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AMBULATORY BLOOD PRESSURE MONITORING PROFILE AND LEFT VENTRICULAR GEOMETRY OF TREATED HYPERTENSIVE PATIENTS

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Abstract

Background: Ambulatory blood pressure monitoring is a tool for out of clinic blood pressure monitoring which is helpful in diagnosis of some important aspects of hypertension. The purpose of this study is to observe the ambulatory blood pressure profile of patients on antihypertensive treatment.

Method: Hypertensive patients of age group 19 years to 65 years who were on antihypertensives for a minimum period of one month and were free of any cardiovascular complication or chronic kidney disease were included in the study. After doing routine workup, they were subjected to 24 hour ambulatory blood pressure monitoring.

Results: Out of 119 patients (19-65 years, median age 44±10.9, 62 males, 57 females), 46.3% and 45.4% had uncontrolled office SBP and DBP. Controlled 24-hour mean SBP and DBP were found in 63%, with daytime control in 65% and 71%, and nighttime control in 53% and 50%, respectively. For SBP, 10.1% , 52.9% , 32.8% , and 4.2% were reverse dippers, non-dippers, dippers and extreme dippers respectively; for DBP, 10.1% , 35.3% , 45.4% , and 9.2% were reverse dippers, non-dippers, dippers and extreme dippers. Elevated daytime SBP and DBP loads were found in 55.5% and 65.5%, respectively, with significant positive correlations between BP measures and LVH characterized by increased LVMI.

Conclusion: ABPM parameters like 24 hour mean BP, mean daytime BP, mean night time BP and BP load were directly related to increased LV mass index which is a marker of LVH.

Key words: Ambulatory Blood Pressure Monitoring, Hypertension.

INTRODUCTION

Hypertension is a common cause of global morbidity and mortality. Morbidity is on rise due changing lifestyle and rising prevalence of obesity.[1] Despite the availability of effective

antihypertensive drugs, a significant proportion of the hypertensive population remains underdiagnosed or undertreated. This underdiagnosis leads to a substantial burden of morbidities and mortalities associated with hypertension, including cardiovascular diseases, stroke, and hypertensive end-organ damage.[2] Patients diagnosed with hypertension represent only the tip of the iceberg, as many individuals remain undiagnosed due to the asymptomatic nature of the condition, contributing to non-compliance with treatment. Even among those who are treated, achieving optimal blood pressure control remains a challenge[3].

Ambulatory Blood Pressure Monitoring (ABPM) provides a more comprehensive assessment of blood pressure by taking readings at regular intervals throughout the day and night. This method offers insight into mean 24-hour blood pressure, daytime and nighttime blood pressure, nocturnal dipping, blood pressure load, and morning blood pressure surge.[4]

ABPM has been recognized for its ability to better predict cardiovascular events and target organ damage compared to office blood pressure readings.[5] Our study aims to examine the relationship between ABPM parameters, antihypertensive medication, and target organ damage. Our study seeks to contribute valuable insights to the ongoing efforts in optimizing hypertension treatment and monitoring.

MATERIALS AND METHODS

This was a cross sectional observational study of Patients who presented in the OPD from 01st January 2023 to 31st march 2024 and diagnosed with hypertension and are on antihypertensive drugs were included in the study after taking written and informed consent. All hypertensive patients of age group 19 years to 65 years, who were on regular antihypertensive therapy for a minimum period of one month and were compliant with treatment. Patients with following diseases were not included in the study.

1. Coronary artery disease
2. Chronic Kidney Disease
3. Cardiomyopathy
4. Congenital Heart Disease
5. Valvular Heart Disease
6. Cardiac failure

A detailed history of each patient was taken including demographic data (current age, age at the time of diagnosis, gender, occupation, residence), history of presenting symptoms, precomorbid conditions, risk factors of hypertension and the patient's treatment history followed by detailed clinical examination with specific reference to end organ damage secondary to uncontrolled hypertension. Office BP were taken according to standard protocol and average of three BP reading was recorded. Then the patients were subjected to 24 hour Ambulatory BP monitoring using ABPM50 device by Contec Medical Systems. BP cuff was tied around left upper arm with

monitor held hanging around waist side from shoulder with a strap. A standard software provided by contec medical system was used to upload and download data from ABPM50. Average office systolic/diastolic blood pressure were compared with average 24 hours systolic/diastolic ambulatory blood pressure. Laboratory and Radiological evaluation Lab evaluation will be done including baseline Haemoglobin, creatinine, Sodium Potassium, Lipid profile, Urine Albumin Creatinine Ratio, Electro cardiography, X-ray chest postero anterior view, 2D Echo cardiography.Parameters of ABPM including 24 hour SBP and DBP, mean daytime SBP and DBP, mean night time SBP and DBP , day time and night time SBP and DBP load were analysed for their association with target organ damage in form of LVH diagnosed by LVMI calculated as:

LVMI = LVM (left ventricular mass)/body surface area.

left ventricular mass = $0.8\{1.04[([LVEDD + IVSd + PWd]^3 - LVEDD^3)]\} + 0.6$

- LVEDD = LV end-diastolic dimension (mm)
- IVSd = interventricular septal thickness at end-diastole (mm)
- PWd = posterior wall thickness at end-diastole (mm)

STATISTICS

The data from the present study was systematically collected, compiled and statistically analyzed to draw relevant conclusions using SPSS-22 software version. The observations were tabulated in the form of frequency, percentage and mean + standard deviation (SD). In parametric data, student t-test was used. Quantitative variables were correlated using chi-square test and correlation coefficient was calculated by Spearman's test. The data was analyzed and level of significance was determined as its p value with $p<0.05$ as significant, $p<0.001$ as highly significant and $p>0.05$ as non-significant.

RESULTS

Table1: Distribution of study population according to age distribution

Age group (years)	No. of cases	%age
19-45	59	49.6
45-65	60	50.4
Total	119	100.0

In the present study, total of 119 patients were enrolled. 59 patients were in 19-45 years age group comprising 49.6%. 60 patients were in 46-65 years age group comprising 50.4%. The mean age was 44.9±10.9 years.

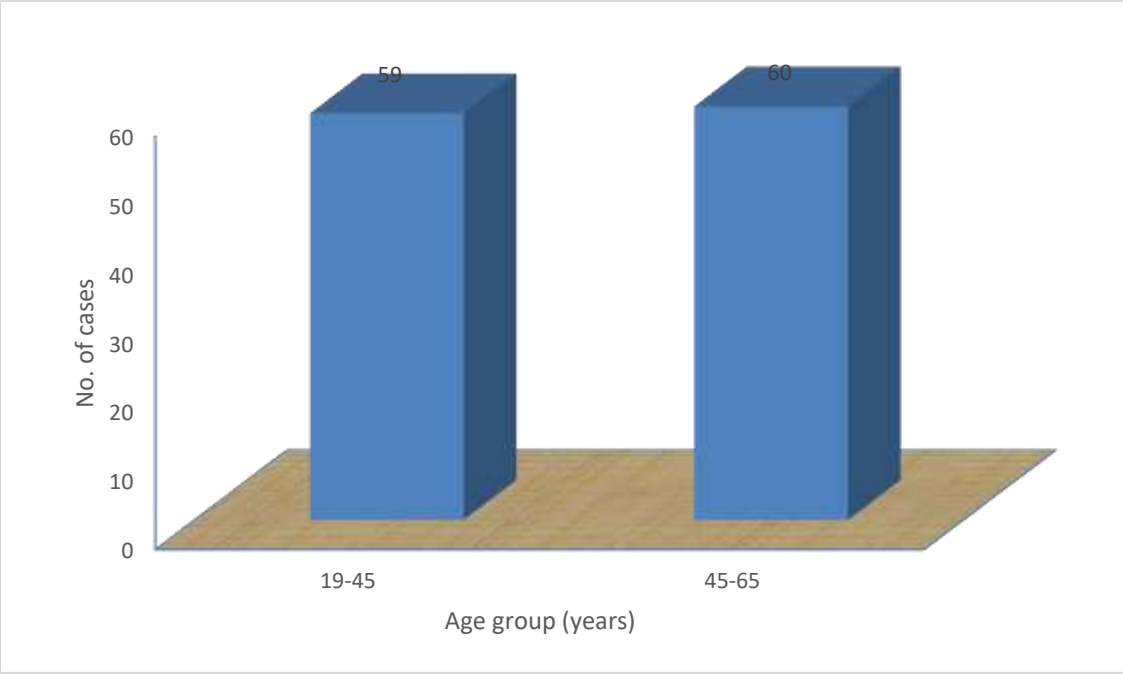

Figure1: Distribution of study population according to age distribution

Table 2: Distribution of study population according to gender

Gender	No. of cases	%age
Females	57	47.9
Males	62	52.1
Total	119	100.0

In present study, 57 patients were females constituting 47.9% of the study population and 62 patients were females constituting 52.1% of the study population.

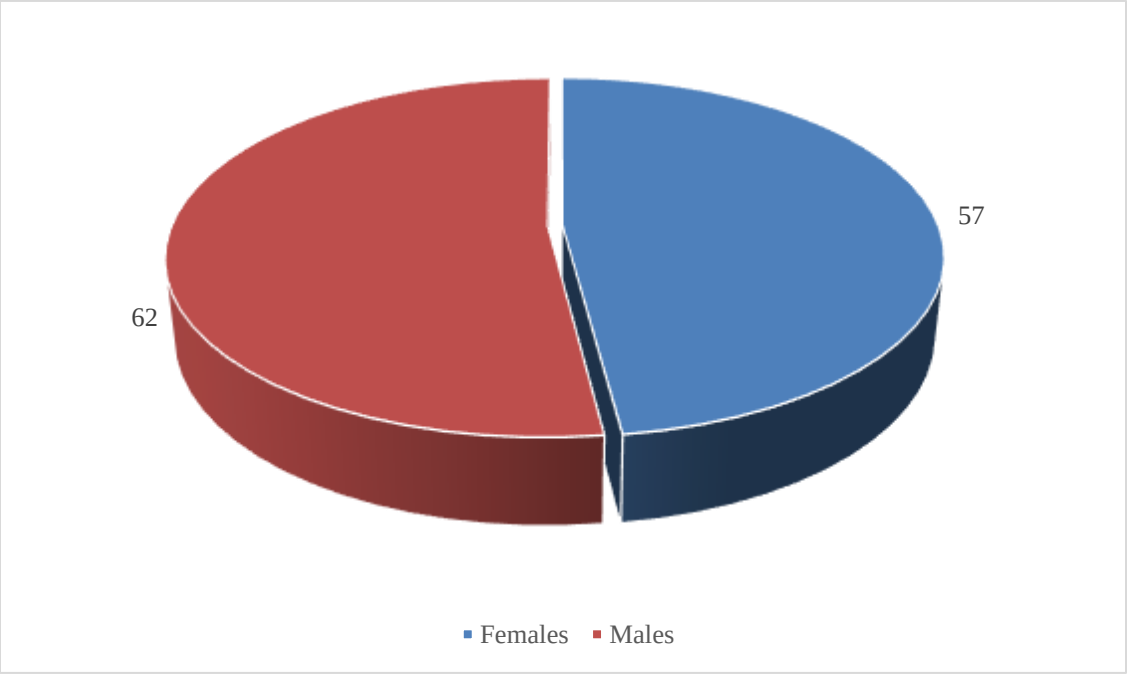

Figure 2 : Distribution of study population according to gender

Table 3: Distribution of study population according to SBP category

Office SBP	No.	%age
<120mm hg(optimal)	21	17.6
120-129mm hg(normal)	9	7.6
130-139 mm Hg (high normal)	34	28.6
140-159mm Hg (grade 1 hypertension)	29	24.4
160-179mm Hg (grade 2 hypertension)	17	14.3
>180mm Hg (grade 3 hypertension)	9	7.6
Total	119	100.0

In this study, 28.6% (n=34) of individuals had high normal SBP (130-139 mm Hg), and 45.8% (n=55) were hypertensive, with 24.4% having grade 1, 14.3% grade 2, and 7.6% grade 3

hypertension. Additionally, 17.6% (n=21) had optimal SBP, while 7.6% (n=9) had normal SBP.

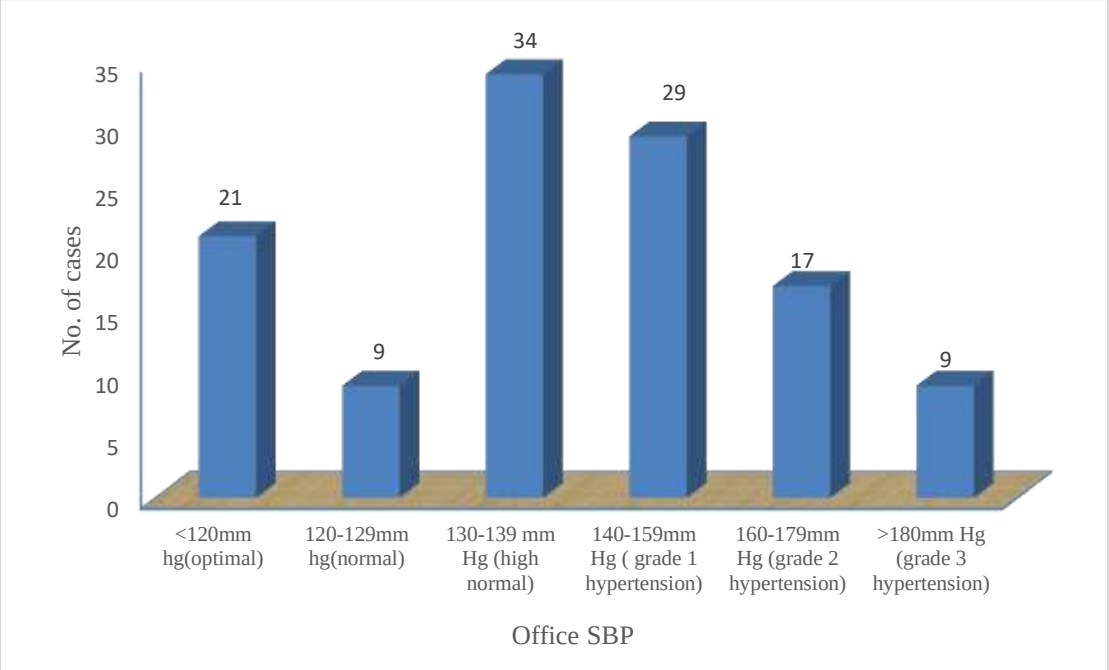

Figure 3: Distribution of study population according to SBP category

Table 4: Distribution of study population according to DBP category

Office DBP	No.	%age
<80mm Hg (optimal)	28	23.5
80-84 mm Hg (normal)	28	23.5
85-89 mm Hg (high normal)	9	7.6
90-99 mm Hg (grade 1 hypertension)	27	22.7
100-109 mm Hg (grade 2 hypertension)	20	16.8
>=110 mm Hg (grade 3 hypertension	7	5.9
Total	119	100.0

In this study, the majority of patients were classified into the optimal and normal blood pressure categories, with 28 patients in each group, accounting for 23.5% of the total study population in each category. Additionally, 9 patients were categorized as having high-normal blood pressure,

representing 7.6% of the total study population. The prevalence of hypertension increased with severity, with 27 patients (22.7%) classified as grade 1 hypertensive, 20 patients (16.8%) as grade 2 hypertensive, and 7 patients (5.9%) as grade 3 hypertensive.

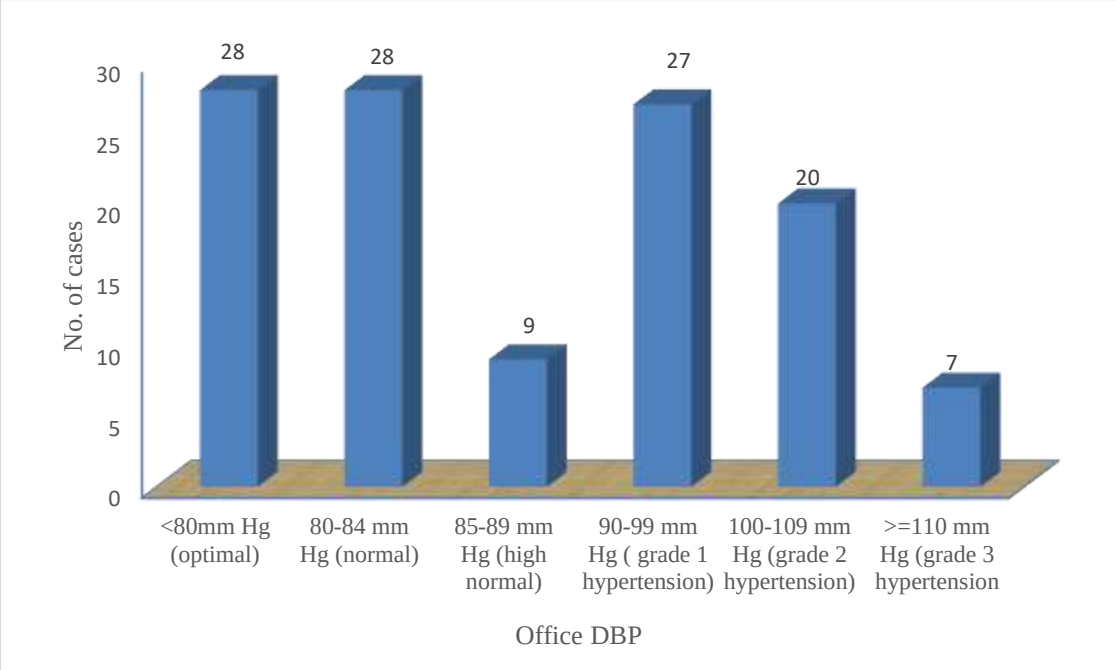

Figure 4: Distribution of study population according to DBP category

Table 5: Distribution of study population as per mean 24 hour SBP categories

Mean 24 hours SBP	No.	%age
<130mm Hg(normal)	63	52.9
>=130mm Hg (hypertension)	56	47.1
Total	119	100.0

In this study, the mean 24-hour systolic blood pressure (SBP) was categorized into two groups: normal and hypertension. Among the participants, 63 individuals (52.9%) had a mean 24-hour SBP of less than 130 mm Hg, classified as normal. Conversely, 56 individuals (47.1%) had a mean 24-hour SBP of 130 mm Hg or higher, indicating hypertension.

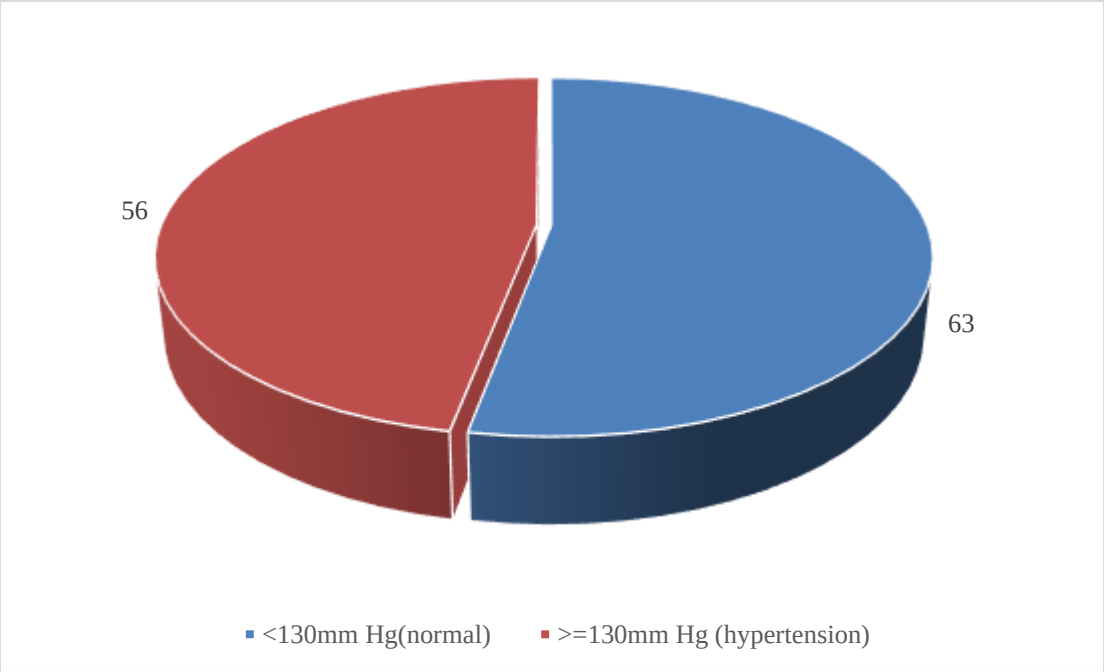

Figure 5: Distribution of study population as per mean 24 hour SBP categories

Table 6: Distribution of study population as per mean 24 hour DBP categories

Mean 24 hours DBP	No.	%age
<80mm Hg(normal)	63	52.9
>=80mm Hg (hypertension)	56	47.1
Total	119	100.0

In this study, the mean 24-hour diastolic blood pressure (DBP) was categorized into two groups: normal and hypertension. Among the participants, 63 individuals (52.9%) had a mean 24-hour DBP of less than 80 mm Hg, classified as normal. Conversely, 56 individuals (47.1%) had a mean 24-hour DBP of 80 mm Hg or higher, indicating hypertension.

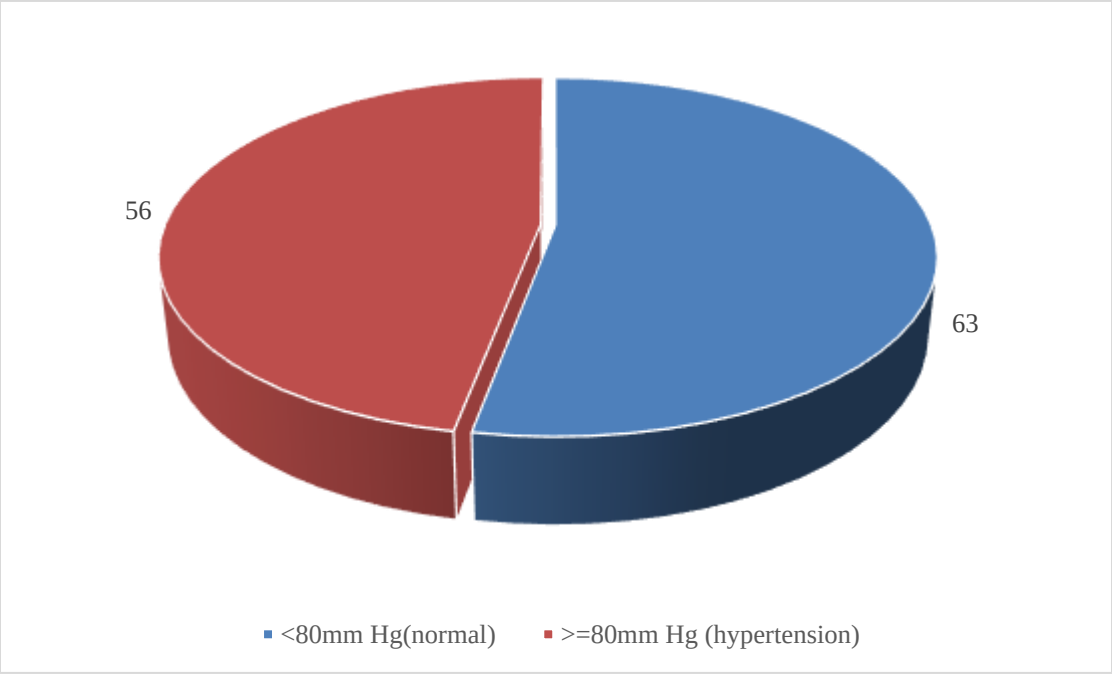

Figure 6: Distribution of study population as per mean 24 hour DBP categories

Table 7: Distribution of study population as per mean day time SBP categories

Mean day SBP	No.	%age
<135mm Hg (normal)	65	54.6
>=135mm Hg (hypertension)	54	45.4
Total	119	100.0

Among a sample of 119 individuals, 54.6% had a mean daytime systolic blood pressure (SBP) of less than 135 mm Hg, indicating normal blood pressure, while 45.4% had a mean daytime SBP of 135 mm Hg or higher, indicating hypertension according to European Society of Hypertension (ESH) guidelines.

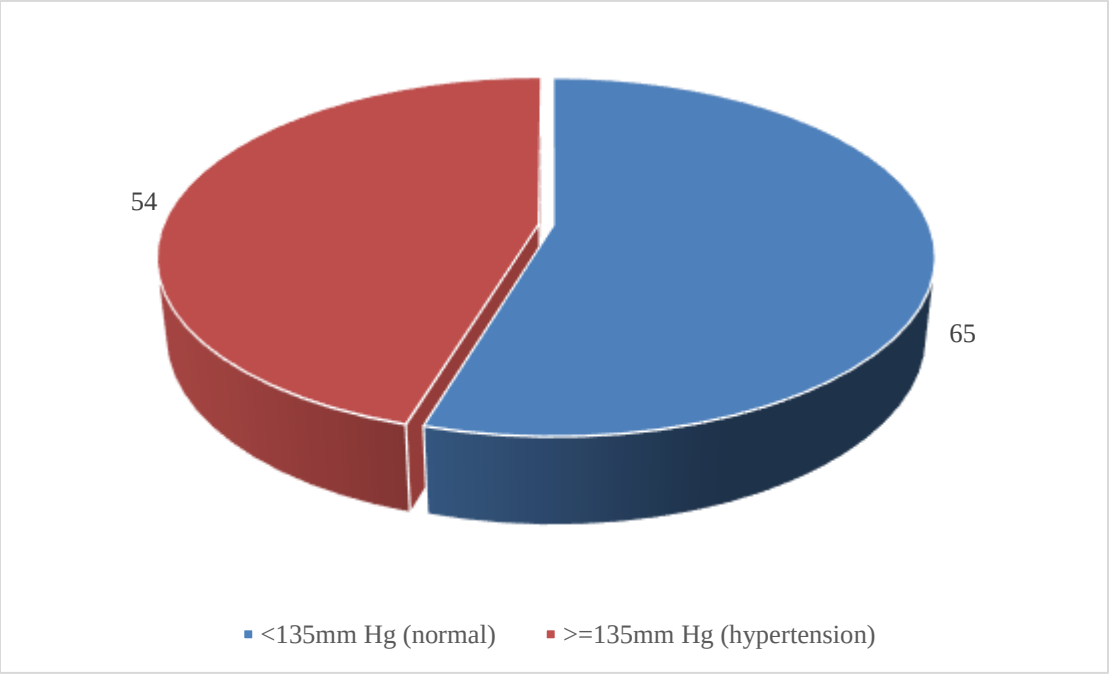

Figure 7: Distribution of study population as per mean day time SBP categories

Table 8: Distribution of study population as per mean daytime DBP categories

Mean day DBP	No.	%age
<85mm Hg(normal)	71	59.7
>=85mm Hg (hypertension)	48	40.3
Total	119	100.0

In this study, 71 individuals (59.7%) have a mean daytime diastolic blood pressure (DBP) below 85 mm Hg, indicating normal blood pressure, while 48 individuals (40.3%) have a mean daytime DBP of 85 mm Hg or higher, indicating hypertension.

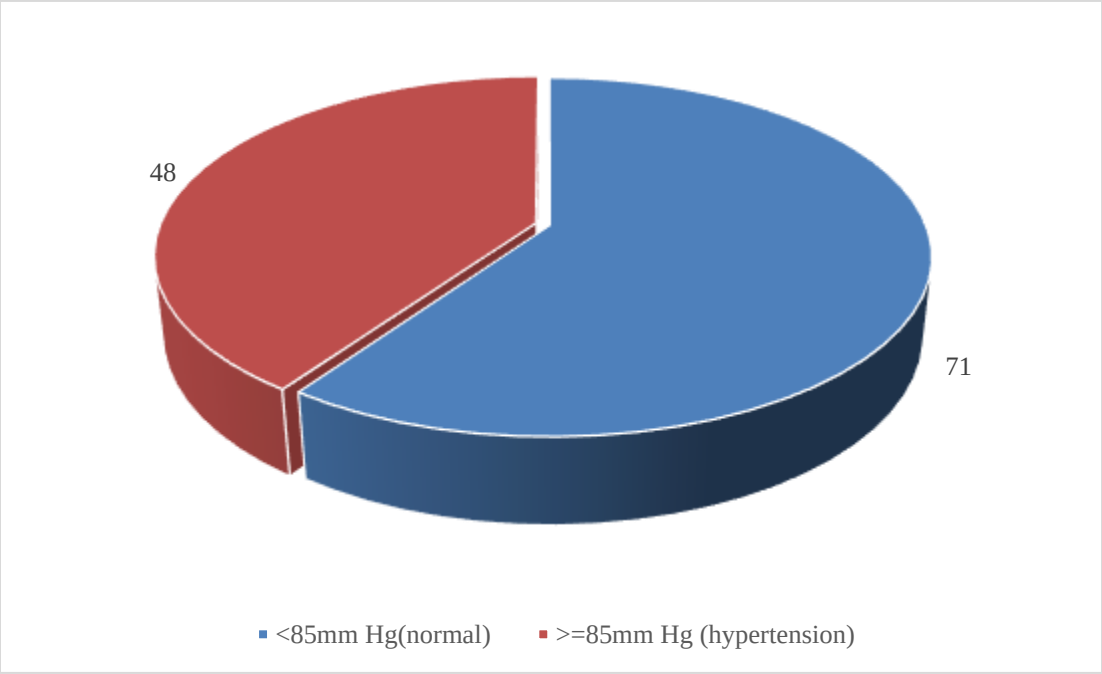

Figure 8: Distribution of study population as per mean daytime DBP categories

Table 9: Distribution of study population as per mean night time SBP categories

Mean night SBP	No.	%age
<120mm Hg (normal)	53	44.5
>=120mmHg (hypertension)	66	55.5
Total	119	100.0

In this study, 53 individuals (44.5%) have a mean nighttime systolic blood pressure (SBP) below 120 mm Hg, indicating normal blood pressure, while 66 individuals (55.5%) have a mean nighttime SBP of 120 mm Hg or higher, indicating hypertension.

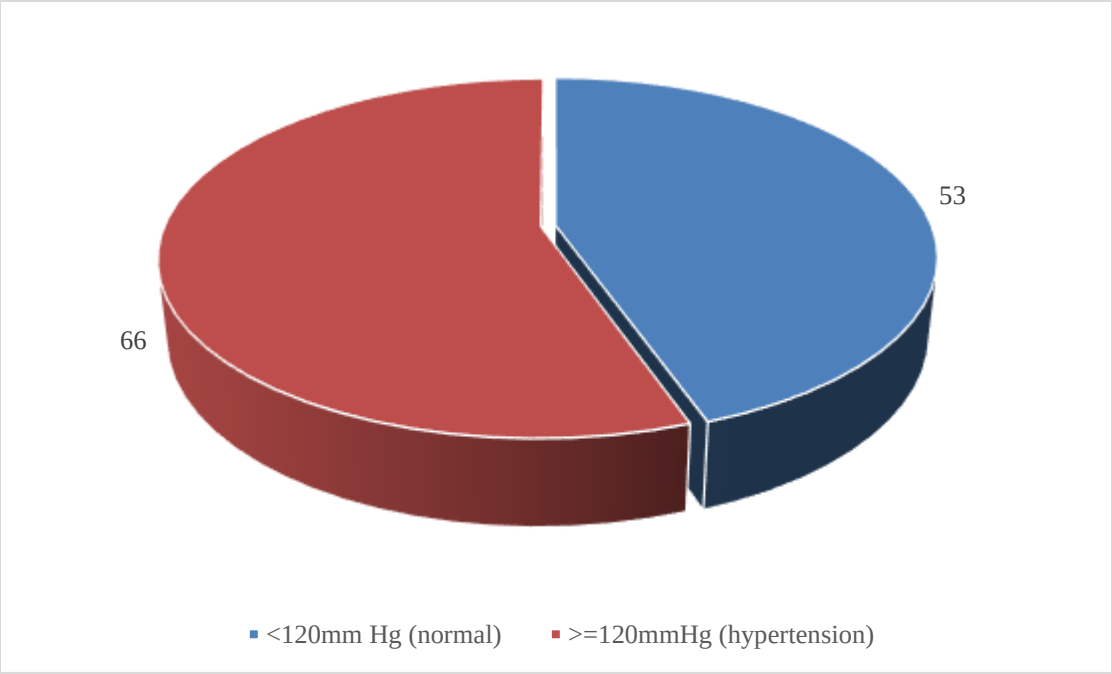

Figure 9: Distribution of study population as per mean night time SBP categories

Table 10: Distribution of study population as per mean night time DBP categories.

Mean night DBP	No.	%age
<70mm Hg (normal)	50	42.0
>=70mm Hg (hypertension)	69	58.0
Total	119	100.0

In this study, 50 individuals (42.0%) have a mean nighttime diastolic blood pressure (DBP) below 70 mm Hg, indicating normal blood pressure, while 69 individuals (58.0%) have a mean nighttime DBP of 70 mm Hg or higher, indicating hypertension.

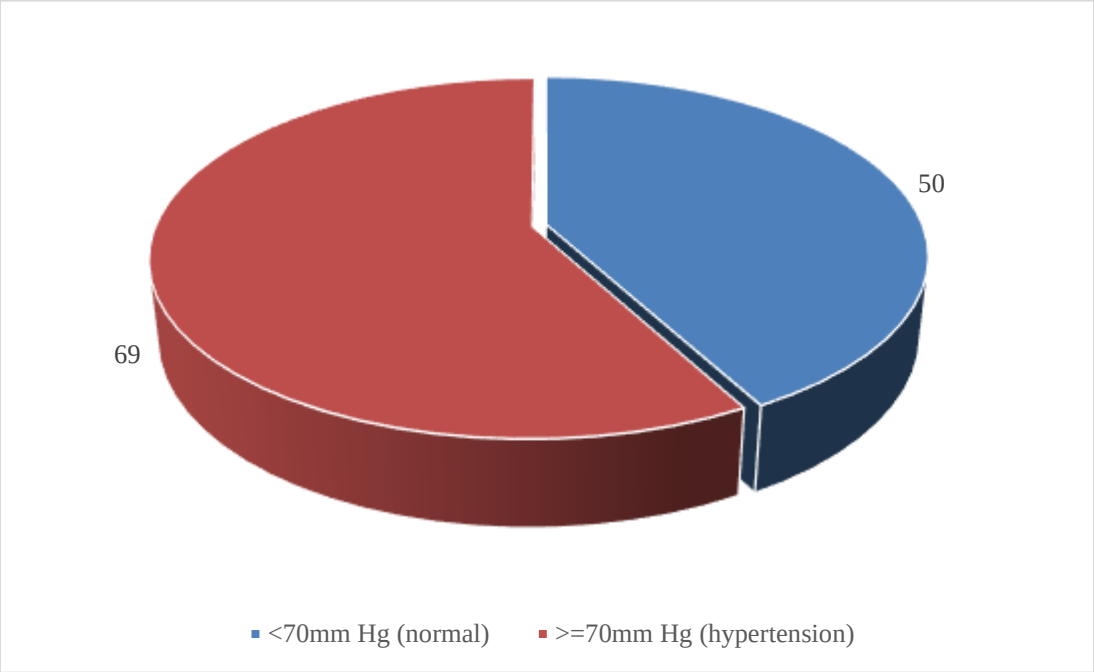

Figure 10: Distribution of study population as per mean night time DBP categories.

Table 11: Mean LVMI in relation to mean day time SBP load categories

Mean day BP load SBP	No.	LVMI		p-value
		Mean	SD	
<30%	53	87.6358	19.83895	0.001
>=30%	66	127.1332	25.31301	
Total	119	109.5419	30.24929	

In this study, among 53 individuals with a mean daytime BP load systolic blood pressure (SBP) of less than 30%, the mean left ventricular mass index (LVMI) was 87.6358 with a standard deviation of 19.83895. Among 66 individuals with a BP load SBP of 30% or more, the mean LVMI was 127.1332 with a standard deviation of 25.31301. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with less than 30% and those with 30% or more daytime BP load SBP was observed, with a p-value of 0.001.

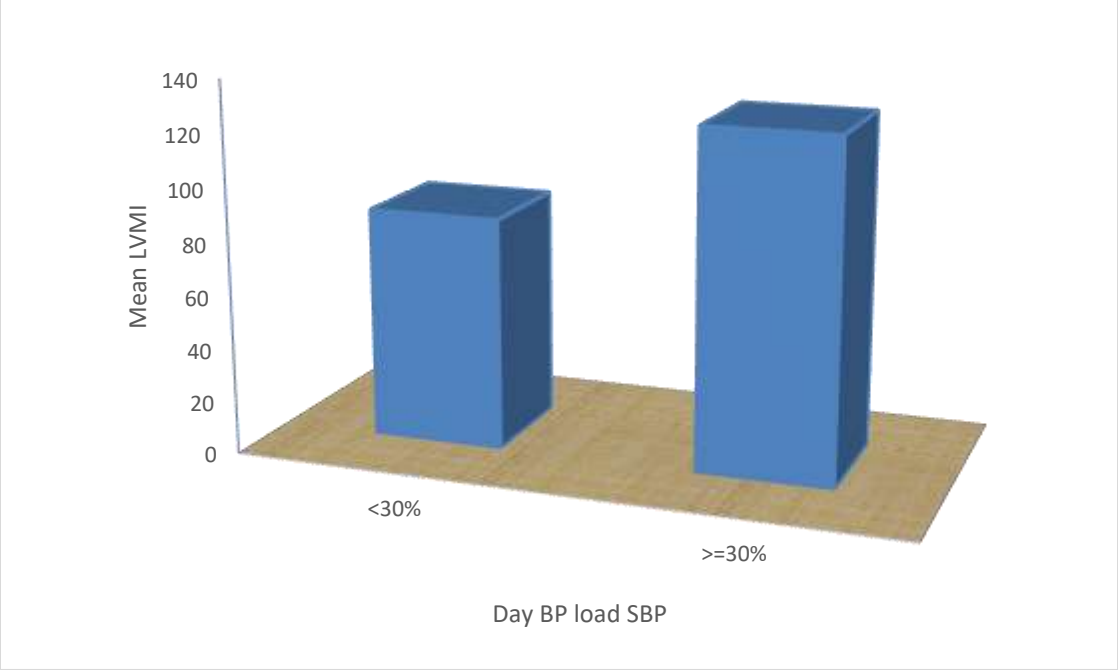

Figure 11: Mean LVMI in relation to mean day time SBP load categories

Table 12: Mean LVMI in relation to mean day time DBP load categories

Mean day BP load DBP	No.	LVMI		p-value
		Mean	SD	
<30%	61	96.0166	24.37614	0.001
>=30%	58	123.7669	29.44670	
Total	119	109.5419	30.24929	

In this study, among 61 individuals with a mean daytime BP load diastolic blood pressure (DBP) of less than 30%, the mean left ventricular mass index (LVMI) was 96.0166 with a standard deviation of 24.37614. Among 58 individuals with a BP load DBP of 30% or more, the mean LVMI was 123.7669 with a standard deviation of 29.44670. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with less than 30% and those with 30% or more daytime BP load DBP was observed, with a p-value of 0.001.

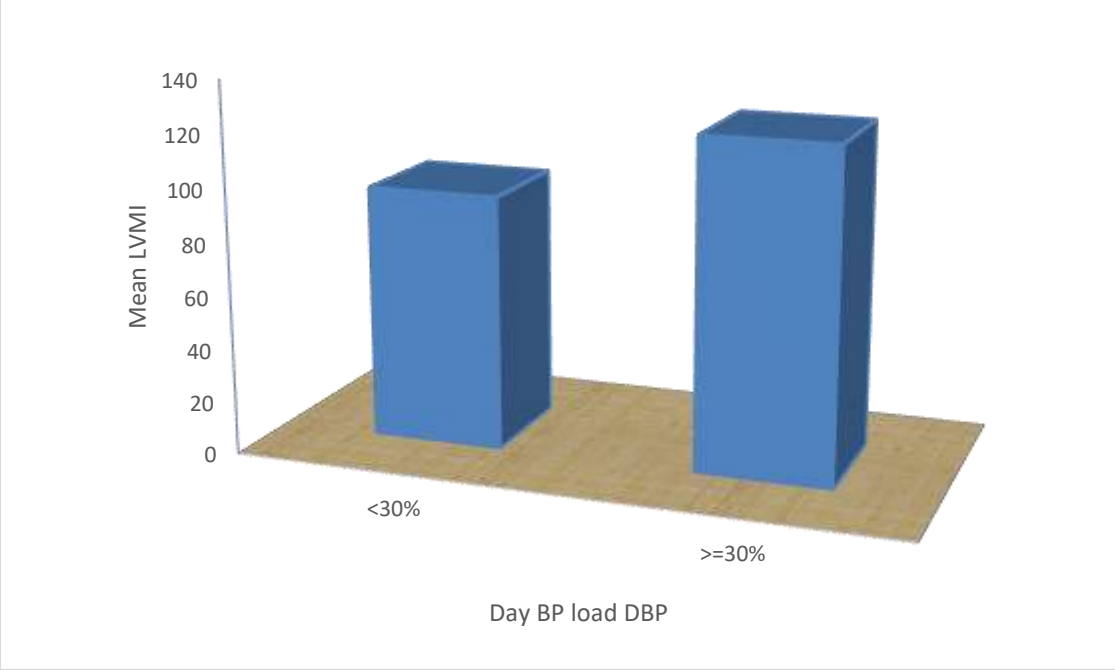

Figure 12: Mean LVMI in relation to mean day time DBP load categories

Table 13: Mean LVMI in relation to mean night time SBP load categories

Mean night BP load SBP	No.	LVMI		p-value
		Mean	SD	
<30%	41	85.4371	20.88933	0.001
>=30%	78	122.2124	26.52435	
Total	119	109.5419	30.24929	

In this study, among 41 individuals with a mean nighttime BP load systolic blood pressure (SBP) of less than 30%, the mean left ventricular mass index (LVMI) was 85.4371 with a standard deviation of 20.88933. Among 78 individuals with a BP load SBP of 30% or more, the mean LVMI was 122.2124 with a standard deviation of 26.52435. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with less than 30% and those with 30% or more nighttime BP load SBP was observed, with a p-value of 0.001.

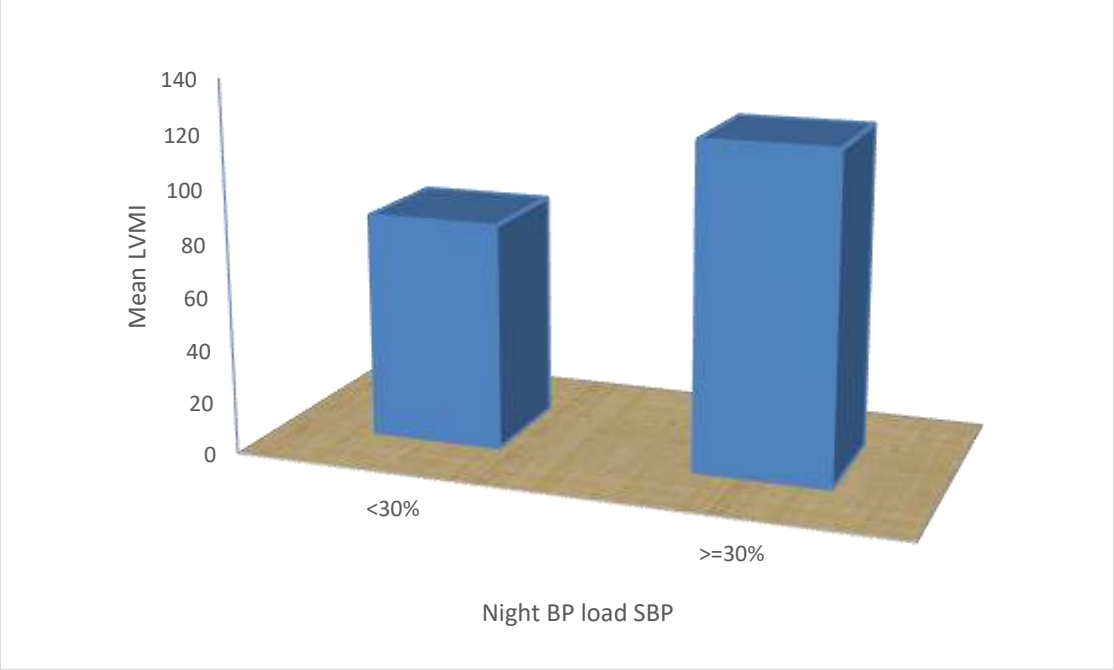

Figure 13: Mean LVMI in relation to mean night time SBP load categories

Table 14: Mean LVMI in relation to mean night time DBP load categories

Mean night BP load DBP	No.	LVMI		p-value
		Mean	SD	
<30%	30	81.5787	17.02828	0.001
>=30%	89	118.9678	27.83837	
Total	119	109.5419	30.24929	

In this study, among 30 individuals with a mean nighttime BP load diastolic blood pressure (DBP) of less than 30%, the mean left ventricular mass index (LVMI) was 81.5787 with a standard deviation of 17.02828. Among 89 individuals with a BP load DBP of 30% or more, the mean LVMI was 118.9678 with a standard deviation of 27.83837. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with less than 30% and those with 30% or more nighttime BP load DBP was observed, with a p-value of 0.001.

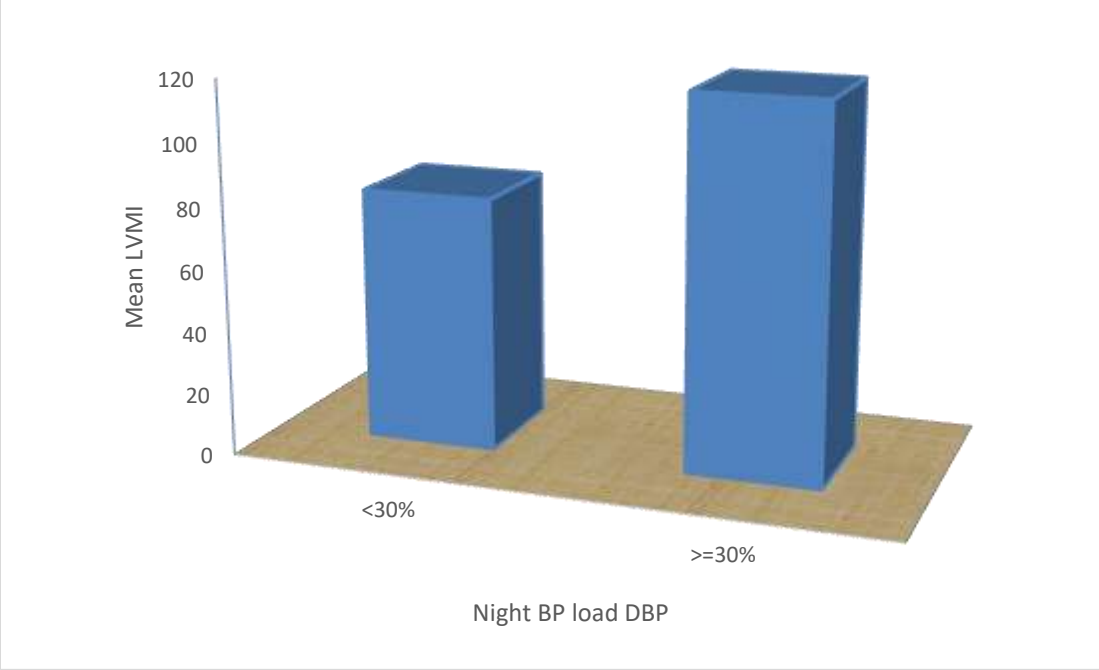

Figure 14: Mean LVMI in relation to mean night time DBP load categories

Table 15: Mean LVMI in realation to office SBP categories

Office SBP	No.	LVMI		p-value
		Mean	SD	
<120mm Hg(optimal)	21	87.6757	19.69784	0.001
120-129mm Hg(normal)	9	98.2333	21.70454	
130-139mm Hg(high normal)	34	98.3671	26.36037	
140-159mm Hg (grade 1 hypertension)	29	112.4393	25.65971	
160-179mm Hg (grade 2 hypertension)	17	136.9294	21.76411	
>180mm Hg (grade 3 hypertension)	9	153.0200	16.01907	
Total	119	109.5419	30.24929	

In this study, among 21 patients with optimal SBP (<120 mm Hg), the mean LVMI was 87.6757 with a standard deviation of 19.69784. For 9 patients with normal SBP (120-129 mm Hg), the mean LVMI was 98.2333 with a standard deviation of 21.70454. Among 34 individuals with high normal SBP (130-139 mm Hg), the mean LVMI was 98.3671 with a standard deviation of 26.36037. For 29 subjects with grade 1 hypertension (140-159 mm Hg), the mean LVMI was 112.4393 with a standard deviation of 25.65971. Among 17 patients with grade 2 hypertension (160-179 mm Hg), the mean LVMI was 136.9294 with a standard deviation of 21.76411. For 9 individuals with grade 3 hypertension (>180 mm Hg), the mean LVMI was 153.0200 with a standard deviation of 16.01907. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI across different SBP categories was observed, with a p-value of 0.001.

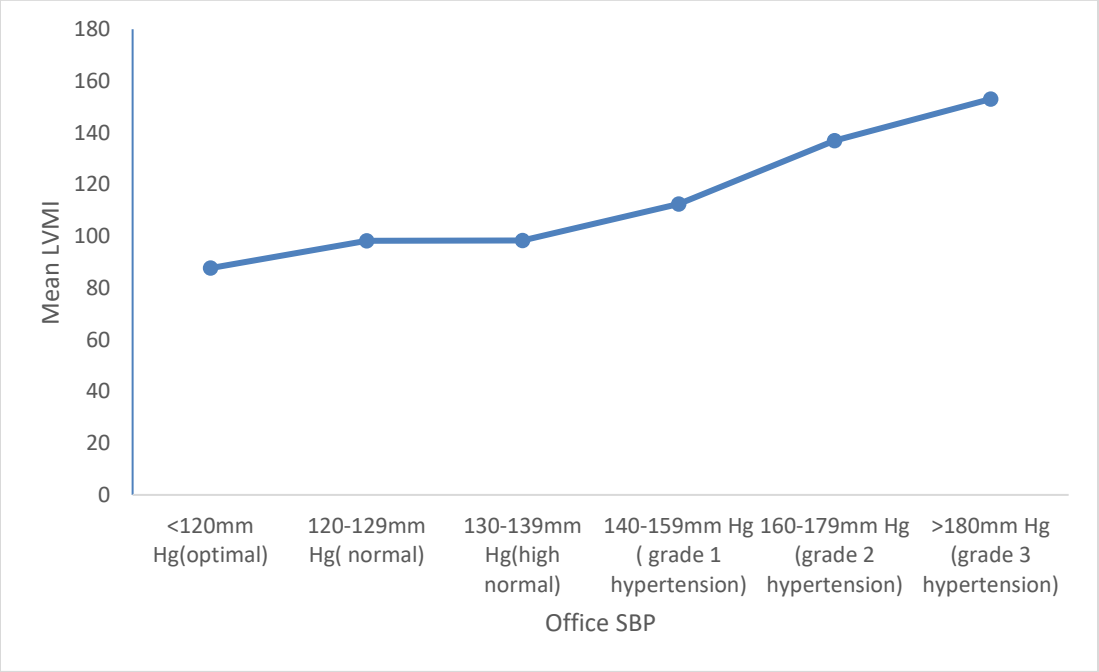

Figure 15: Mean LVMI in realation to office SBP categories

Table 16: Mean LVMI in relation to office DBP categories

Office DBP	No.	LVMI		p-value
		Mean	SD	
<80mm Hg (optimal)	28	90.4900	20.58522	0.001
80-84 mm Hg (normal)	28	102.4446	29.22890	
85-89 mm Hg (high normal)	9	99.3744	22.25807	
90-99 mm Hg (grade 1 hypertension)	27	117.8541	28.28209	
100-109 mm Hg (grade 2 hypertension)	20	129.1350	31.23857	
>=110 mm Hg (grade 3 hypertension)	7	139.1700	18.12338	
Total	119	109.5419	30.24929	

In this study, the relationship between office diastolic blood pressure (DBP) and left ventricular mass index (LVMI) was examined. Among 28 individuals with optimal DBP (<80 mm Hg), the mean LVMI was 90.4900 with a standard deviation of 20.58522. For 28 individuals with normal DBP (80-84 mm Hg), the mean LVMI was 102.4446 with a standard deviation of 29.22890. Among 9 individuals with high normal DBP (85-89 mm Hg), the mean LVMI was 99.3744 with a standard deviation of 22.25807. For 27 individuals with grade 1 hypertension (90-99 mm Hg), the mean LVMI was 117.8541 with a standard deviation of 28.28209. Among 20 individuals with grade 2 hypertension (100-109 mm Hg), the mean LVMI was 129.1350 with a standard deviation of 31.23857. For 7 individuals with grade 3 hypertension (≥110 mm Hg), the mean LVMI was 139.1700 with a standard deviation of 18.12338. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI across different DBP categories was observed, with a p-value of 0.001.

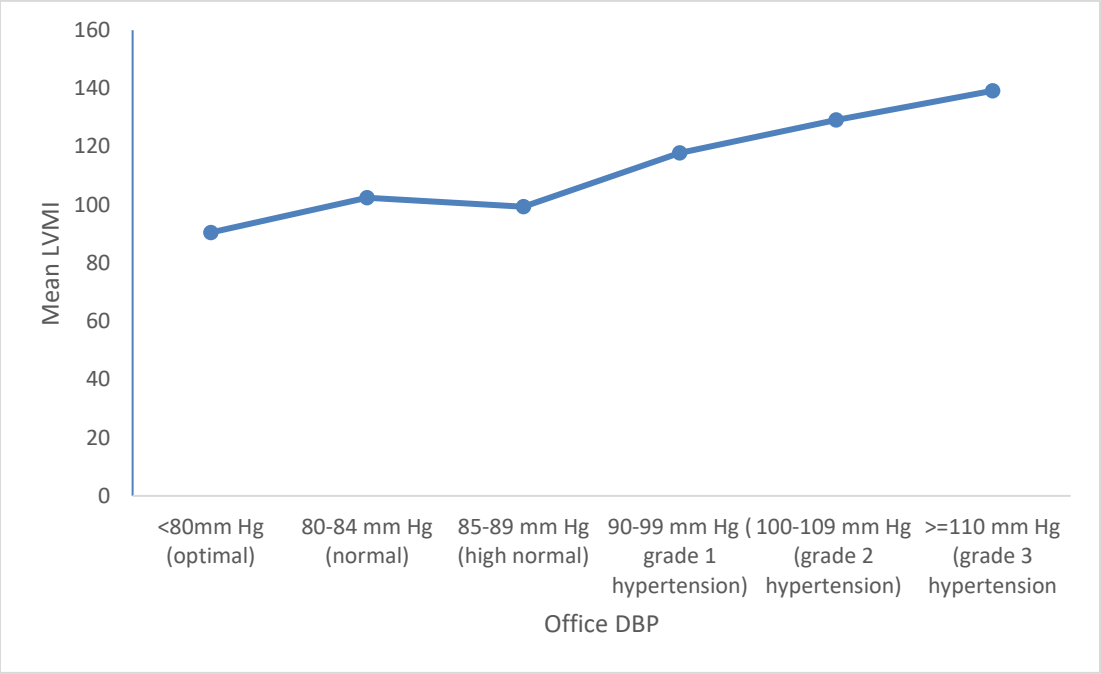

Figure 16: Mean LVMI in relation to office DBP categories

Table 17: Mean LVMI in relation to mean 24 hour SBP categories

Mean 24 hrs SBP	No.	LVMI		p-value
		Mean	SD	
<130mm Hg(normal)	63	89.2505	19.97413	0.001
>=130mm Hg (hypertension)	56	132.3698	22.60905	
Total	119	109.5419	30.24929	

In this study, the relationship between mean 24-hour systolic blood pressure (SBP) and left ventricular mass index (LVMI) was examined. Among 63 individuals with normal 24-hour SBP (<130 mm Hg), the mean LVMI was 89.2505 with a standard deviation of 19.97413. For 56 individuals with hypertensive 24-hour SBP (≥130 mm Hg), the mean LVMI was 132.3698 with a standard deviation of 22.60905. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with normal and hypertensive 24-hour SBP was observed, with a p-value of 0.001.

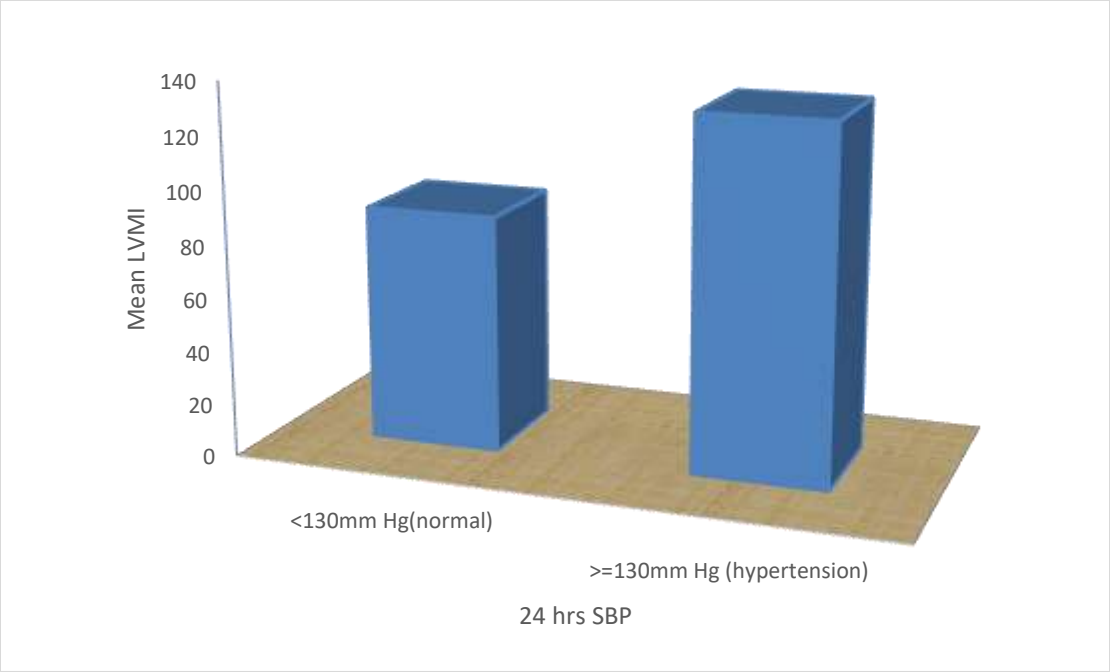

Figure 17: Mean LVMI in relation to mean 24 hour SBP categories

Table 18: Mean LVMI in relation to mean 24 hour DBP categories

Mean 24 hrs DBP	No.	LVMI		p-value
		Mean	SD	
<80mm Hg(normal)	63	95.2359	24.64871	0.001
>=80mm Hg (hypertension)	56	125.6363	27.92990	
Total	119	109.5419	30.24929	

In this study, the relationship between mean 24-hour diastolic blood pressure (DBP) and left ventricular mass index (LVMI) was examined. Among 63 individuals with normal 24-hour DBP (<80 mm Hg), the mean LVMI was 95.2359 with a standard deviation of 24.64871. For 56 individuals with hypertensive 24-hour DBP (≥80 mm Hg), the mean LVMI was 125.6363 with a standard deviation of 27.92990. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with normal and hypertensive 24-hour DBP was observed, with a p-value of 0.001.

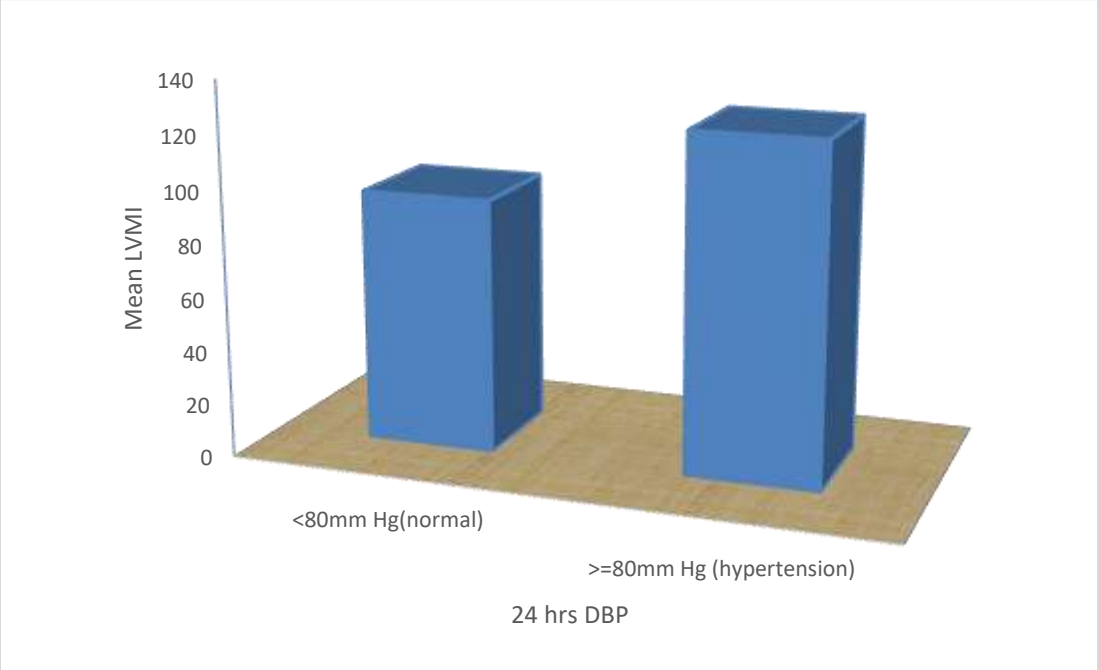

Figure 18: Mean LVMI in relation to mean 24 hour DBP categories

Table 19: mean lvmi in relation to mean day time SBP categories

Mean day SBP	No.	LVMI		p-value
		Mean	SD	
<135mm Hg (normal)	65	89.8335	19.92444	0.001
>=135mm Hg (hypertension)	54	133.2650	22.54040	
Total	119	109.5419	30.24929	

In this study, the relationship between mean daytime systolic blood pressure (SBP) and left ventricular mass index (LVMI) was investigated. Among 65 individuals with normal mean daytime SBP (<135 mm Hg), the mean LVMI was 89.8335 with a standard deviation of 19.92444. For 54 individuals with hypertensive mean daytime SBP (≥135 mm Hg), the mean LVMI was 133.2650 with a standard deviation of 22.54040. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with normal and hypertensive mean daytime SBP was observed, with a p-value of 0.001.

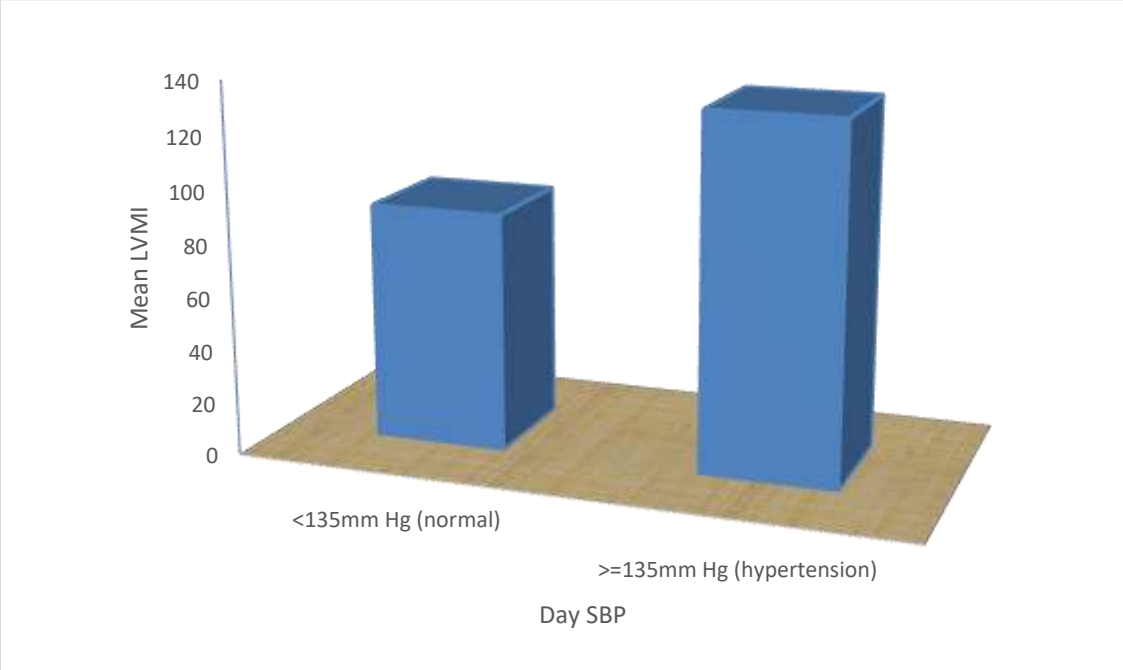

Figure 19: mean LVMI in relation to mean day time SBP categories

Table 20: mean LVMI in relation to mean day time DBP categories

Mean day DBP	No.	LVMI		p-value
		Mean	SD	
<85mm Hg(normal)	71	97.2038	24.35414	0.001
>=85mm Hg (hypertension)	48	127.7921	29.04803	
Total	119	109.5419	30.24929	

In this study, the relationship between mean daytime diastolic blood pressure (DBP) and left ventricular mass index (LVMI) was examined. Among 71 individuals with normal mean daytime DBP (<85 mm Hg), the mean LVMI was 97.2038 with a standard deviation of 24.35414. For 48 individuals with hypertensive mean daytime DBP (≥85 mm Hg), the mean LVMI was 127.7921 with a standard deviation of 29.04803. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with normal and hypertensive mean daytime DBP was observed, with a p-value of 0.001.

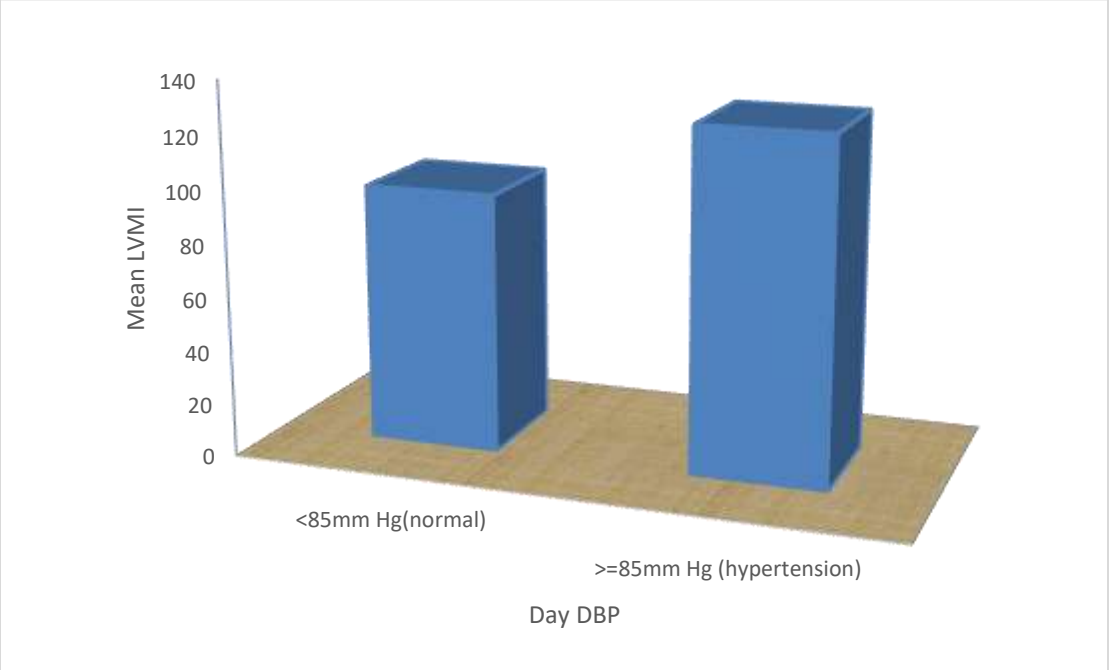

Figure 20: mean LVMI in relation to mean day time DBP categories

Table 21: mean LVMI in relation to mean night SBP categories

Mean night SBP	No.	LVMI		p-value
		Mean	SD	
<120mm Hg (normal)	53	87.8853	20.61748	0.001
>=120mmHg (hypertension)	66	126.9329	25.13018	
Total	119	109.5419	30.24929	

In this study, among 53 individuals with normal mean nighttime systolic blood pressure (SBP) (<120 mm Hg), the mean left ventricular mass index (LVMI) was 87.8853 with a standard deviation of 20.61748. Among 66 individuals with hypertensive mean nighttime SBP (≥120 mm Hg), the mean LVMI was 126.9329 with a standard deviation of 25.13018. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with normal and hypertensive mean nighttime SBP was observed(p-value of 0.001).

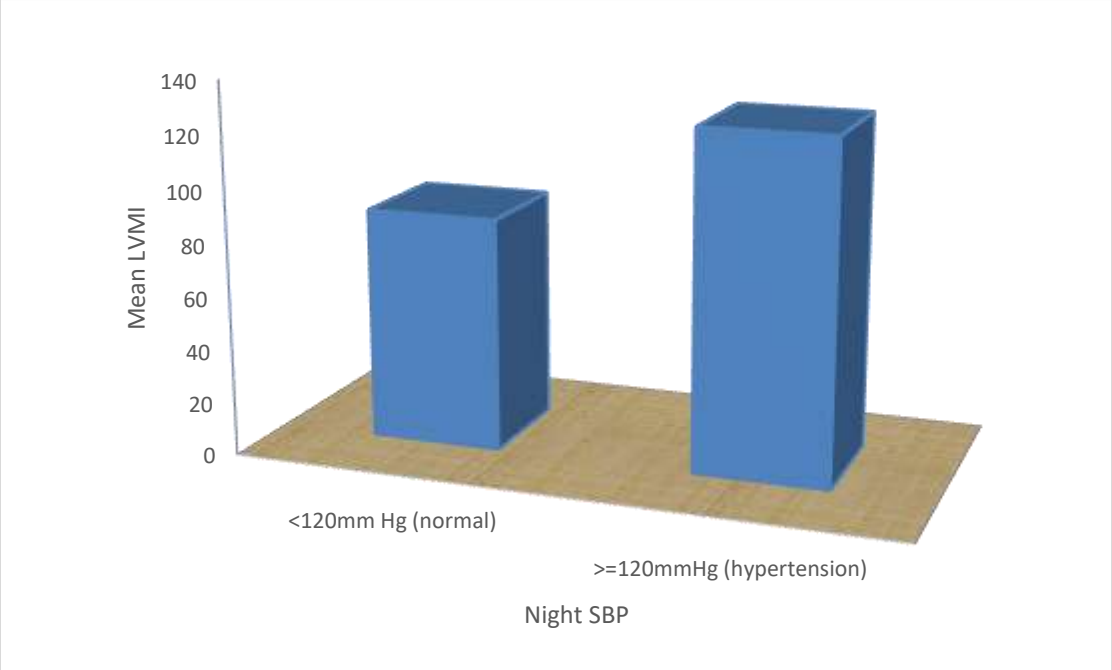

Figure 21: mean LVMI in relation to mean night SBP categories

Table 22: mean LVMI in relation to mean night time DBP categories

Mean night DBP	No.	LVMI		p-value
		Mean	SD	
<70mm Hg (normal)	50	89.6472	22.32186	0.001
>=70mm Hg (hypertension)	69	123.9584	26.96040	
Total	119	109.5419	30.24929	

In this study, among 50 individuals with normal mean nighttime diastolic blood pressure (DBP) (<70 mm Hg), the mean left ventricular mass index (LVMI) was 89.6472 with a standard deviation of 22.32186. Among 69 individuals with hypertensive mean nighttime DBP (≥70 mm Hg), the mean LVMI was 123.9584 with a standard deviation of 26.96040. The total mean LVMI for all 119 individuals was 109.5419 with a standard deviation of 30.24929. A significant difference in mean LVMI between individuals with normal and hypertensive mean nighttime DBP was observed, with a p-value of 0.001.

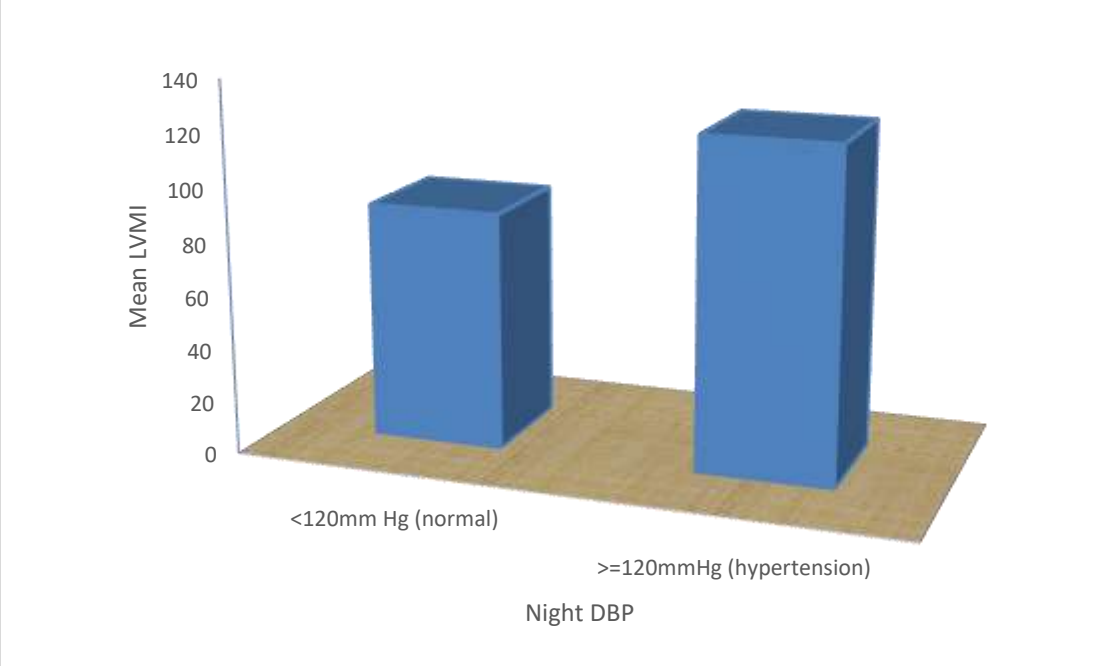

Figure 22: mean LVMI in relation to mean night time DBP categories

DISCUSSION

Hypertension usually presents with complications and represent population which has been undertreated. Traditional office measurements are sometimes inadequate to accurately diagnose hypertension, leading to overtreatment or undertreatment. Ambulatory blood pressure monitoring (ABPM) is a potential solution which provides continuous blood pressure readings over 24 hours. This method improves the accuracy of hypertension diagnosis, helps in identifying patterns such as nocturnal hypertension, and allows for more individualised.[6]

In the present study, 119 patients of 19-65 age group were included with mean age of 44.9±10.9 years. A study by **Anstey D Edmund et al.**[6] aimed to diagnose masked hypertension included 408 patients with median age of 40.1±12.9 years which was almost similar to our study. A study by **Larsen, Timothy R et al.**[7] to study masked hypertension included 73 patients with mean age of 49.8±13 years.

In this study, there were 52.1%males (n=62) more than 47.9% (n=57) females showing even distribution. A study by **Paula Daniela P et. al.**[8] to examine patterns of blood pressure variation throughout day and night included 782 patients of which 50.2% were males and 49.8% were females, consistent with our study. A study by **Aristizábal-Ocampo, Dagnovar et al.**[9] to study ABPM profiles included 7434 patients of which 54.8% were males, almost similar to our study.

In this study, distribution of patients in various office SBP categories was as 17.6%, 7.6%, 28.6% and 46.3% among optimal, normal, high normal and hypertension categories respectively. For DBP it was 23.5%, 23.5%, 7.6% and 45.4% among optimal, normal, high normal and hypertension categories respectively. A study by **Mahmmud Azra et.al.**[10] to study ambulatory blood pressure phenotypes included 428 patients. The prevalence of optimal normal and high normal categories among treated patients was 9.5%, 10.7%, 17.6%, and 62% respectively. This study had higher prevalence of hypertension as compared to our study as it included 22% untreated patients. A study by **Valee Alexendre et.al.**[11] to study patterns of hypertension in france included 2105 patients for analysis and 48.9% of them were treated. 49.7% among treated patients had controlled blood pressure. These results were consistent with our study.A study by **Barega Binyam et al.**[12] to study blood pressure control among hypertensive adults included 369 patients and medicine adherence rate was 91% and 39.8% patients had their blood pressure

controlled. The control rate was lower in this study as compared to our study which could be due to inclusion of higher age groups and patients with comorbidities like chronic renal failure.

In the present study, among 119 patients, 63% had controlled mean 24-hour systolic blood pressure (SBP), 63% had controlled mean 24-hour diastolic blood pressure (DBP), 65% had controlled mean daytime SBP, 71% had controlled mean daytime DBP, 53% had controlled mean nighttime SBP, and 50% had controlled mean nighttime DBP. A study by **Mahmmud Azra et.al.**[10] to study ambulatory blood pressure phenotypes included 48 patients and prevalence of hypertension among treated patients was 68%, 56% and 86.5% for 24 hour mean, mean day time , mean night time blood pressure categories respectively. A study by **Nabil Naser et.al.**[13] to study BP control in hypertensive patients include 2514 patients, out of which 803 were treated and ambulatory BP control rate was 32.7%. The prevalence was higher in these studies due to inclusion of higher age groups and untreated patients.A study by **Youssef Ghada et al**[14] to study prevalence of masked hypertension included 199 hypertensive patients on treatment and 33.2% of patients were having uncontrolled hypertension according to 24 hour mean blood pressure. It was 27.1% and 57.2% for day time and night time blood pressures. These results were consistent with our study.

In this study, the mean left ventricular mass index (LVMI) was significantly higher in patients with daytime SBP load >30% (127.1332 vs. 87.6358), daytime DBP load >30% (123.7669 vs. 96.0166), nighttime SBP load >30% (122.2124 vs. 85.4371), and nighttime DBP load >30% (118.9678 vs. 81.5787) than in those with BP loads <30%. A study by **Falqui Valeria et al.**[15] to study BP load, concluded that patients with higher BP load had higher LVMI (p-value <0.0001). A study by **Eyal Ophir and Iddo Z Ben-Dov**[16], a meta-analysis to study the role of blood pressure load in ABPM, included around 18,600 patients from studies over the last 30 years and concluded that a significant correlation exists between LVH and blood pressure load, as has been demonstrated by various studies in the last 30 years. A study by **Liu Ming et al.**[17] to study the correlation between BP load and target organ damage included 869 patients and found that LVMI increased significantly increasing BP load similar to our study.

In this study, mean LVMI increased with the increasing stage of hypertension (p value= 0.001) for both SBP and DBP. A study by **Odili Augustine N et al.**[18] to compare office and home

blood pressure related LVH in various ethnicities included 954 patients and compared office BP and home BP for relation with LVH and its variation with black and white race. It was found that office BP correlates directly with LVH. A study by **Schwartz Joseph E et al.**[19] to study correlation of office, home and ambulatory blood pressure with LV mass included 408 participants and it was found that office SBP and DBP correlates directly with left ventricular mass index when adjusted for age, sex, race, ethnicity, body mass index and diabetes mellitus (p value <0.001). We found similar findings in our study.

In the current study, the mean left ventricular mass index (LVMI) was significantly higher in patients with elevated ABPM parameters, indicating a strong correlation between increased blood pressure and LVH. A study by **Gómez-Marcos et al.**[20] involving 1,544 subjects found that patients with LVH had higher values of 24-hour SBP and DBP, as well as higher awake and asleep SBP, showing a significant relationship between ambulatory blood pressure monitoring (ABPM) parameters and LVH similar to our study

CONCLUSION

In this study of 119 patients, it was concluded that there is a direct positive correlation between ABPM and office BP parameters and left ventricular mass index, which represents LV geometry and is marker of target organ damage. Routine screening and inclusion of ABPM in clinical practice is suggested for better control of hypertension which is known to be associated with adverse cardiovascular events.

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