

A Study on Lipid Profile in Hypertensive Patients

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Abstract

Background: Hypertension and dyslipidemias are major risk factors for Coronary artery disease. It is well known that diabetes mellitus associated with dyslipidemias. But hypertension associated with abnormal lipid profile Also can occur. Various studies Have shown that lipid levels are abnormally high in Hypertensive patients compared to control group. It appears that Dyslipidemias and hypertension may also have synergistic effect on atherosclerosis.

Aim and Objective: (1) To study the lipid values in hypertensive individuals. (2) Comparison of lipid values between smokers and non smokers with hypertension. (3) Comparison of lipid values between obese and non obese patients with hypertension. (4) Age wise distribution of hyperlipidemia.

Material and Methods: This prospective randomized clinical study entitled "A Study on Lipid Profile in Hypertensive Patients" A cross-sectional study was conducted after clearance from Board of Studies and Ethical committee in the Department of General Medicine at Rajshree medical and research institute and hospital during the period 2021-2022. The total sample size was determined to be 157 patients.

Results: Among study population, majority belonged to 40-50 years age group (52.9%) followed by 51-60 years (31.2%) and above 60 years (15.9%). The risk factors reported were Obesity (52.2%), Smoking (66.9%) and Alcohol (44.6%).

Among the hypertensive patients Raised Total Cholesterol, LDL and Triglycerides was reported as 61.8%, 49.0% and 65.6% respectively. Low HDL was reported among 58.6% subjects.

There was a significantly positive correlation of age with Total Cholesterol, LDL, Triglycerides (61.8%, 49%, 65% respectively). Low HDL was reported among 58.6% subjects. There was a significantly negative correlation of age with HDL.

Raised Total Cholesterol, LDL and Triglycerides was significantly more among smokers (73.1%, 59.6% and 75.0% respectively) compared to non-smokers (56.2%, 43.8% and 61.0%).

Raised Total Cholesterol, LDL and Triglycerides was significantly more among obese people (96.3%, 92.7%, and 92.7% respectively) low HDL (100%) was significantly more among obese people.

Conclusion: In the research area hypertension individuals had a significant frequency of abnormal lipid profiles and poorly managed blood pressure, according to the study findings.

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Significantly more overweight and obese individuals had hypertension than normal.

There was significantly positive correlation of age, smoking, Obesity with total cholesterol, triglycerides, LDL, VLDL and negative correlation with HDL.

Keywords: Hypertension; Lipid Profile; Obesity; Dyslipidemia.

INTRODUCTION

Coronary artery disease, stroke, heart failure, renal failure are all substantial independent risk factors for hypertension (JNC 8).¹ New ACC/AHA guidelines cite the definition of hypertension as when blood pressure is consistently more than or equal to 130 mm Hg and/or 80 mm Hg.

High risk individuals initiate drug therapy when Blood pressure is $\geq$ or equal to 130/80 mmHg.

Non high risk individuals initiate drug therapy when Blood pressure is $\geq$ or equal to 140/90 mmHg.

Target blood pressure is 130/80 among the age group of above 65 years and committee made diastolic blood pressure is < 80 mmHg.

New BP categories according to ACC/AHA new guidelines.²

Elevated 120-129 mmHg systolic, < 80 mmHg diastolic.

Stage 1: Hypertension 130-139, systolic or 80-89 mmHg diastolic.

Stage 2: Hypertension ≥ 140 mmHg systolic or ≥ 90 mmHg diastolic.

These groups shouldn't be based on blood pressure readings taken at one particular moment. However, this should be supported by two or more readings taken at least twice apart. Pre-hypertension BP category is no longer utilized. The 4 different pharmaceutical classes that are frequently used as first line treatment for hypertension are Thiazide diuretics, Calcium channel antagonists, ACE inhibitors, or ARBS.

Unless a coexisting condition makes the use of a different pharmacological class more appropriate. 2018 recommendations from the ACC/AHA state: (3) elevated triglycerides $\geq$ or equal to 175 mg/dl Elevated LDL levels $\geq$ or equal to 190 mg/dl increases the chances of cardiovascular atherosclerotic diseases one of the most important risk factors for cardiovascular disease worldwide is hypertension. India by 2020, according to a World Health Organization (WHO) study.

The leading causes of disability and mortality will be cardiovascular illnesses. By 2020, it is anticipated that over 26 million Indians would pass away from coronary heart disease.

Hypertension is a significant public health concern In both industrialized and developing nations. Oxidative stress is linked to hypertension, dyslipidemia, and cardiovascular disease, which collectively account for 30% of all fatalities

worldwide.⁴ A change in the ratio of LDL and HDL atherogenic subfraction to the other may leads to the development of hypertension, obesity, metabolic syndrome, insulin resistance, and, finally diabetes mellitus.⁵⁻⁸

Evaluation of the lipid profile in normotensive individuals would enable early, precise pharmacological intervention in vulnerable patients if dyslipidaemia is associated with development of hypertension. This strategy may delay the onset of hypertension or perhaps prevent it (and any consequences that may result) completely. Given that hypertension is one of the important epidemiological problems in the world, this strategy would probably lead to significant improvements in public health.⁹ It is commonly known that hypertension and dyslipidemia are related to each other and these two conditions may raise the risk of developing coronary heart disease.¹⁰

It is known that Increased blood levels of triglycerides, low density lipoproteins, total cholesterol, and reduced high density lipoproteins (HDL) are the key risk factors for cardiovascular disease.¹¹ More than 80% of hypertensive people in Framingham heart study had atleast one additional risk factor for cardiovascular disease and majority of these risk factors had an atherogenic origin.¹²

The National Cholesterol Education Program Guidelines states that important elements of metabolic syndrome includes essential components such as dyslipidemia and hypertension (Adult Treatment Panel III).¹³ The chance of The multiplicative effect of dyslipidemia and hypertension in the coexistence of cardiovascular disease is greater than the sum of the individual risk factors.¹⁴⁻¹⁷

AIM

To Study the Lipid Profile in Hypertensive Patients.

OBJECTIVES

1. To study the lipid values in hypertensive individuals.
2. Comparison of lipid levels between smokers and non smokers with hypertension.
3. Comparison of lipid levels between obese and non obese hypertensive patients.
4. Age wise distribution of hyperlipidemia in selected Hypertensive individuals.

MATERIALS AND METHODS

This cross-sectional study entitled "A Study on Lipid Profile in Hypertensive Patients" was conducted after clearance from Board of Studies and Ethical committee in Rajshree medical and research institute and hospital during the period 2021-2022.

Sample Size:

The study population has been calculated by using G-power software with 80% of the power and 5% of the significance level. The total sample size was determined to be 157 patients.

Formula to determine sample size extracted from principles and practice of biostatistics by J.V Dixit Gupta PK

$$N = 4p(100-p)/d^2$$

Where n ie sample size; p is prevalence; d is absolute precision Taking,

P= Prevalence of hypertensives in India was found to be 11% from National Family Health Survey 4 Data 2015-16.

The calculated sample size was 157 with 95% confidence level and 5% absolute precision.

Sample Design: It was a cross sectional study.

Study Period: 1 year institutional clearance 1/2/2021 to 31/7/2022.

Sampling Technique: Convenience sampling.

Inclusion and Exclusion Criteria

The study subjects were chosen as per the inclusion and exclusion criteria:

Inclusion Criteria:

1. Patients who give written informed consent for study
2. Patients newly detected hypertensives and patients with hypertension on treatment are selected for the study.
3. Study population included patients above 40 years both males and females.
4. Individuals whose blood pressure is more than 140 mm hg that is systolic and diastolic pressure above 90 mm hg were selected bases on JNC VIII criteria and ACC / AHA Stage 2 Hypertension.

Exclusion Criteria

1. Patients with Diabetes mellitus

2. Hypertensive patients with complications such as cerebrovascular disease and cardiovascular disease
3. Patients on lipid lowering drugs
4. Patients with acute illness

Study Procedure:

After approval from the Institutional Ethical committee all patients were selected as per inclusion and exclusion criteria. A detailed history, complete physical examination and routine & appropriate investigations were done for all patients. Pretested predesigned questionnaire will be used for data collection.

Sample Preparation Steps:

1. Following overweight fasting for 12 hours.
2. 10 ml of blood is drawn from ante cubital vein.
3. Serum centrifuged for 10 minutes 5000 rpm.
4. Stored in refrigerator at temperature 4 degrees Celsius.

Laboratory Procedures:

Estimation of serum cholesterol, triglycerides Based on enzymatic calorimetric method (cholesterol oxidase method).

- Estimation of HDL cholesterol-Based on modified Burstein method
- Estimation of LDL cholesterol-Based on total cholesterol, triglycerides, HDL values

$LDL \text{ cholesterol} = \text{Total cholesterol} - \text{triglycerides} / 5 - HDL$

- Estimation of VLDL cholesterol - Approximate VLDL values obtained by dividing plasma triglycerides value by 5

In the selected cases each person was evaluated based on history and physical examination. Laboratory investigations were done and following parameters were looked for:

1. Complete blood count
2. Fasting and post prandial blood sugar
3. Blood urea and serum creatinine
4. Electrolytes – sodium, potassium, chloride and bicarbonate
5. Urine for albumin and sugar
6. Chest X-Ray PA view
7. Electrocardiogram

8. Lipid Profile

- Total cholesterol
- LDL cholesterol
- HDL-Cholesterol
- Triglycerides

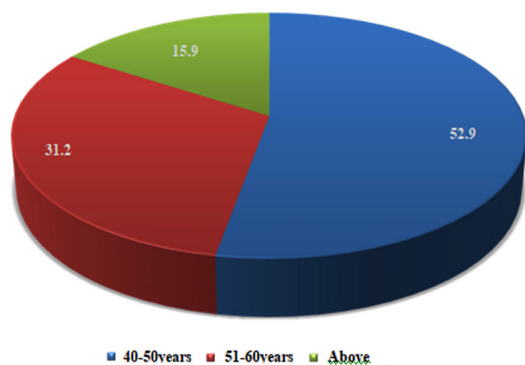
9. Echo cardiography

Table 1: Distribution of study population according to Age

Age Group	Frequency	Percent
40-50 years	83	52.9%
51-60 years	49	31.2%
Above 60 years	25	15.9%

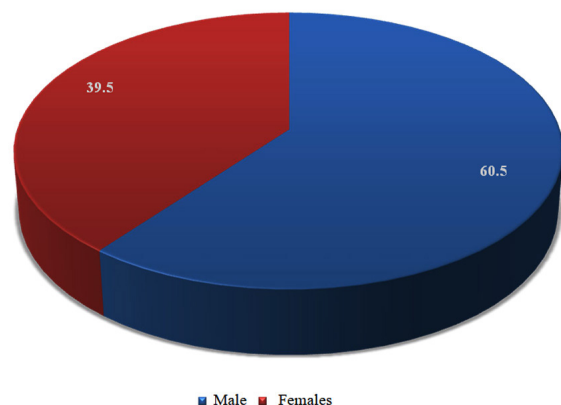
RESULTS

Among study population, majority belonged to

**Table 2:** Distribution of study population according to Gender

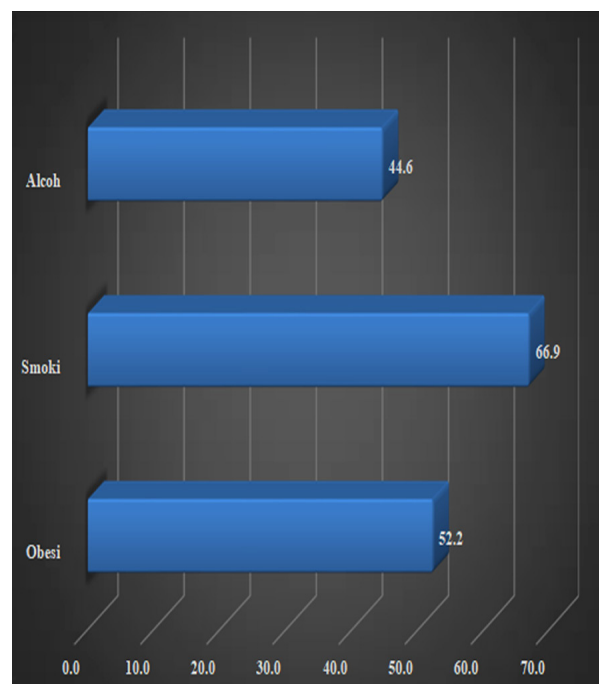
Gender	Frequency	Percent
Male	95	60.5%
Female	62	39.5%

40-50 years age group (52.9%) followed by 51-60 years (31.2%) and above 60 years (15.9%).

**Table 3:** Distribution of study population according to Risk factors

Risk factors	Frequency	Percent
Obesity	82	52.2%
Smoking	105	66.9%
Alcohol	70	44.6%

There were 95 (60.5%) males and 62(39.5%) females in this selected study population.

**Table 4:** Distribution of study population according to Lipid profile

-	Mean	Std. Deviation	Minimum	Maximum
Total Cholesterol	241.27	20.98	206.00	322.00
Trigly- cerides	216.33	40.32	142.00	278.00
HDL	36.34	11.60	5.00	58.00
LDL	153.96	26.75	110.00	198.00
VLDL	36.21	14.50	20.00	67.00
TC/HDL	8.20	7.25	3.55	50.80
LDL/HDL	5.34	4.83	1.90	32.80

The risk factors reported were Obesity (52.2%), Smoking (66.9%) and Alcohol (44.6%).

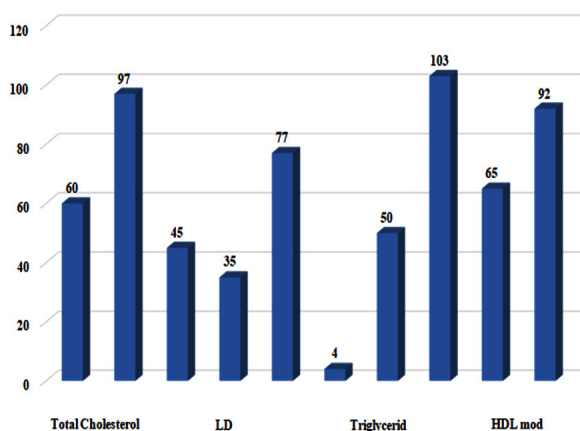
The mean Total cholesterol was 241.27 ± 20.98 , Triglycerides was 216.33 ± 40.32 , HDL was $36.34 \pm$

Table 5: Distribution of Hypertensive study population according to changes in frequency of lipid profile.

-		Frequency	Percent
Total Cholesterol	Borderline	60	38.2%
	Raised	97	61.8%
LDL	Normal	45	28.7%
	Borderline	35	22.3%
	Raised	77	49.0%
Triglycerides	Normal	4	2.5%
	Borderline	50	31.8%
	Raised	103	65.6%
HDL	Normal	65	41.4%
	Low	92	58.6%

11.60, LDL was 153.96 ± 26.75 , VLDL was 36.21 ± 14.50 , TC/HDL was 8.20 ± 7.25 and LDL/HDL was 5.34 ± 4.83 .

Raised Total Cholesterol, LDL and Triglycerides was reported among 61.8%, 49.0% and 65.6% respectively. Low HDL was reported among 58.6% subjects.



Data revealed that levels of total Cholesterol, LDL, HDL, triglycerides adversely affected Among those hypertensive Patients selected for this study.

Here the graph showing frequency of changes in Lipid profile on x axis, hypertensive study population on y axis.

There is significant raise in Total Cholesterol in 97 patients out of 157.

There is significant raise in LDL cholesterol in 77 patients out of 157.

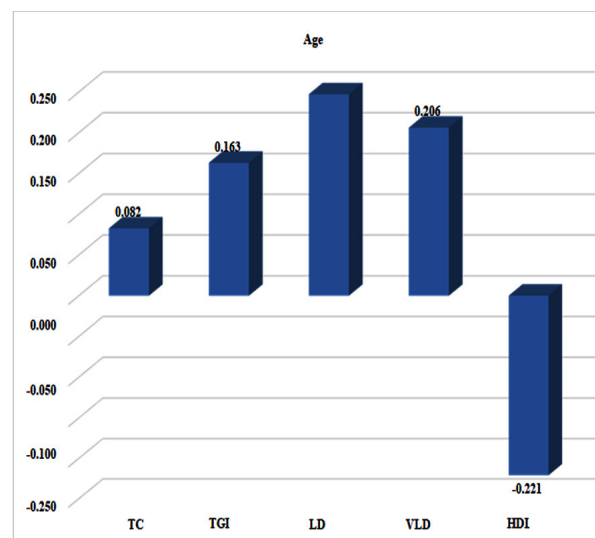
Table 6: Distribution of study population according to Lipid profile with age

-		Age
Total Cholesterol	Pearson Correlation	0.082
	p-value	0.305
Triglycerides	Pearson Correlation	0.163
	p-value	0.041*
LDL	Pearson Correlation	0.247
	p-value	0.002*
VLDL	Pearson Correlation	0.206
	p-value	0.009*
HDL	Pearson Correlation	-0.221
	p-value	0.005*

There is significant raise in triglycerides in 103 patients out of 157.

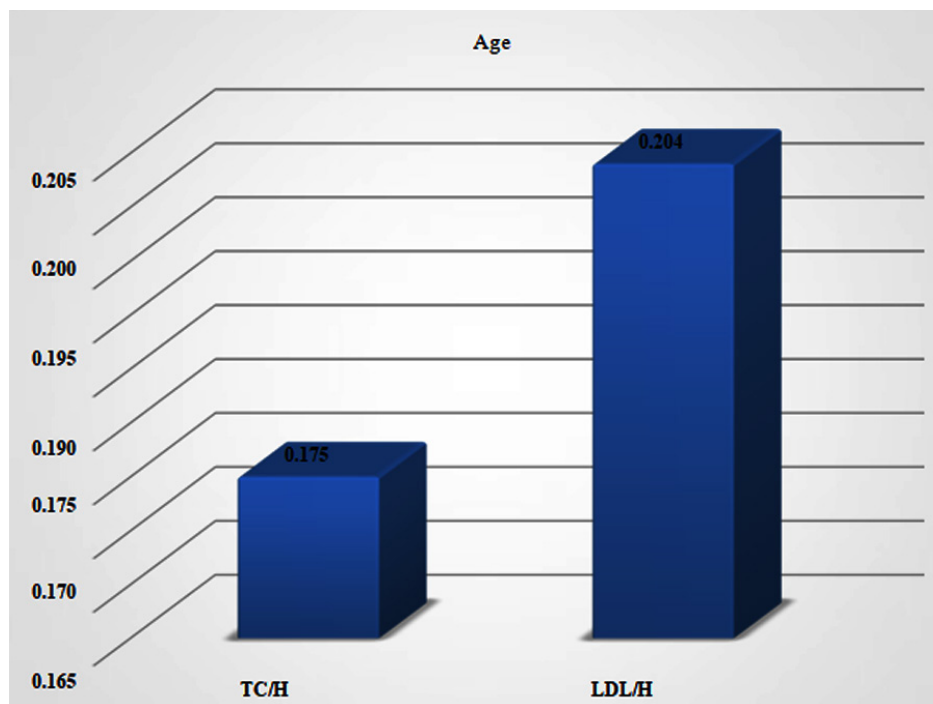
Low HDL was reported in 92 patients.

There was a significantly positive correlation of age with total cholesterol, LDL, triglycerides

**Table 7:** Distribution of study population according to age group

-		Age
TC/HDL	Pearson Correlation	0.175
	p-value	0.029*
LDL/HDL	Pearson Correlation	0.204
	p-value	0.010*

and VLDL. Low HDL was reported among 58.6% subjects. There was a significantly negative

**Table 8:** Distribution of study population according to distribution of lipid profile according to age group

		Age groups			p-value	
		40-50 years	51-60 years	Above 60 years		
Total Cholesterol	Borderline	5	15	40	0.016*	
		20%	30.6%	48.2%		
LDL	Raised	20	34	43	0.001*	
		51.8%	69.4%	80.0%		
	Normal	5	10	30		0.001*
		20%	20.4%	36%		
Borderline	3	4	28	0.001*		
	12%	8.2%	37%			
Raised	17	25	35		0.001*	
	30.1%	71.4%	68.0%			
Triglycerides	Normal	4	0	0		0.001*
		4.8%	0.0%	0.0%		
	Borderline	6	8	36	0.007*	
		43.4%	12.2%	32.0%		
Raised	17	43	43	0.007*		
	51.8%	87.8%	68.0%			
HDL	Normal	44	13		8	0.007*
		53.0%	26.5%		32.0%	
	Low	17	36	36	0.007*	
		47.0%	73.5%	68.0%		

correlation of age with HDL.

There was a significantly positive correlation of age with Total Cholesterol/HDL and LDL/HDL.

Raised Total Cholesterol, LDL and Triglycerides was significantly more among above 60 years age group. Low HDL was significantly more among above 60 years age group.

Data revealed that levels of total Cholesterol, LDL, HDL, triglycerides adversely affected Among those patients aged above 60 years compared to those who aged less than 60 years. Raised total cholesterol levels in 40-50 years age group, 51-60

years age group, above 60 years is 51.8%, 69.4%, 80% respectively. Raised triglycerides levels in 40-50 years age group, 51-60 years age group, above 60 years is 51.8%, 68%, 87.8% respectively. Raised LDL levels in 40-50 years age group is 30.1%, 51-

Table 9: Distribution of study population according to smoking history

		Smoking		p-value
		No	Yes	
Total Cholesterol	Borderline	14	46	0.040*
		26.9%	43.8%	
	Raised	38	59	
		73.1%	56.2%	
LDL	Normal	10	35	0.044*
		19.2%	33.3%	
	Borderline	11	24	
		21.2%	22.9%	
	Raised	31	46	
		59.6%	43.8%	
Triglycerides	Normal	0	4	0.048*
		0.0%	3.8%	
	Borderline	13	37	
		25.0%	35.2%	
	Raised	39	64	
		75.0%	61.0%	
HDL	Normal	19	46	0.384
		36.5%	43.8%	
	Low	33	59	
		63.5%	56.2%	

60 years is 68%, above 60 years it is 71.4%. P value statistically highly significant for total Cholesterol, LDL, Triglycerides and HDL.

Raised Total Cholesterol, LDL and Triglycerides was significantly more among smokers (73.1%, 59.6% and 75.0% respectively) compared to non-smokers (56.2%, 43.8% and 61.0% Respectively data reveal that the levels of total Cholesterol, LDL, HDL and TG are adversely affected among smokers Compared to non smokers.

Adjusted levels among smokers were about 7% lower for HDL and 14% higher for TG, 15% higher for LDL, 21% Higher for total Cholesterol all are undesirable associations. Prevalence of abnormal or low levels of HDL among smokers was 8.3% higher than non smokers.

The prevalence of abnormal or elevated levels of TG was 3.7% higher among smokers than non smokers. Odds of having abnormal levels for smokers was about 60% higher for HDL and about

Table 10: Distribution of study population according to obesity

		Obesity		P-value
		No	Yes	
Total Cholesterol	Borderline	57	3	0.001*
		76.0%	3.7%	
	Raised	18	79	
		24.0%	96.3%	

LDL	Normal	44	1	0.001*
		58.7%	1.2%	
	Borderline	30	5	
		40.0%	6.1%	
Triglycerides	Normal	1	76	0.001*
		1.3%	92.7%	
	Borderline	4	0	
		5.3%	0.0%	
HDL	Normal	44	6	0.001*
		58.7%	7.3%	
	Low	27	76	
		36.0%	92.7%	
		65	0	0.001*
		86.7%	0.0%	
		10	82	
		13.3%	100.0%	

31% higher for TG than non smokers.

P-value statistically significant 0.040 for total Cholesterol, 0.048 for LDL, 0.048 for triglycerides.

Table 11: Distribution of study population according to obesity

	Obese		Non-Obese		Mean Difference	t-test value	p-value
	Mean	Std. Deviation	Mean	Std. Deviation			
Total Cholesterol	252.85	13.48	226.91	18.81	25.95	9.099	0.001*
Triglycerides	245.94	24.93	187.09	34.38	58.84	11.250	0.001*
HDL	26.82	6.69	45.84	8.09	-19.02	-14.789	0.001*
LDL	178.81	14.07	129.17	11.09	49.63	23.084	0.001*
VLDL	41.87	17.77	33.32	10.89	8.55	3.457	0.001*
TC/HDL	11.74	10.40	5.13	1.13	6.61	5.468	0.001*
LDL/HDL	8.17	6.62	2.91	0.60	5.26	6.853	0.001*

Raised Total Cholesterol, LDL and Triglycerides was significantly more among obese people.

Low HDL was significantly more among obese people.

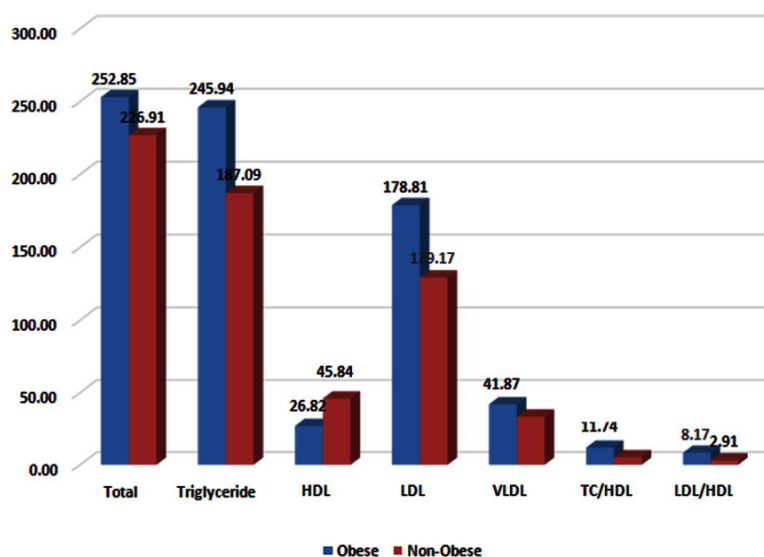
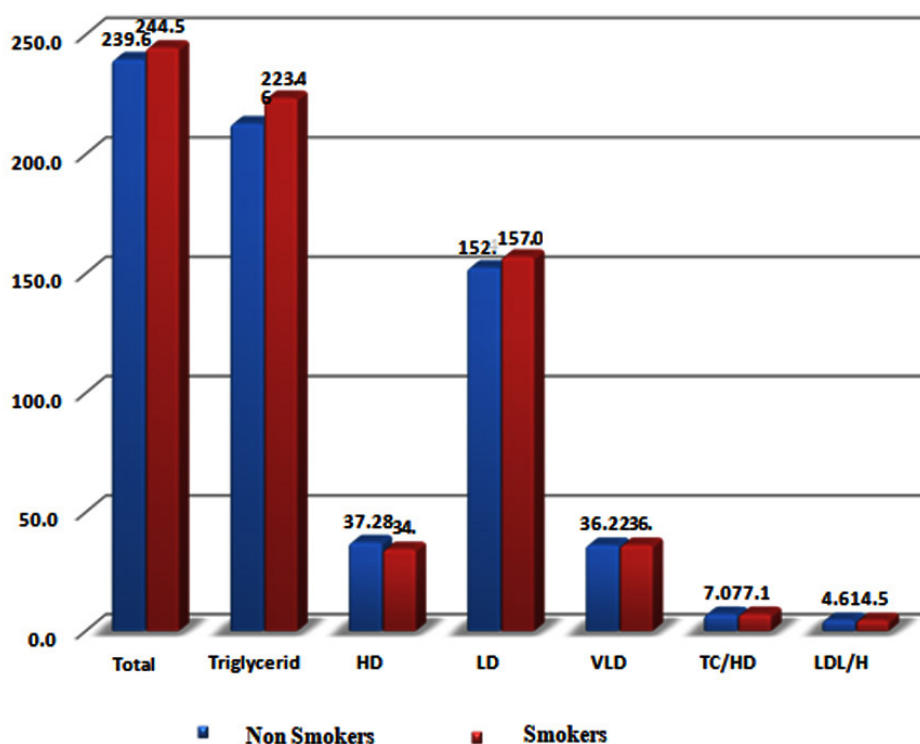


Table 12: Distribution of study population according to

	Non Smokers		Smokers		Mean Difference	t-test value	p-value
	Mean	Std. Deviation	Mean	Std. Deviation			
TC	239.64	21.41	244.56	19.87	-4.92	-1.387	0.04
TGL	212.80	42.83	223.46	33.98	-10.66	-1.566	0.119
HDL	37.28	10.91	34.46	12.79	2.81	1.436	0.03
LDL	152.44	27.27	157.04	25.66	-4.60	-1.014	0.312
VLDL	36.22	14.84	36.19	13.93	0.03	0.011	0.991
TC/HDL	7.07	2.34	7.10	1.55	-0.03	-0.824	0.305
LDL/HDL	4.61	2.00	4.56	7.74	-0.05	-0.767	0.416

The mean Total Cholesterol, LDL, VLDL, Triglycerides, TC/HDL and LDL / HDL was

significantly more among obese people. Mean HDL was significantly more among non-obese people.



There was significant difference in mean total cholesterol, LDL, VLDL, Triglycerides HDL, TC/HDL and LDL/HDL between smokers and non-smokers.

DISCUSSION

Globally, hypertension is acknowledged as a serious public health issue.¹⁸ It is a well-known risk factor for kidney illnesses, type 2 diabetes, and coronary heart disease.¹⁹

Around 80% of people with hypertension also have co-morbid conditions such as obesity, glucose intolerance, low HDL cholesterol, high LDL cholesterol, elevated triglycerides, etc. Over 50% of people with hypertension have two or more co-morbidities.

Age Group

It was found in our study that majority belonged to 40-50 years age group (52.9%) followed by 51-60 years (31.2%) and above 60 years (15.9%).

Similar to present study, Butola et al.²⁰ reported that maximum hypertensives (52.7%) were in the age group of 50 to 70 years and 132 (88.0%) of them were in the 2nd stage of Hypertension. Agarwal and Pandey et al. stated that the maximum numbers of patients of were between 41-60 years age. The mean age of hypertensive patients and normal individuals is 47.67±1.11 vs 38.39±1.43 years.

Mahapatro et al.²¹ found that most of the study participants belongs to 60-70 years followed by 50-59 years.

Gebrie et al.²² stated that the average age of hypertensive patients was 51.21 (±12.30) years with majority in the age group of 40-59 years.

In a study by Pyadala N et al.¹¹ and Murali Krishna et al.,⁶¹ similar results were seen.¹² These results were at odds with a study conducted by Idemudia et al.,⁶² which discovered that the majority (63%) of study participants were in the 30- to 39-year-old age range.

Gender

In our study, there were 60.5% males and 39.5% females. Butola et al. reported that there were 106 males and 44 female which was in line with our study. Mahapatro et al. found that 44% were female and 56% were male. Agarwal and Pandey. stated that there were 88 males and 71 females. Gebrie et al. stated that were 45% females, and 55% were males.

Risk Factors

The co-morbidities reported were DM (1.9%) and CAD (0.6%). The risk factors reported were Obesity (52.2%), Smoking (66.9%) and Alcohol (44.6%).

Michael et al.²³ stated that connected risk factors for cardiovascular disease that frequently coexist are obesity and hypertension. One of the best preventative methods for lowering blood pressure and total cardiovascular risk is a reduction in body fat. However, it was found that the measures of obesity could not independently predict abnormal lipid levels in individuals newly diagnosed with hypertension.

Gebrie et al. stated that found that the research participants' average BMI was high normal (24.60 kg/m²). About 31% and 10%, respectively, of individuals with hypertension were overweight or obese. Males are less likely to be impacted (18% overweight and 10% obese compared to 13% overweight and 0% obese).

Cholesterol levels In present study, the mean

Total cholesterol was 241.27±20.98, Triglycerides was 216.33±40.32, HDL was 36.34±11.60, LDL was 153.96±26.75, VLDL was 36.21±14.50, TC/HDL was 8.20±7.25 and LDL/HDL was 5.34±4.83.

Agarwal and Pandey stated that among Hypertensives, serum levels of total cholesterol, triglycerides, and LDL-C were 238.31±2.17, 178.34±1.94, and 151.28±1.55 mg/dl, respectively, whereas in people with normotension, the values were 187.01±4.26, 141.48±2.48, and 110.31±2.33 mg/dl, respectively. Patients with hypertension experienced considerably greater amounts. In hypertension individuals, the serum HDL-C was considerably lower than in normotensive participants (44.28±1.82mg/dl vs. 41.24±1.07mg/dl).

Bindu et al.²⁴ found that Serum levels of cholesterol, triglyceride and LDL were 194.2, 152.2 and 122.2 mg/dl respectively in hypertensive patients, whereas in normotensive patients they were 146.4, 110.2 and 102.6 mg/dl respectively. Mahapatro et al.⁴² reported that Compared to controls (186.41±32.12), hypertension patients had a higher mean total cholesterol (202.46±40.12). In comparison to controls (186.41±32.12), hypertension patients' mean triglycerides were higher (161.51±40.61). In comparison to controls (49.16±3.84), cases had lower mean HDL levels (42.86±5.23). Compared to controls (114.12±31.48), cases had a mean LDL that was higher (124.18±36.85).

Pre-hypertensives had significantly higher levels of total cholesterol, LDL, VLDL, and serum triglycerides than normotensives, according to Jani et al. Prehypertensive individuals' HDL levels do not differ significantly from those in normotensive individuals.

According to Forhad et al hypertension subjects had statistically significant higher blood levels of total cholesterol, triglycerides, and LDL-C than normotensive subjects. The study identified a strong correlation between dyslipidemia and hypertension in individuals.

CONCLUSION

In the research area, hypertension individuals had a significant frequency of aberrant lipid profiles and poorly managed blood pressure, according to the study's findings. Significantly more overweight and obese individuals had dyslipidemias than normal. The Hypertensive patients with increasing

age (>60 years) associated with aberrant lipid profile. Modifying hypertension, and dyslipidemia can be accomplished by appropriate dietary adjustments, medical treatment, or a combination of the two. According to this study, hypertension people must go for regular blood pressure and lipid profile checking to help and prevent cardiovascular illnesses.

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