016.1157545
15. Riley L, Guthold R, Cowan M, *et al.* The World Health Organization STEPwise approach to noncommunicable disease risk-factor surveillance: Methods, challenges, and opportunities. American Journal of Public Health, 2016;106(1):74-8. https://doi.org/10.2105/AJPH.2015.302962
16. Hotelling H. Analysis of a complex of statistical variables into principal components. Journal of Educational Psychology, 1933;24(6):417-41. https://doi.org/10.1037/h0071325.

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