

# The Average Diameter of Coronary Artery in the Healthy Adult Population of Pakistan: A Cross-Sectional Study

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## ABSTRACT

**Aim:** To determine the average diameters of the coronary arteries in the healthy adult population of Pakistan

**Study design:** A cross-sectional study

**Place and duration:** This study was conducted at Civil Hospital, BMCH Quetta Pakistan from March 2020 to March 2021.

**Methodology:** A total of 120 participants were included in the study. All the patients included in the study were advised coronary angiography, nonetheless, their angiograms were normal. According to the inclusion criteria, the patients included in the study could be of any gender, above the age of 18 years, and have normal angiograms. The segments of the artery were divided as per the 29-segment model. The segments selected for the study were studied by the method of quantitative coronary angiography (QCA) method.

**Results:** A total of 120 participants were considered in the study. The mean age of the included participants was  $54.35 \pm 12.39$  years. The mean of the Body Surface Area (BSA) was  $1.78 \pm 0.163$ . The mean of the Body Mass Index (BMI) was  $27.96 \pm 3.1$  kg/m<sup>2</sup>. Proximal Left Circumflex (PLCx) and proximal left anterior descending (PLAD) were larger in diameter and the left main stem diameter was smaller. The Mid right coronary (MRCA) was greater in diameter, whereas the diameters of the proximal right coronary (PRCA), left main, distal left circumflex (DLCx), mid (MLAD), and distal (DLAD) were smaller. The MLAD, PLAD, PLCx, and DLAD had larger diameters and MRCA as well as the left main stem had smaller diameters.

**Conclusion:** The diameters of the segments of the left stem of the coronary artery were smaller in the present study. Standardized data is needed for an accurate comparison.

**Keywords:** Pakistanis, Comparison, Coronary Artery, Diameter

## INTRODUCTION

Coronary Artery Disease (CAD) is a chronic inflammatory disease. It results in the remodeling of the coronary arteries and sometimes blockage too [1]. It is considered one of the major causes of morbidity and mortality on a global level [2]. It was previously thought that CAD is a common disease in developed countries. However, now it has been seen that it is equally common in developing countries [3]. Two major drifts in the epidemiology of the mortality rate have been seen in the period of the last 30 years. The pattern observed in the developed countries was such that a fall in the mortality due to CAD was seen followed by a rise. On the other side, the mortality rate due to CAD mainly seems to rise. According to the estimations of the World Health Organization (WHO), 60% of the global burden increased due to CAD was present in developing countries [4].

There are various studies that have shown that the probability of CAD is more at an earlier age with increased severity of the disease in the population of the South Asian region [5]. Early determination of the disease and control of risk factors potentially help in controlling CAD which is rampant in the people of South Asia [6]. Of all these risk factors, a low level of high-density lipoprotein cholesterol (HDL-C) was low in the South Asian population [7]. However, the higher occurrence of high blood pressure among this population, higher levels of total cholesterol, smoking, or higher lipid levels are reasons for CAD in the South Asian population. The higher rate of mortality in this population can be due to the smaller diameter of coronary arteries [8]. However, some studies suggest that the difference in the size of the coronary artery is not important [9].

The segments of the coronary artery with smaller diameters are significant in the diagnosis of CAD and the prognosis of the therapy of CAD. Stenosis of 60% in a blood vessel of 2.5mm diameter is more threatening than the same level of stenosis in a blood vessel of 3.5mm diameter. It happens due to a decrease in the cross-sectional area of the blood vessel [10]. The current study is planned to determine the average diameters of the coronary arteries in the healthy adult population of Pakistan

## METHODOLOGY

Permission was taken from the ethical review committee of the institute. In this cross-sectional study, the participants were selected on the basis of the diameter of the right coronary artery which was expected to be 1.69mm. A standard error of 0.15mm was also expected. A total of 120 participants were included in the study. All the patients included in the study were advised coronary angiography, nonetheless, their angiograms were normal. According to the inclusion criteria, the patients included in the study could be of any gender, above the age of 18 years, and have normal angiograms. On the other hand, the patients that were on intravenous vasodilators, left-ventricular hypertrophy (LVH), and dilated cardiomyopathy (DCMP) were excluded from the study.

The films of the angiography were collected for deep analysis. The data relating to baseline characteristics such as the age of the patient, gender, height, weight, pulse rate, blood pressure, hypertension, diabetes, serum creatinine, smoking DCMP, and LH, was recorded on individual proforma. The findings of the angiograms were also recorded on the proforma. BSA was calculated by the Mosteller formula. It was used to index the diameter of the coronary artery. LAO 60° view was taken for the measurement of the diameter of RCA. RAO 30° view was used for the measurement of the diameter of LCx and LAD. The segments of the artery were divided as per the 29-segment model. The segments studied for the present study are proximal LAD 12, distal LAD 14, mid-RCA 2, proximal LCx18, distal LCx 19, left the main stem 11, mid LAD 13, proximal RCA 1, and distal RCA 3. The segments of the artery were analyzed by the QCA method. The most proximal was measured as it is uniform with respect to distension, absence of kinking, and no overlapping. The actual size of the vessel can be assessed by using the QCA method. The measurements of the coronary artery dimension were taken for obtaining the absolute diameter of the artery. The diameter was calculated with the help of software analysis.

The data was analyzed in the IBM SPSS version 26. The student's t-test was applied for the comparison of clinical characteristics and qualitative demographic characteristics between female and male participants. The Chi-square test was

applied for the comparison of categorical variables. The diameters of the coronary artery in females and males were compared by the application of the student's t-test.

## RESULT

The mean age of the included participants was 54.35±12.39 years ranging from 32 years to 81 years. The mean of the Body Surface Area (BSA) was 1.78±0.163. The mean of the Body Mass Index (BMI) was 27.96±3.1 kg/m<sup>2</sup>. The baseline characteristics of the female and male patients were not significantly different except for BSA which was lower in the female patients and BMI which was higher in the female patients (As shown in Table 1). The diameters of the coronary artery of all the participants are shown in Table 2. Both indexed values and values without indexing have been shown. It can be observed that the indexed diameters are smaller compared to the non-indexed diameters of the coronary artery.

Table 1: Baseline characteristics of the patients n=120

Variables	Female patients (Mean ± Standard Deviation)	Male patients (Mean ± Standard Deviation)	p-value
Age (years)	57.9±10.5	54.6±10.4	0.632
BSA (m <sup>2</sup> )	1.71±0.05	1.86±0.03	0.0001
BMI (Kg/m <sup>2</sup> )	30.6±3.1	27.6±1.2	0.0001
Blood pressure			
-Systolic (mmHg)	130.5±13.6	135.2±13.5	0.465
-Diastolic (mmHg)	83.1±8.2	80±9.3	0.654
Pulse rate (Pulse/min)	77.8±5.5	79.5±6.1	0.396

Table 2: Comparison of the diameters of the coronary arteries, indexed and non-indexed

Coronary Artery	Non-indexed diameters of coronary artery (Mean ± Standard Deviation)	Indexed diameters of the coronary artery (Mean ± Standard Deviation)
Left main stem	4.065±0.363	2.63±0.263
M LAD	2.737±0.37	1.486±0.186
P LAD	3.559±0.33	1.837±0.168
PLCx	3.182±0.38	1.637±0.234
D LAD	1.775±0.31	0.963±0.191
P RCA	2.996±0.33	1.581±0.212
D LCx	2.029±0.31	1.049±0.162
D RCA	1.723±0.48	0.915±0.235
M RCA	2.274±0.47	1.183±0.259

## DISCUSSION

The individuals of different regions have different diameters of the coronary arteries. There are multiple factors responsible for this variation such as genetic factors, gender, age, weight, BMI, BSA, the weight of the heart, size of the heart, racial factors, and ethnic factors. All these factors are related to the anatomy of the coronary arteries [11].

The study of Saikrishna et al showed a statistically significant difference was seen between the DLCx of female and male patients. Whereas, the difference is not significant in PLCx, all the segments of LAD, and RCA. According to the same study, the size of proximal LAD, distal LAD, and distal LCx were larger in the Indo-Asian population living in the UK. On the other hand, the diameters of the distal and proximal RCA were larger in the Indian population included in the study. After a comparison of indexed diameters of the arteries, it was observed that the diameters of the distal LCx, left the main stem and all the remaining segments of the LAD were larger in the Caucasian population. However, the distal RCA and the proximal RCA were larger in the individuals included in the Indian population. The results of this study were consistent with the results of our study [12].

The mean body surface area of the individuals in our study was 1.78±0.163. These results are comparable with the study of Adil et al in which the BSA was 1.8004±0.11 [13] and a similar study conducted by Hasan et al in which the BSA was 1.86 ± 0.20

[14]. The former was conducted on the population of Pakistan and the latter was conducted on the South Asian individuals. A similar study was conducted by Lip et al in which the Caucasian population was included. The mean BSA of the participants in this study was 1.68 ± 0.17 [15]. It was lower compared to our study.

According to the study of Hasan et al, the diameters of the lumen of proximal LAD were smaller in the population of South Asia as compared to the population of Caucasian individuals even following the indexing with the BSA. No significant difference was noted between the studies regarding left main, LCx, RCA, and LAD diameters. Our study had different results compared to the study of Hasan et al. Moreover, a comparison of the study conducted on the South Asian population by Hasan et al and our study shows that the diameters of PLCx, MLAD, PRCA, DLAD, and PLAD were larger, while the diameters of MRCA and left main were smaller in the present study. A comparison of the study of the Caucasian population included in the study of Hasan et al and the present study shows that the diameters of most of the segments of the coronary arteries such as PLAD, DLAD, PLCx, and MLAD had a larger diameter, while the MRCA and left the main stem were smaller in the present study. A comparison of the diameters of the coronary artery of Caucasians in the study of Lip et al and Caucasians in the study of Hasan et al shows similar diameters. However, the diameter of MRCA in the study of Lip et al was smaller than that of Hasan et al. The diameter of MLAD, PLAD, DLAD, PRCA, and PLCx of Caucasians in the study of Lip et al were larger than those present in the study of Hasan et al. Hence, a standardized data regarding the diameter of coronary artery of Caucasians is not available for an efficient comparison [14].

## CONCLUSION

The diameters of the segments of the left stem of the coronary artery were smaller in the present study. Standardized data is needed for an accurate comparison.

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**Conflict of interest:** The present study did not have any kind of conflicts of interest

**Permission:** Permission was asked for and taken from the ethical committee of the institute.

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