

## RESEARCH ARTICLE

## A STUDY OF LEFT VENTRICULAR MASS IN YOUNG ADULTS AGED 18 TO 25 YEARS

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**Abstract: Background:** Normal reference values of left ventricular mass (LVM) are essential for early identification of pathological cardiac remodeling. Left ventricular hypertrophy is an independent predictor of cardiovascular morbidity and mortality. Factors such as age, sex, blood pressure, and body mass index (BMI) influence LVM even in apparently healthy individuals. However, region-specific data on normal LVM values in young Indian adults are limited. **Objectives:** To determine the normal values of left ventricular mass in young adults aged 18–25 years and to evaluate its association with age, sex, blood pressure, and body mass index in a hospital-based rural population. **Materials and Methods:** This descriptive cross-sectional study was conducted over a period of two years (December 2020–November 2022) at Dr. Vitthalrao Vikhe Patil, Loni. A total of 400 asymptomatic subjects aged 18–25 years without known structural heart disease were included. Detailed clinical evaluation, anthropometric measurements, blood pressure recording, and two-dimensional echocardiography were performed. Left ventricular parameters—left ventricular internal diameter in diastole (LVIDD), posterior wall thickness in diastole (PWTD), and interventricular septal thickness in diastole (IVSTD)—were measured, and left ventricular mass was calculated. Statistical analysis assessed correlations between LVM and demographic as well as clinical variables. **Results:** The mean age of participants was  $22 \pm 2.13$  years, with female predominance (59.25%). The mean left ventricular mass was  $129.45 \pm 50.51$  g. LVM was significantly higher in males ( $153.45 \pm 47.05$  g) compared to females ( $112.94 \pm 46.06$  g) ( $p < 0.01$ ). Subjects aged 22–25 years demonstrated higher LVM than younger age groups ( $p = 0.001$ ). A significant positive correlation was observed between LVM and BMI ( $r = 0.29$ ,  $p = 0.02$ ), as well as between LVM and age ( $r = 0.224$ ,  $p < 0.001$ ). Increasing BMI categories were associated with progressive increases in LVM. **Conclusion:** Left ventricular mass in young adults is significantly influenced by age, sex, and body mass index. Males and individuals with higher BMI exhibit greater LVM even in the absence of overt cardiovascular disease. Establishing normative LVM values in young adults may aid in early risk stratification and prevention of future cardiovascular morbidity, particularly in populations with a high prevalence of overweight and obesity.

**Keywords:** Left ventricular mass; Echocardiography; Young adults; Body mass index; Cardiac remodeling; Left ventricular hypertrophy; Rural population; India.

## Introduction

Normal values of left ventricular mass (LVM) and cardiac chamber sizes in asymptomatic subjects are prerequisites for the diagnosis of individuals with heart disease. Left ventricular hypertrophy is an independent risk factor for cardiovascular morbidity and sudden cardiac death.<sup>1</sup> In addition, enlarged left ventricular, right ventricular, or left atrial chamber sizes have been shown to be independent markers of poor prognosis in several patient groups.<sup>2</sup>

Increased left ventricular mass as measured by echocardiography is a risk factor for cardiovascular morbidity and mortality that stands on its own.<sup>3</sup> Blood Pressure (BP) readings that are in the high normal range as well as excessive body weight (which is frequently

risk factors that have long-term impacts on the structure and function of the Left Ventricle (LV).<sup>4</sup> Both high blood pressure and a high body mass index are independently related with left ventricular myocardial infarction. Despite the fact that higher BMI categories are associated with a stronger link between blood pressure and LVMI, this relationship can only be described as

additive, not synergistic or multiplicative.<sup>5</sup> The use of left ventricular mass/ height<sup>6</sup> has not been reported in children and adolescents. In the absence of long-term cardiovascular outcome studies in children, obesity, as measured by body mass index, has traditionally been used, although a poor surrogate, as one of the potential cardiovascular risk factors

connected with hyperinsulinemia) are both cardiovascular

There are no documented studies for the determinants of LVM in the Indian population in the state of Maharashtra, hence the present study is an attempt to study the normal values of left ventricular mass and its determinants in the hospital based population with no structural heart disease. Material and methods

It was a Descriptive cross-sectional study conducted between December 2020 to November 2022 (Two years) at Dr. Vitthalrao Vikhe Patil Pravara Rural Hospital, Loni, a tertiary care teaching hospital situated in the rural are of Ahmednagar district. A total of 400 patients of age between 18 to 25 years, satisfying the inclusion and exclusion criteria, were included in the study.

The study was conducted after the ethics committee approval from the Institutional Ethics committee of Pravara Institute of Medical Sciences, Loni after submitting the synopsis mentioning the proposed study details and protocols.

Inclusion criteria:

All subjects included in the study are of age 18 to 25 years.

Subjects willing to give written & informed consent for this study.

Exclusion criteria:

Patients who are known cases of cardiovascular diseases.

Pregnant females.

Subjects with incidental anomalies detected on 2D Echo.

Subjects not willing to give written consent.

Results

A well informed documented consent was taken in oral and written in understandable vernacular language, preferably local language of the patient and confidentiality was assured. Methodology:

All the selected patients were subjected to detailed history taking, clinical examination and a 2-Dimensional Echocardiography. A structured proforma was designed as attached to Annexure to collect information and data regarding the study. Subjects underwent 2D Echo for calculation of left ventricular mass and rule out any cardiovascular abnormalities, using PHILIPS HD7 Diagnostic Ultrasound System (Hardware Rev:2.0) machine in our hospital. Patient was examined in the supine position, where the transducer was placed in the left para-sternal area and cardiac measurements were taken in short axis view in the diastole. Left ventricular parameters like LVIDD, PWTD, IVSTD were measured on the echocardiography and left ventricular mass was calculated.

Where,

LVIDD = Left Ventricular Internal Diameter in Diastole  
PWTD = Posterior Wall Thickness in Diastole

IVSTD = Interventricular Septum Thickness in Diastole

Figure no. 1: left ventricular parameters on 2 d echocardiography.

Table no 1: Descriptive statistics of the study

	Minimum	Maximum	Mean	Standard Deviation
Age	18	25	22.00	2.128
Height	144	182	164.76	9.011
Weight	40	93	63.91	12.412
BMI	19.3	39.90	29.72	4.84

In our study, The mean age of the subjects was  $22 \pm 2.128$  years. The mean height of the subjects was  $164.76 \pm 9.011$  cm. The mean weight of the subjects was  $63.9 \pm 12.412$  Kg. The mean BMI of the subjects was  $29.72 \pm 4.84$  Kg/m<sup>2</sup>. Maximum number of the patients were in the age group of 22-25 years of age (47.8%). 237 out of 400 were females (59.25%) 163 out of 400 were males (40.75%). Male to female ratio was 1:1.45.

**Table no. 2: Mean values of systolic blood pressure (sbp) and diastolic blood pressure (dbp) measured in millimeters of mercury (mmhg) of the subjects.**

Blood Pressure	Minimum	Maximum	Standard Deviation
SBP	100	134	8.174
DBP	58	88	8.485

In our study, The mean systolic blood pressure was  $118.55 \pm 8.174$  mmHg. The mean diastolic blood pressure was  $72.95 \pm 8.485$  mmHg.

**Table no. 3: parameters of left ventricle as seen on 2-D ECHO**

Left Ventricular Parameters	Minimum	Maximum	Standard Deviation
Left ventricular internal diameter at diastole (LVIDD) (cm)	3.60	6.10	0.66
Posterior wall thickness at diastole (PWTD) (cm)	0.6	1.0	0.09
Inter-ventricular septum thickness at diastole (IVSTD) (cm)	0.5	1.3	0.103
Left ventricular mass (LVM) (grams)	62.94	343.15	50.51

The mean left ventricular internal diameter in diastole (LVIDD) was  $4.63 \pm 0.66$  cm. The mean posterior wall thickness in diastole (PWTD) was  $0.697 \pm 0.09$  cm. The mean interventricular septum thickness in diastole (IVSTD) was  $0.688 \pm 0.103$  cm. The mean left ventricular mass (LVM) was  $129.45 \pm 50.51$  cm.

Table no. 4: comparison of age with left ventricular mass (lvm).

	Frequency of subjects	Mean (LVM) (gm)	Standard Deviation	
	115	119.695	42.38	
	94	117.307	42.31	
	191	141.31	55.96	

Subjects in the age group of 22-25 years were found to have higher left ventricular mass with mean of 141.31±55.96 grams. The subjects in the age group of 18-20 years were found to have the mean left ventricular mass of 119.69±42.38 grams. The subjects in the age group of 20-22 years were found to have the mean left ventricular mass of 117.307±42.31 grams.

Table no. 5: comparison of gender and left ventricular mass (LVM)

		Mean left ventricular mass (LVM) (gm)			Mean LVM (gm) in subjects with normal BMI (N=49)		
		112.94			123.78		
		153.45			139.401		

Male subjects were found to have the mean left ventricular mass of 153.45±46.06 grams. Female subjects were found to have the mean left ventricular mass of 112.94±47.05 grams. The left ventricular mass in males and females with normal BMI was found to be 139.40±33.19 grams and 123.78±53.20 grams respectively. Table no. 6: comparison of body mass index (bmi) and left venricular mass (lvm)

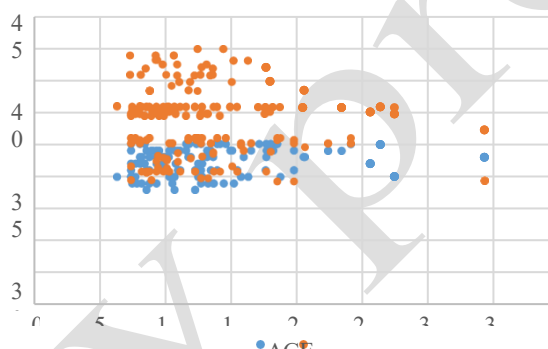
BMI (Kg/m <sup>2</sup> )	Mean Left Ventricular Mass (LVM) (grams)	Standard Deviation	
18.5-24.9 (normal)	129.71	56.28	
25-29.9 (overweight)	130.47	45.96	
30-34.9 (obesity I)	134.40	54.15	

The subjects with obesity II (BMI=35-39.9 Kg/m<sup>2</sup>) showed maximum left ventricular mass with mean 139.45±27.06 grams. The subjects with normal BMI (18.5-24.9 Kg/m<sup>2</sup>) were found to have the mean left ventricular mass of 129.71±56.28 grams. The overweight subjects (BMI=25-29.9 Kg/m<sup>2</sup>) were found to have the mean left ventricular mass of 130.47±45.96 grams. The subjects with obesity I (BMI= 30-34.9 Kg/m<sup>2</sup>) were found to have the mean left ventricular mass of 134.40±54.15 grams.

**Table no 7: correlation of left ventricular mass with age and body mass index.**

		AGE	BMI
Left Ventricular Mass	Pearson Correlation	0.224	0.29
	Significance	0.000 (S)	0.02 (S)
	N	400	400

Left ventricular mass showed significant positive correlation with Body mass index. Left ventricular mass showed positive correlation with age.



**Figure 2- correlation of left ventricular mass with age and body mass index**

## Discussion

In present study, total 400 subjects were included aged 18 to 25 years. Maximum subjects belonged to age group of 22-25 years. The mean age in our study was 22±2.128 years. In our study out of total 400 subjects, maximum were females comprising 59.25% while, males were 40.75%. The male to female ratio was 1:1.45. Similar to our study, in a study conducted by Cuspidi C et al,<sup>7</sup> maximum subjects were females comprising 58%. Similar to our study, in a study conducted by Gardin JM et

al,<sup>8</sup> maximum subjects were females comprising of 56%.

In our study, out of 400 subjects, 49 subjects (12.3%) had normal BMI, 147 subjects (36.8%) were overweight (36.8%), 134 subjects (33.5%) had obesity I and 70 subjects (17.5%) had obesity II. Similarly, in a study conducted by Turkbey EB et al,<sup>9</sup> the number of subjects with normal BMI was less than half the total subjects. The study included 30% subjects with normal BMI, 29% overweight subjects and 41% obese individuals.

In our study, 2D Echo was done to measure the left ventricular mass using the following parameters-

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LVIDD- Left Ventricular Internal Diameter at Diastole PWT- Posterior Wall Thickness at Diastole IVSTD- Inter-Ventricular Septum Thickness at Diastole.

Similar to our study, in a study conducted by G. Shillaci et al<sup>10</sup>, the mean value of LVIDD was found to be 4.9 cm. Similar to our study, in a study conducted by J.M. Gardin et al<sup>8</sup>, the mean value of LVIDD was found to be 4.95 cm, the mean value of PWT was found to be 0.8 cm, the mean value of IVSTD was found to be 0.86 cm and the mean value of LVM was found to be 148.6 g.

Contrary to our study, in a study conducted by Nabeel Amer Mohammed Ali Al Quraishi et al<sup>11</sup>, the mean value of LVIDD was found to be 5.22 cm. In our study, it was found that left ventricular mass in males was significantly higher as compared to the left ventricular mass in the females. The mean values of LVM in male and females were found to be 153.45±47.05 grams and 112.94±46.06 grams respectively. The mean values of left ventricular mass in subjects with normal BMI was found to be 139.4±33.19 grams in males and 123.78±53.20 grams in females. Similar to our study, in a study conducted by JM Gardin et al<sup>8</sup>, it was found that the left ventricular mass in males (169.3±54.8 g) is higher as compared to that in the females (128.2±37.7 g).

Similar to our study, in a study conducted by A. Fuchs et al<sup>12</sup>, the left ventricular mass in males was found



significantly higher in males ( $116 \pm 20$  g) as compared to that in the females ( $85 \pm 14$  g). Contrary to our study, in a study conducted by A. Fuchs et al<sup>13</sup>, the mean values of left ventricular mass in males and females both were significantly on the lower side. In our study, the left ventricular mass was found to have a positive correlation

with the BMI. The mean value of left ventricular mass in subjects with normal BMI was found to be  $129.71 \pm 56.28$  g, in overweight subjects was found to be  $130.47 \pm 45.96$  g, in subjects with obesity was found to be  $134.40 \pm 54.15$  g and in subjects with obesity was found to be  $139.45 \pm 27.06$  g. Similar to our study, in a study conducted by OJ Rider et al<sup>13</sup>, the left ventricular mass showed positive correlation with BMI with mean values of LVM in subjects with normal BMI and in obese subjects of  $90 \pm 20$  g and  $126 \pm 27$  g respectively. Our study has few limitations: As the number of males and females in the study was

disproportionate, the mean values of left ventricular mass and its determinants may vary. Maximum subjects belonged to overweight and obese group, hence the value of normal left ventricular mass may vary.

## Conclusions

The mean value of posterior wall thickness at diastole was  $0.697 \pm 0.09$  cm. The mean value of inter-ventricular septum thickness at diastole was  $0.688 \pm 0.103$  cm. The mean value of left ventricular mass was  $129.45 \pm 50.51$  grams. The left ventricular mass was found higher in the age group of 22-25 years ( $141.31 \pm 55.96$  grams) as compared to the other age groups. The mean value of left ventricular mass in males ( $153.45 \pm 47.05$  grams) was higher as compared to females ( $112.94 \pm 46.06$  grams). It indicates that the left ventricular mass is higher in males as compared to females. The mean values of left ventricular in subjects with normal BMI was  $139.4 \pm 33.19$  grams in males and  $123.78 \pm 53.2$  grams in females. The normal value of left ventricular mass in males is  $139.40 \pm 33.19$  grams and in females is  $123.78 \pm 53.20$  grams. The left ventricular mass increases with increase in BMI. The left ventricular mass is higher in males as compared to females

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