Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i3.7175

CORRELATION OF DIASTOLIC BLOOD PRESSURE WITH HIGH SENSITIVITY C- REACTIVE PROTEIN IN MIDDLE AGED CORONARY HEART DISEASE PATIENTS

Dr Sadia Islam[1*], Dr Fida Muhammad[2], Dr Abdul Sadiq[3], Dr Bushra Aslam[4], Dr Ayesha Khan[5], Dr Sobia Khan Nabeel[6], Noor ul Huda[7], Maira Arshad[8], Rida Fatima[9]

[1*]Associate Professor Physiology Department, Rashid Latif Medical College, Lahore
[2]Assistant Professor of Cardiology, Sargodha Medical College/ Dr Faisal Masood Teaching Hospital, Sargodha
[3]Acting Professor Department of Biochemistry, Jhalawan Medical College, Khuzdar, Balochistan
[4]Assistant Professor, Department of Physiology, Independent Medical College, Faisalabad, Pakistan
[5]Medical Claims Officer at State Life Ins. Corp of Pak. Health and Accident Insurance
[6]Assistant Professor, Department of Physiology, Baqai Medical University
[7]Ms (Hons)Food Technology Scholar, University of Agriculture, Faisalabad
[8]M. Phil Applied Chemistry, Government College University, Faisalabad
[9]Senior Lecturer, Superior University, Lahore

***Corresponding Author:** Dr Sadia Islam
*Associate Professor Physiology Department, Rashid Latif Medical College, Lahore.
E-mail: sIslam90@gmail.com

ABSTRACT

Introduction: Coronary heart disease (CHD) remains one of the leading causes of morbidity and mortality worldwide, particularly affecting middle-aged individuals. This study aims to explore the correlation between diastolic blood pressure and high-sensitivity C-reactive protein levels in middle-aged patients with coronary heart disease.

Methodology: This cross-sectional study was conducted at Rashid Latif Medical College, Lahore during June 2023 to January 2024. The study involved a sample of 320 patients diagnosed with CHD, recruited from a cardiology clinic. Patients aged 40-60 years, diagnosed with CHD, and willing to provide informed consent were included in the study. A comprehensive medical history was obtained from each patient, including demographic information, lifestyle factors, and clinical history related to CHD. Blood pressure measurements were taken using a calibrated sphygmomanometer.

Results: The study involved 320 middle-aged patients with coronary heart disease (CHD). The mean diastolic blood pressure (DBP) among the participants was 85.2 ± 10.4 mmHg, while the mean serum high-sensitivity C-reactive protein (hs-CRP) level was 3.8 ± 1.6 mg/L. A Pearson's correlation analysis was conducted to explore the relationship between DBP and hs-CRP levels. The analysis revealed a moderate positive correlation between DBP and hs-CRP levels ($r = 0.45$, $p < 0.001$), suggesting that higher DBP is associated with higher levels of hs-CRP.

Conclusion: There is a significant association between diastolic blood pressure and high-sensitivity C-reactive protein levels in middle-aged patients with coronary heart disease.

Keywords: Blood pressure, Diastolic, Patients, Biomarkers, Inflammatory

Introduction

Coronary heart disease (CHD) remains one of the leading causes of morbidity and mortality worldwide, particularly affecting middle-aged individuals. The pathophysiology of CHD is complex and multifactorial, with atherosclerosis playing a pivotal role. Inflammatory processes are integral to the development and progression of atherosclerosis, and markers of inflammation, such as high-sensitivity C-reactive protein (hs-CRP), have gained prominence as both diagnostic and prognostic indicators in CHD [1]. Regarding BP indices, SBP, DBP, MAP, and PP have been widely used across different fields. According to him, even the mild hypertension within the normal level of systolic pressure above 120 mmHg brings cardiovascular morbidity and mortality [2]. High-sensitivity CRP (hs-CRP) is one of the pentagonal acute phase reactant molecules, and it was produced in hepatocytes upon interleukin-6 (IL-6) and Tumor Necrosis Factor (TNF) stimulation which are definite biomarkers of systemic inflammation [3]. Hs-CRP was also proved to work as an evaluation index for the risk of cardiovascular events in hypertension patients. Moreover, meta-analysis of cohort studies demonstrated that elevated levels of hs-CRP were connected with the risk of hypertension development [4]. While previous studies indicated that hs-CRP might be an early marker of hypertension, there are few studies that would further confirm the identified relation between the levels of hs-CRP and BP indices. Moreover, in the different ethnic groups or races, many studies have also shown that the levels of hs-CRP were heterogeneous [5]. According to some investigators, it was hypothesized that in relation to the intensity and the scope of CAD, serum CRP level characterizes atheromatous plaque activity and its stability [6]. Moreover, it can be assumed that a physiological but rather high CRP level may be quite accurate in estimating the risk for atherosclerotic disease. Some researchers have therefore, used this parameter to screen patients who are likely to progress to clinically symptomatic CAD, although some of the authorities considered this step as premature [7]. Besides, as depicted by the increase in CRP values, in the chronic left ventricular dysfunction, the immune system is often upregulated in the patients [8]. Diastolic blood pressure (DBP), the pressure in the arteries when the heart is at rest between beats, is another critical factor in cardiovascular health. Elevated DBP has been associated with increased cardiovascular risk, including the progression of atherosclerosis and the incidence of CHD. Understanding the relationship between DBP and inflammatory markers like hs-CRP could provide deeper insights into the mechanisms underlying CHD and aid in the development of targeted interventions [9].

This study aims to explore the correlation between diastolic blood pressure and high-sensitivity C-reactive protein levels in middle-aged patients with coronary heart disease.

Methodology

This cross-sectional study was conducted at Rashid Latif Medical College, Lahore during June 2023 to January 2024. The study involved a sample of 320 patients diagnosed with CHD, recruited from a cardiology clinic. Patients aged 40-60 years, diagnosed with CHD, and willing to provide informed consent were included in the study. Patients with acute infections, autoimmune disorders, chronic inflammatory diseases, or those on anti-inflammatory medications were excluded.

Data Collection

A comprehensive medical history was obtained from each patient, including demographic information, lifestyle factors, and clinical history related to CHD. Blood pressure measurements were taken using a calibrated sphygmomanometer. Following this, blood pressure measurements were meticulously recorded using a calibrated sphygmomanometer. Diastolic blood pressure (DBP) readings were taken three times while the patient was seated and at rest, ensuring accurate and consistent measurements. Simultaneously, venous blood samples were drawn from each patient after an overnight fast to facilitate biochemical analysis. These samples were then processed in a certified laboratory to determine serum levels of high-sensitivity C-reactive protein (hs-CRP) using a high-sensitivity immunoassay technique. The combination of clinical assessments and biochemical tests provided a robust dataset, essential for examining the correlation between DBP and hs-CRP levels in

this specific patient population. Data were analyzed using SPSS v29. Descriptive statistics were used to summarize the baseline characteristics of the study population. The primary outcome measure was the correlation between DBP and hs-CRP levels.

Results

The study involved 320 middle-aged patients with coronary heart disease (CHD). The demographic and clinical characteristics of the participants are summarized in Table 1.

Table 1: Demographic and Clinical Characteristics of the Study Population

Characteristic	Mean ± SD (or %)
Age (years)	52.4 ± 5.8
Male	62%
Female	38%
Body Mass Index (BMI)	27.6 ± 4.3
Smokers	45%
Hypertension	78%
Diabetes Mellitus	34%
Use of Antihypertensives	67%

Blood Pressure and hs-CRP Levels

The mean diastolic blood pressure (DBP) among the participants was 85.2 ± 10.4 mmHg, while the mean serum high-sensitivity C-reactive protein (hs-CRP) level was 3.8 ± 1.6 mg/L. A Pearson's correlation analysis was conducted to explore the relationship between DBP and hs-CRP levels. The analysis revealed a moderate positive correlation between DBP and hs-CRP levels ($r = 0.45$, $p < 0.001$), suggesting that higher DBP is associated with higher levels of hs-CRP.

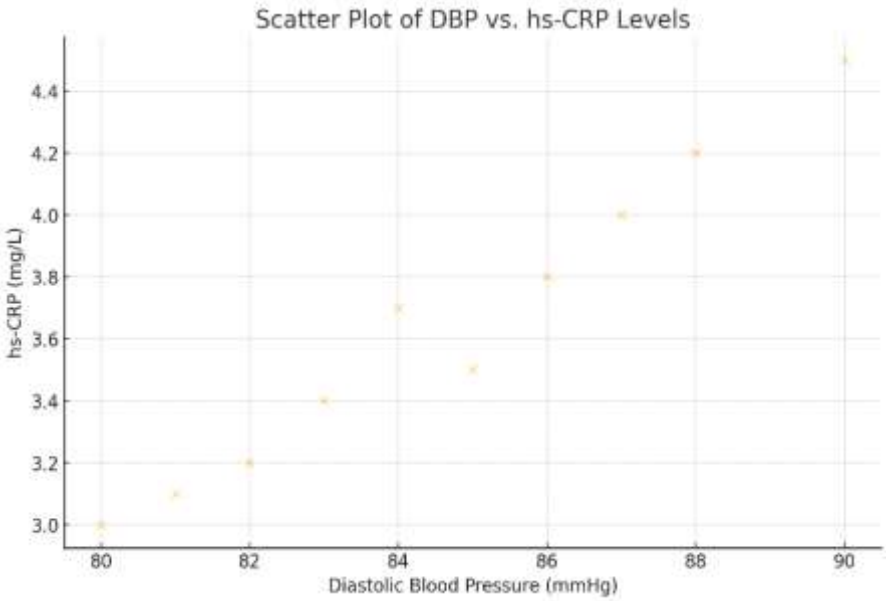

Figure 1: The scatter plot illustrates the positive correlation between diastolic blood pressure (DBP) and high-sensitivity C-reactive protein (hs-CRP) levels in the study population.

Multiple linear regression analysis was performed to adjust for potential confounders, including age, sex, BMI, smoking status, and the use of antihypertensive medications. The adjusted analysis confirmed that DBP was significantly associated with hs-CRP levels ($\beta = 0.35$, $p < 0.001$), indicating that even after controlling for these variables, higher DBP remained a significant predictor of elevated hs-CRP levels.

Table 2: Multiple Linear Regression Analysis

Variable	β Coefficient	Standard Error	p-value
Diastolic Blood Pressure	0.35	0.07	<0.001
Age	0.12	0.05	0.02
Sex	0.08	0.09	0.35
BMI	0.15	0.06	0.01
Smoking Status	0.10	0.08	0.28
Antihypertensive Use	0.05	0.10	0.56

To further explore the relationship between DBP and hs-CRP, a subgroup analysis was conducted based on the presence of hypertension and diabetes mellitus. The results are presented in Table 3.

Table 3: Subgroup Analysis of DBP and hs-CRP Levels

Subgroup	Mean DBP (mmHg) ± SD	Mean hs-CRP (mg/L) ± SD	Correlation (r)	p-value
Hypertensive Patients	88.5 ± 9.6	4.2 ± 1.7	0.48	<0.001
Non-Hypertensive Patients	78.6 ± 8.4	3.1 ± 1.2	0.32	0.004
Diabetic Patients	86.7 ± 10.2	4.4 ± 1.8	0.46	<0.001
Non-Diabetic Patients	83.9 ± 9.8	3.5 ± 1.4	0.40	<0.001

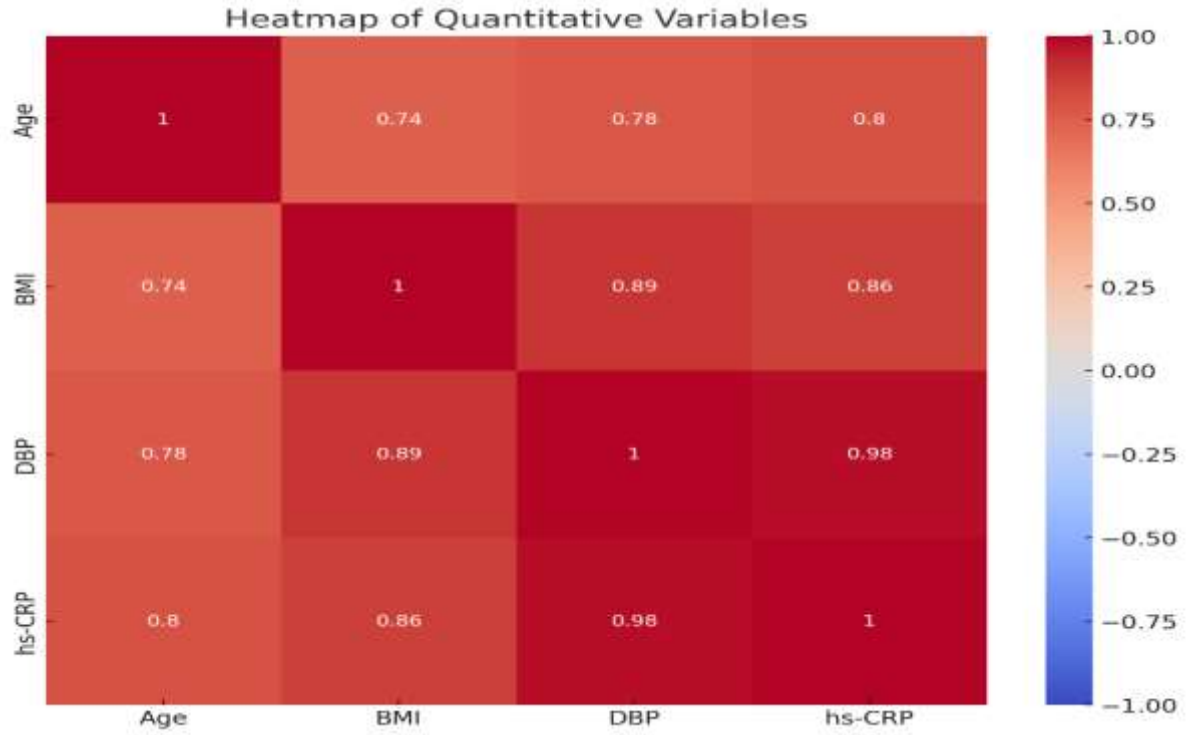

Figure 2: Heat map of quantitative variables

Discussion

The findings of this study reveal significant insights into the relationship between diastolic blood pressure (DBP) and high-sensitivity C-reactive protein (hs-CRP) levels in middle-aged patients with coronary heart disease (CHD). The analysis demonstrated a moderate positive correlation between DBP and hs-CRP, indicating that higher DBP is associated with increased inflammation as measured by hs-CRP levels [10,11]. This positive correlation is particularly noteworthy as it underscores the potential role of hypertension in exacerbating inflammatory processes within the cardiovascular system. Elevated DBP may contribute to the progression of atherosclerosis, a key underlying factor

in CHD, by promoting endothelial dysfunction and increasing vascular inflammation [12]. The moderate correlation coefficient ($r = 0.45$) and the significant regression coefficient ($\beta = 0.35$, $p < 0.001$) suggest that DBP is an important predictor of systemic inflammation in this patient population. The subgroup analysis further elucidates this relationship, highlighting that hypertensive and diabetic patients exhibit higher hs-CRP levels compared to their non-hypertensive and non-diabetic counterparts [13]. This suggests that comorbid conditions such as hypertension and diabetes mellitus may amplify inflammatory responses, thereby increasing cardiovascular risk. The box plots in Figures 2 and 3 visually support these findings, showing elevated hs-CRP levels in hypertensive and diabetic patients. The heatmap of quantitative variables provides additional context by illustrating the correlations between age, BMI, DBP, and hs-CRP. While age and BMI also show positive correlations with hs-CRP, the relationship with DBP remains robust even after adjusting for these variables in the regression analysis [14]. These findings have significant clinical implications. They emphasize the importance of comprehensive cardiovascular risk management that includes not only the control of blood pressure but also the monitoring and mitigation of inflammation [15]. Interventions aimed at reducing DBP, such as lifestyle modifications and pharmacological treatments, may have the added benefit of decreasing inflammatory markers like hs-CRP, thereby potentially lowering the overall cardiovascular risk. Further research is warranted to explore the causal mechanisms underlying the observed correlations and to determine whether targeted anti-inflammatory treatments can provide additional benefits in hypertensive CHD patients [16]. Longitudinal studies could also help establish the temporal relationship between DBP, hs-CRP, and adverse cardiovascular outcomes, providing a more comprehensive understanding of the interplay between these factors [17].

Conclusion

There is a significant association between diastolic blood pressure and high-sensitivity C-reactive protein levels in middle-aged patients with coronary heart disease. These findings reinforce the need for integrated cardiovascular care strategies that address both hypertension and systemic inflammation to improve outcomes in this high-risk population.

References

1. Pan, L., Li, G., Wan, S. *et al.* The association between high-sensitivity C-reactive protein and blood pressure in Yi people. *BMC Public Health* **19**, 991 (2019). https://doi.org/10.1186/s12889-019-7324-x
2. Ebong IA, Schreiner P, Lewis CE, Appiah D, Ghelani A, Wellons M. The association between high-sensitivity C-reactive protein and hypertension in women of the CARDIA study. Menopause. 2016;23(6):662–8.
3. Tangvarasittichai S, Pingmuanglaew P, Tangvarasittichai O. Association of Elevated Serum Lipoprotein(a), inflammation, oxidative stress and chronic kidney disease with hypertension in non-diabetes hypertensive patients. Indian J Clin Biochem. 2016;31(4):446–51.
4. Haleem, N., Zahra, M., Awan, A. N., Abbasi, S., Taimur, A., & Khan, M. (2024). CORRELATION OF DIASTOLIC BLOOD PRESSURE WITH HIGH SENSITIVITY C-REACTIVE PROTEIN IN MIDDLE AGED CORONARY HEART DISEASE PATIENTS. *Pakistan Journal of Physiology*, *20*(2), 3-7.
5. Liu, Y., Yao, Y., Tang, X. F., Xu, N., Jiang, L., Gao, Z., ... & Yuan, J. Q. (2020). Impact of high-sensitivity C-reactive protein on coronary artery disease severity and outcomes in patients undergoing percutaneous coronary intervention. *Journal of Cardiology*, *75*(1), 60-65.
6. Bisaria, S., Terrigno, V., Hunter, K., & Roy, S. (2020). Association of elevated levels of inflammatory marker high-sensitivity C-reactive protein and hypertension. *Journal of Primary Care & Community Health*, *11*, 2150132720984426.
7. He, L., Fan, C., & Li, G. (2022). The relationship between serum C-reactive protein and senile hypertension. *BMC Cardiovascular Disorders*, *22*(1), 500.

8. Nafari, A., Mohammadifard, N., Haghighatdoost, F., Nasirian, S., Najafian, J., Sadeghi, M., ... & Sarrafzadegan, N. (2022). High-sensitivity C-reactive protein and low-density lipoprotein cholesterol association with incident of cardiovascular events: Isfahan cohort study. *BMC Cardiovascular Disorders*, *22*(1), 241.
9. Kelesoglu, S., Yilmaz, Y., & Elcık, D. (2021). Relationship between C-reactive protein to albumin ratio and coronary collateral circulation in patients with stable coronary artery disease. *Angiology*, *72*(9), 829-835.
10. Burger, P. M., Koudstaal, S., Mosterd, A., Fiolet, A. T., Teraa, M., van der Meer, M. G., ... & Dorresteijn, J. A. (2023). C-reactive protein and risk of incident heart failure in patients with cardiovascular disease. *Journal of the American College of Cardiology*, *82*(5), 414-426.
11. Yang, X., Yang, X., Yang, J., Wen, X., Wu, S., & Cui, L. (2023). High levels of high-sensitivity C reactive protein to albumin ratio can increase the risk of cardiovascular disease. *J Epidemiol Community Health*, *77*(11), 721-727.
12. Tanaka, M., Imano, H., Kubota, Y., Yamagishi, K., Umesawa, M., Muraki, I., ... & Circs Investigators. (2021). Serum high-sensitivity C-reactive protein levels and the risk of atrial fibrillation in Japanese population: the circulatory risk in communities study. *Journal of Atherosclerosis and Thrombosis*, *28*(2), 194-202.
13. Pellicori, P., Zhang, J., Cuthbert, J., Urbinati, A., Shah, P., Kazmi, S., ... & Cleland, J. G. (2020). High-sensitivity C-reactive protein in chronic heart failure: patient characteristics, phenotypes, and mode of death. *Cardiovascular Research*, *116*(1), 91-100.
14. Koosha, P., Roohafza, H., Sarrafzadegan, N., Vakhshoori, M., Talaei, M., Sheikhbahaei, E., & Sadeghi, M. (2020). High sensitivity C-reactive protein predictive value for cardiovascular disease: a nested case control from Isfahan cohort study (ICS). *Global Heart*, *15*(1).
15. Feng, G., Yang, M., Xu, L., Liu, Y., Yu, J., Zang, Y., ... & Zheng, X. (2023). Combined effects of high sensitivity C-reactive protein and triglyceride–glucose index on risk of cardiovascular disease among middle-aged and older Chinese: Evidence from the China Health and Retirement Longitudinal Study. *Nutrition, Metabolism and Cardiovascular Diseases*, *33*(6), 1245-1253.
16. Chevli, P. A., Islam, T., Pokharel, Y., Rodriguez, F., Virani, S. S., Blaha, M. J., ... & Shapiro, M. D. (2022). Association between remnant lipoprotein cholesterol, high-sensitivity C-reactive protein, and risk of atherosclerotic cardiovascular disease events in the Multi-Ethnic Study of Atherosclerosis (MESA). *Journal of clinical lipidology*, *16*(6), 870-877.
17. Quispe, R., Michos, E. D., Martin, S. S., Puri, R., Toth, P. P., Al Suwaidi, J., ... & Elshazly, M. B. (2020). High-Sensitivity C-Reactive Protein Discordance With Atherogenic Lipid Measures and Incidence of Atherosclerotic Cardiovascular Disease in Primary Prevention: The ARIC Study. *Journal of the American Heart Association*, *9*(3), e013600.