



ISSN: 0975-833X

## RESEARCH ARTICLE

### A COMPARATIVE STUDY ON LIPID PROFILE AND COMORBID FACTORS IN HYPERTENSIVE PATIENTS AND NORMAL SUBJECTS

<sup>1</sup>Srinivas Pai, K., <sup>\*2</sup>Sanjay B. Bhagoji and <sup>2</sup>Anupam Biswas

<sup>1</sup>Department of Biochemistry, K.V.G Medical College and Hospital, Kurunjibhag, Sullia, Karnataka, India

<sup>2</sup>Department of Physiology, K.V.G Medical College and Hospital, Kurunjibhag, Sullia, Karnataka, India

#### ARTICLE INFO

##### Article History:

Received 02<sup>nd</sup> December, 2013  
Received in revised form  
15<sup>th</sup> January, 2014  
Accepted 27<sup>th</sup> February, 2014  
Published online 25<sup>th</sup> March, 2014

##### Key words:

Hypertension,  
Diabetes,  
Hyperlipidemia,  
Triglycerides,  
VLDL.

#### ABSTRACT

**Background and objectives:** Hypertension and abnormalities of lipid profile often co-exist. Several well conducted epidemiological studies have demonstrated that cholesterol levels are significantly higher in hypertensive patients than in age, sex and body mass index matched normotensive patients. Hence this study is undertaken to study the demographic profile of hypertensive patient (sex, age group and other comorbid factors) and Comparison of lipid levels between hypertensive and healthy subjects.

**Methodology:** Present study was conducted in Kasturba Medical College and Hospital, Mangalore on 50 hypertensive and 50 normal subjects aged (30-80 yrs.). Lipid profile was estimated for Total cholesterol (CHOD-PAP Method), HDL Cholesterol (second-generation enzymatic colorimetric method), Triglycerides (GPO-PAD method), LDL-C-[Total cholesterol -(HDL-C+VLDL-C) and VLDL-Cholesterol (VLDL-C). Following were the statistical tests used; CHI - SQUARE TEST, Z - MANN WHITNEY TEST, and H - KRUSKAL WALLIS TEST.

**Results:** All the lipid fractions TC, TGL, LDL-C, VLDL, TC/HDL-C ratio were higher in the hypertensive than those in the healthy controls. This study found no significant difference in hypertensive and non-hypertensive Subjects in relation to veg and non-veg diet. The values of diabetics with hypertension showed no significant increase in mean lipid levels when compared with diabetics without hypertension. There was a very highly significant increase in TC, TG and VLDL (P<0.001) in obese compared to non-obese patients.

**Interpretation and Conclusion:** In the present study group age range was from 30-80 years and mean age was 55 years. Higher numbers of patients of hypertension were seen between age group 50-60 years contributing to 36% of the cases studied. There was no significant difference in the mean values of lipid levels in IHD and non-IHD hypertensives. There was no statistically significant different between the hypertensive and normal subjects in the relation to smoking and alcohol consumption. There are no statistically significant difference in the lipid level with men and women with hypertension. In this study we observed that factors like type of diet, diabetes, smoking, alcohol consumption, age, sex and ischaemic heart disease contributed to the observed results very less when compared with the obesity.

Copyright © 2014 Srinivas Pai et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## INTRODUCTION

"Hypertension" continues to be one of the most common diseases treated by physicians. Ongoing research has better defined the mechanisms and clinical characteristics for this condition and enlarged the score of therapeutic options. It is increasingly clear that high blood pressure although an independent risk factor for adverse clinical events frequently exists as a part of a syndrome of cardiovascular neuroendocrine and metabolic abnormality (John Farmer and Antonio Gotto 1997; Joshi *et al.*, 1993). A systolic blood pressure of 160mmHg now puts patients into the moderate hypertension category, which was recently published in Systolic Hypertension in Elderly Program (SHEP) report, as well as Swedish Trial in Old Patients with hypertension (STOP) trial in Europe, and the Medical Research Council (MRC) trial in Britain provoked these powerful recommendation (JNC VII report). The blood pressure however, is not the only

determinant of cardiovascular damage and the propensity of hypertensive patients to develop target organ damage is markedly influenced by coexisting risk factors such as age, sex, smoking, obesity, diabetes, dyslipidemia and others. Among these factors lipoproteins are fundamental to the atherosclerotic process and greatly affect the impact of hypertension on development of target organ damage and therefore on cardiovascular morbidity and mortality.

## MATERIALS AND METHODS

The present study was conducted in the department of Biochemistry, Kasturba Medical College and Hospital, Mangalore on 50 hypertensive and 50 normal subjects aged (30-80 yrs.). Patients who diagnosed as cases of essential hypertension based on history and on Anti- hypertensive Medication were included. Patient with history of concurrent DM, IHD and h/o Alcoholism, Smoking were included in the study. Subjects were on medication and without any complication. Exclusion criteria; following groups were excluded from the study - Patients with complication of HTN,

*\*Corresponding author: Sanjay B. Bhagoji,*  
Department of Physiology, K.V.G Medical College and Hospital,  
Kurunjibhag, Sullia, Karnataka, India.

renal failure, familial dys epidemic, thyroid disorder & patients on lipid lowering drugs. History was taken from all subjects regarding age, sex, weight, food habits life style, history of HTN and associated medical disorders based on a questionnaire. The subjects were explained the purpose and nature of the study being carried out. Only subjects who gave their informed consent were selected. 5 ml venous blood was collected in a vacutainer from each patient who was fasting overnight (12 – 14 hr). The samples were immediately dispatched to the Biochemistry Lab and the estimation was done using Hitachi 917 auto analyzer for lipid profile. (Total cholesterol, Triglycerides, LDL- Cholesterol, HDL- Cholesterol, VLDL-Cholesterol and Ratio of total cholesterol to HDL –cholesterol) Relevant statistical methods were applied, to see the significance of difference in mean values and to see the correlation between groups. Tests used were CHI – SQUARE TEST, Z – MANN WHITNEY TEST, and H – KRUSKAL WALLIS TEST.

## RESULTS AND DISCUSSION

Refer Table 1. With regard to the diet 41 (82%) patient were found to be non-vegetarians and 9(18%) were vegetarians. 18 (36%) of the patient had concurrent DM while (64%) were non-diabetics. 5 (10%) patients among the 50 had a history of IHD while 28 (56%) were found to be obese. Lifestyle study showed that 15 Patients (30%) were smokers and 20 (40%) was alcoholics. Refer Table 2. There was a very high statistical significant difference ( $P < 0.001$ ) in the mean levels of TC, LDL and TC/HDL in hypertensive and non-hypertensive subjects. There was also a highly significant difference in the levels of TG ( $P = .004$ ) and VLDL ( $P = .007$ ) between the 2 groups compared. There was no statistical significant difference in the HDL level between the 2 groups was observed. Refer Table 3 and Table 4. There was no statistically significant difference in the lipid profile in the different age groups. There was no statistical significant difference was found in the lipid profile between males and females. Refer Table 5. There was no significant difference in the lipid profile between vegetarian and non-vegetarians. There was no significant difference in the mean values of lipid levels in IHD and non-IHD hypertensives. There was no significant difference in the mean values of lipid levels in Diabetic and non-diabetic Hypertensives. There was very highly significant difference ( $P < 0.001$ ) in the mean levels of total cholesterol, TG, and VLDL and a highly significant difference in the mean levels of LDL ( $P = .006$ ) and TC/HDL ratio ( $P = .003$ ) between obese and non-obese hypertensive was observed. Also there was no significant difference in the lipid profile between smoker and non- smoker hypertensives and also between alcoholic and non-alcoholic hypertensive. The present study has shown that all the lipid fractions TC, TGL, LDL-C, VLDL, TC/HDL-C ratio were higher in the hypertensive than those in the healthy controls, which is in accordance with most of the previous reports by various workers. In the present study all the lipid fractions were elevated except HDL-C, which was normal in most of the cases. The increase in TC, LDL and TC/HDL ratio was statistically very highly significant in hypertensive subjects compared to healthy controls while the increased level of TG & LDL was highly significant in hypertensive subjects. In the

present study group age range was from 30-80 years and mean age was 55 years.

**Table 1. Frequency distribution table for hypertensive patients**

		Frequency	Percentage
SEX	Male	34	68.0
	Female	16	32.0
DIET	Non-veg	41	82.0
	Veg	9	18.0
DIABETESMELLITUS	Present	18	36.0
	Absent	32	64.0
SMOKING	Present	15	30.0
	Absent	35	70.0
ALCOHOL	Present	20	40.0
	Absent	30	60.0
OBESITY	Present	28	56.0
	Absent	22	44.0
ISCHAEMIC DISEASE	Present	5	10.0
	Absent	45	90.0

**Table 2. Comparison of lipid profile between hypertensive and non hypertensive subjects**

	GROU	N	Mea	Std.	Z
TC	Case	50	230.220	42.7757	$p < 0.001$ vhs
	Contro	50	197.680	26.2199	
TG	Case	50	199.300	88.0251	$p = .004$ hs
	Contro	50	153.820	72.8489	
LDL	Case	50	146.860	33.2541	$p < 0.001$ vhs
	Contro	50	118.580	27.0389	
HD	Case	50	43.900	9.7797	$p = .168$ ns
	Contro	50	46.400	8.9397	
VLDL	Case	50	39.272	17.6651	$p = .007$ hs
	Contro	50	30.556	14.5336	
TC/HDL	Case	50	5.313	1.2552	$p < 0.001$ vhs
	Contro	50	4.352	.8857	

vhs=Very highly significant., hs= Highly significant, ns= Not significant.

\*Mean values are in mg/dl

**Table 3. Age distribution of lipid profile in hypertensives**

AGE (yrs)	TC (mg/dl)	TG (mg/dl)	LDL (mg/dl)	HD (mg/dl)	VLDL (mg/dl)	TC/HDL (mg/dl)
30-40	220.7	188	139	43	37	4.9
40-50	225	181	145	44	36	5.1
50-60	231	204	148	43	39	5.3
60-70	253	251	158	44	49	5.9
70-80	186	123	121	41	24	4.7

**Table 4. Sex wise distribution of lipid profile in hypertension**

	SEX	N	Mean	Std.	Z
TC	M	34	237.823	43.4932	$P = .086$ NS
	F	16	214.062	37.4975	
TG	M	34	210.941	95.1747	$P = .248$ NS
	F	16	174.562	66.5091	
LDL	M	34	152.29	33.7939	$P = .124$ NS
	F	16	35.312	29.8456	
HD	M	34	43.911	8.7503	$P = .803$ NS
	F	16	43.875	11.9993	
VLDL	M	34	41.423	19.2174	$P = .9470$
	F	16	34.700	13.1953	
TC/HDL	M	34	5.417	1.2767	$P = .8740$
	F	16	5.092	1.2183	

\*Mean values are in mg/dl

**Table 5. Distribution of lipid profile with comorbid factors in hypertension**

	N	TC	TG	LDL	HD	VLDL	TC/HDL
DIET V NV	9	Z=1.023	Z=1.515	Z=0.493	Z=0.130	Z=1.415	Z=0.480
	41	P=0.306	P=0.130	P=0.622	P=0.99	P=0.157	P=0.631
SMOKING +	15	Z=1.334	Z=1.57	Z=1.51	Z=0.92	Z=1.23	Z=1.31
-	35	P=0.182	P=0.115	P=0.13	P=0.35	P=0.215	P=0.18
ALCOHOL +	20	Z=1.93	Z=1.08	Z=1.60	Z=0.99	Z=1.13	Z=0.79
-	30	P=0.05	P=0.27	P=0.109	P=0.32	P=0.25	P=0.42
OBESITY +	28	Z=3.91	Z=3.88	Z=2.75	Z=0.46	Z=3.98	Z=2.92
-	22	P<0.001	P<0.001	P=0.006	P=0.64	P<0.001	P=0.003
DM +	18	Z=0.92	Z=0.92	Z=1.1	Z=0.08	Z=0.63	Z=0.38
-	32	P=0.35	P=0.35	P=0.24	P=0.93	P=0.52	P=0.70
IHD +	5	Z=0.93	Z=0.30	Z=1.06	Z=1.06	Z=0.35	Z=1.57
-	45	P=0.34	P=0.75	P=0.28	P=0.28	P=0.72	P=0.11

V= vegetarian, NV= non-vegetarian, + = present, - = absent

Higher numbers of patients of hypertension were seen between age group 50-60 years contributing to 36% of the cases studied. In the present study there were 34 males and 16 females. The present study was compared with PROCAM trial data analysis, which showed that prevalence of hypertension strongly increases with age in both sex. In the present study no significant difference was found in the different age groups and no difference was seen between males and females too. Castilli and Anderson (1986) had supported that blood pressure and serum cholesterol are correlated with 'r' factor of 0.12 suggesting that those with higher blood pressure values tend to have higher serum cholesterol in Framingham heart study. Coronary heart disease developed with great consistency in patients with a ratio of total cholesterol to HDL-C of more than 4.5. Half of the women and more than half of the men who presented with hypertension were already having abnormal lipid profile. (Castelli and Anderson 1986) Bonna and Thelle (1991) have supported that in both sexes total and non HDL-C level increased significantly with increasing systolic or diastolic blood pressure. The association between blood pressure and total cholesterol level increased with age in women but decreased with age in men. Smoking, physical activity and alcohol consumption had little influence on the association between blood pressure and serum lipids. (Kaare and Bonna, Dag 1991) Chen Y-DI *et al.* (1991) in their study found that mildly hypertensive patients appears to have faster catabolic rate of Apo-AI/ HDL and lower HDL-C concentration. (Ida Chen *et al.*, 1991) Assmann and Schulte (1987) in his study showed that more than 10% of men and less than 5% of women under 30 years of age were hypertensive and 27% of both men and women aged 40-49 years and 43% of women and 37% of men aged 50-59 years were hypertensive. (Assam and Schulte 1987) This study found no significant difference in hypertensive and non-hypertensive Subjects in relation to veg and non-veg diet. In a study by Melby *et al.* (?) it was found that blood pressure and blood lipid levels were measured and compared for three groups of seventh day Adventist African-American adults including vegetarians, semi vegetarians [1 to 3 servings of meat /week] And non-vegetarians. The vegetarian group had the least cases of hypertension and the lowest serum cholesterol. In another study by Mann *et al.* (?) it was found that saturated animal fat and cholesterol are the primary contributors to ischaemic heart disease. Studies have shown vegetarians to have lower blood pressure than non-vegetarians.

A vegetarian diet has also been shown to reduce blood pressure in hypertensive patients. Manninen *et al.* (1992) in the Helsinki heart study and Misra *et al.* (1980) found that LDL-C/HDL-C ratio, had more prognostic value than LDL-C and HDL-C alone and hypertriglyceridemia was a strong indicator of short term CAD risk especially when LDL-C / HDL-C ratio was also high (Manninen *et al.*, 1992). In the present study, there was no significant difference in the mean values of lipid levels in IHD and non-IHD hypertensives. Rost and Devis *et al.* (1996) in the Systolic Hypertension in the Elderly Program (SHEP) supported the concept that plasma cholesterol, LDL-C and ratios of TC/HDL-C & LDL-C/HDL-C were significantly higher in CAD men and women (Rost and Devis 1996). In the present study, there was a very highly significant increase in TC, TG and VLDL (P<0.001) in obese compared to non-obese patients. There was a highly significant increase in LDL and TC/HDL ratio (P=. 006) and 0.003 in obese compared to non-obese hypertensives. Raj Lakshman *et al.* (1996) found that plasma triglycerides increased progressively with increasing obesity, whereas HDL decreased with increasing obesity (Raj Lakshman *et al.*, 1996). Bonna (1991) in Tromso study showed that when compared to lean subjects overweight subjects had greater increase in the total cholesterol and triglyceride level with increase in blood pressure (Kaare and Bonna, Dag 1991). In the present study, there was no statistically significant difference between the hypertensive and normal subjects in relation to smoking and alcohol consumption. Rastogi *et al.* (1989) in study of lipid profile in smokers found that mean value of HDL-C in smokers was significantly lower in all groups of smokers as compared to non-smokers. The changes in mean levels were maximum in heavy smokers and persons smoking for more than 20 years (Rastogi and Shrinivastava 1989). Gar and Vidhulekha Garg (q982) showed that serum cholesterol, triglycerides and lipoproteins showed no significant changes while serum free fatty acids rise significantly immediately after smoking in control subjects as well as in hypertensive subjects (Garg *et al.*, 1982). In this study it was observed that the values of diabetics with hypertension showed no significant increase in mean lipid levels when compared with diabetics without hypertension. (Suri *et al.*,?) [62] in their study reported that most lipid parameters showed increased levels in diabetics with hypertension. However 45% of the diabetic hypertensive was in the high-risk category of triglycerides. 43% had low HDL levels and 50% of them had a high TC/HDL ratio. The above

findings were in agreement with the study conducted by R K Kotokey *et al.* (?). The Framingham study revealed that HDL-C level was a major potent lipid risk factor having an inverse association with the incidence of CHD both in men and women; the proposed hypothesis that HDL facilitates the uptake of cholesterol from peripheral tissue and helps in its transport to liver for degradation and excretion. However lower the HDL level, higher the LDL levels and TC/HDL ratio are more predictive of coronary heart disease (William and Castelli 1996).

### Conclusion

All the lipid fractions TC, TGL, LDL-C, VLDL, TC/HDL-C ratio were higher in the hypertensive than those in the healthy controls. The study included 50 cases of essential hypertension of which 16 (32%) were females and 34 (68%) were males between the age groups of 30 – 80 years. In the present study no significant difference was found in the different age groups and no difference was seen between males and females too. In the present study group age range was from 30-80 years and mean age was 55 years. Higher numbers of patients of hypertension were seen between age group 50-60 years contributing to 36% of the cases studied. This study was focused on comparison of lipid profile. The other factors like type of diet, obesity, diabetes, smoking, alcohol consumption, age, sex and ischaemic heart disease may be contributed to the observed results. Among all these comorbid factors obesity was associated with significant increase in lipid profile. So a detailed study about the pathogenesis of Hyperlipidemia and association of the above mentioned factors is must.

### Acknowledgement

Authors would like to thank all the participants of the study. Authors also acknowledge the great help received from the scholars whose articles cited and included in references of this manuscript. The authors are also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

### REFERENCES

- Assam G, Schutle H. 1987. The Prospective cardiovascular Munster study-Prevalence and prognostic significance of hyperlipidemia in men with systemic hypertension. *Am.J. Cardiol*; 59:96-117.
- Castelli W P, Anderson K J. 1986. Apopulation at risk prevalence of high cholesterol level in hypertensive patients in Framingham study. *Am. Med.* 80: supp (2A), 23-32.
- Garg JP, Vishulekha Garg, Gupta RC. 1982. Immediate effect of smoking on serum lipids and lipoproteins in patients with hypertension. *J Post Graduate Medicine*; 28 (3): 163-66.
- Ida Chen Y-D., Wayne H-H Sheu, Arthur, Gearld M. 1991. High density lipoprotein turnover in patients with hypertension. *Hypertension*; 17(3):386-93.
- John Farmer, Antonio Gotto 1997. Dyslipidemia and other risk factors for coronary heart diseases. *Brownwald Heart Disease*, Chapter 35, W.B. Saunder's Company, 5<sup>th</sup> edition, 2:1126-60.
- Joshi P, Kate S, Shegokar V. 1993. Blood pressure trends and lifestyle risk factors in rural India. *JAPI*; 41(9): 579-81.
- Kaare II. Bonaa. Dag S. Association between blood pressure and serum lipids in a population-The Tromso Circulation 1991:83 (4): 1305-13.
- Mannine V, Tenkanen L, Koskin P. 1992. Joint effect of serum triglyceride and LDL cholesterol and HDL cholesterol concentration on coronary heart disease-Risk in the Helsinki heart study: Implication for treatment. *Circulation*; 85:34-45.
- Raj Lakshman M., Domenic Reda, William C, Mahendra D. 1996. Comparison of plasma lipid and lipoprotein profiles in hypertensive black versus white men. *AJC*; 78:1236-41.
- Rastogi R, Shrinivastava S. 1989. Lipid profile in smokers. *JAPI*; 37(12): 764-66.
- Rost PH, Devis BR. 1996. Study of systolic hypertension in elderly patients. *Atherosclerosis*; 12:122-26.
- William P, Castelli. 1996. The triglyceride issue-A view from Framingham. *AHJ*; 112 (2): 432-40

\*\*\*\*\*