



A STUDY ON THE ESTIMATION OF SERUM LIPID PROFILE IN NEWLY DIAGNOSED HYPERTENSIVE PATIENTS

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ABSTRACT

Hypertension or high blood pressure (BP) can lead to heart, renal and cerebral problems. Hypertensives in comparison to normotensives may have an altered lipid profile which can cause vascular diseases. In this study 50 newly diagnosed hypertensive cases with blood pressure greater than 140/90 mmHg and 50 normotensive controls with blood pressure less than 140/90mmHg were selected. Body mass Index (BMI) was calculated and lipid parameters namely Total Cholesterol(TC), Triglycerides (TGL), Low density lipoprotein cholesterol (LDL-C) and High-density lipoprotein cholesterol(HDL-C) were investigated. The newly diagnosed hypertensives had a statistically significant increase in height, weight and BMI when compared to controls. A significant increase in all the lipid parameters except HDL-C was found in the cases when compared to the controls with a p value of <0.01. The paired t test, Chi square statistic and Pearson's correlation analysis also showed significance. These findings were similar to some earlier studies. The HDL-C levels were comparable in both cases and controls. Hence this study highlights the importance of lipid profile investigation in hypertension.

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INTRODUCTION

Hypertension also known as high blood pressure (BP) is a medical condition in which the blood pressure(BP) in the arteries is persistently elevated. Hypertension refers to an increase in systolic BP and diastolic BP. In 2014 The Eighth Joint National Committee on Prevention, Detection, Evaluation and Treatment of Hypertension (JNC-8) recommended a systolic BP of < 140 mm Hg and a diastolic BP of <90 mm Hg for general population younger than 60 years of age¹. The Seventh Joint National Committee (JNC-7) had classified BP as normal (systolic BP <120 mmHg and diastolic BP <80 mmHg), prehypertension (systolic BP 120-139 mmHg or diastolic BP 80-89mmHg), Stage 1 hypertension (systolic BP 140-159 mm Hg or diastolic BP 90-99mmHg) Stage 2 hypertension (systolic BP >160mmHg or diastolic BP >100 mmHg)². Newly diagnosed hypertensives are individuals who for the first time have BP recordings that categorize them into stage 1 or stage 2 hypertension.

High blood pressure can lead to abnormalities in cardiac output, systemic vascular resistance and arterial compliance. The higher the BP there is a greater chance of myocardial infarction, cerebral diseases and renal problems³. Hypertension maybe associated with hyperlipidemia which is an increase in serum lipids that can lead to central and peripheral blood

vessel diseases. An increased blood pressure along with abnormalities in lipid profile can damage the vascular endothelium by increasing the concentrations of reactive molecular species. Lipid profile includes Total Cholesterol TC, Triglycerides TGL, High Density Lipoprotein cholesterol HDL-C and Low Density Lipoprotein cholesterol LDL-C. Although hyperlipidemia is symptomless an increase in serum cholesterol is a major risk factor for cardiovascular diseases. Studies revealed that the mean values of serum TC, TGL and LDL-C were significantly higher among hypertensives when compared to normotensives. The mean HDL-C was lower in hypertensives⁴.

Hypertension is a major independent risk factor for coronary artery disease, stroke, heart failure and renal failure. Studies have shown that hypertension associated with hyperlipidemia can significantly increase the coronary, cerebral, renal and peripheral artery diseases⁵. Early onset of treatment with antihypertensive drugs and lifestyle modifications can reduce the mortality and morbidity. Hence this study was undertaken to detect the newly diagnosed hypertensives with hyperlipidemia.

MATERIALS AND METHODS

A cross sectional case-controlled study was conducted on newly diagnosed hypertensive patients in Apollo general hospital Hyderabad from April 2017 to January 2019.

Prevalence of hypertension in Andhra Pradesh and Telangana is 36 in male and 28 in female⁶. So average prevalence of

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hypertension is 32%. The sample size was calculated from the formula:

$$\text{Sample size} = [Z^2 (1 - \alpha/2) p (1 - p)] / d^2$$

Where n= Sample Size, $Z^2 (1 - \alpha/2) = 1.96$, α = level of significance (95%), p= prevalence (32%), d = Absolute precision (5%). So Sample size was found to be 335.

Informed consent was taken from the volunteered individuals. Approval from the ethical committee of Apollo Institute of Medical Sciences and Research was sought before commencing the study.

RESULTS

Table 1 Measurements and Lipid profile in newly diagnosed hypertensives and normotensives

Measurements	Cases	Controls
	Mean ± SD	Mean±SD
Weight (kg)	69.34 ± 10.57	64.14 ± 7.21
Height (cm)	156.87 ± 7.95	155.24 ± 5.26
BMI(kg/m ²)	28.26 ± 4.31	26.62 ± 2.76
Systolic BP (mm Hg)	145.24 ± 13.07	111.2 ± 7.60
Diastolic BP (mm Hg)	94.9 ± 4.68	75 ± 4.84
TC (mg/dl)	188 ± 42.51	162.38 ± 34.14
TGL (mg/dl)	148.84 ± 83.05	112.1 ± 48.40
HDL-C (mg/dl)	42.14 ± 9.12	40.6 ± 10.11
LDL-C (mg/dl)	116.78 ± 37.21	99.16 ± 27.69
TC / HDL-C ratio	4.57 ± 1.03	4.13 ± 1.03

Note : Cases=Newly diagnosed hypertensives ;Controls = Normotensives Normal range of TC= 150-200mg/dl,TGL=40-140mg/dl,HDL-C = 35-80mg/dl ,LDL-C =107-152mg/dl Mean value of TC,TGL,LDL-C,TC/HDL-C ratio is higher in cases than controls

157 individuals were diagnosed as hypertensives. 77 individuals, who were already hypertensive, were excluded from the study. Among 80 newly diagnosed hypertensives, 50 individuals (16 male and 34 female) had volunteered for the study and were classified as cases. 50 volunteered individuals (16 male and 34 female) who had blood pressure of less than 140 / 90 mm Hg, age matched and sex matched to cases, were selected as controls.

A simple questionnaire was given to the participants which contains preliminary data.

Weight was measured using an electronic weight scale and was recorded to the nearest 0.1 kg. Height was measured using a stadiometer. Subjects were standing on barefoot on a flat horizontal surface, with their heels, buttocks, shoulders and back of the head touching the wall. Body Mass Index (BMI) was calculated by the formula weight/ height² (kg/m²). Subjects with BMI below 18.5 were classified to be underweight, 18.5 to 24.9 to be normal weight, 25 to 29.9 to be overweight and >30 to be obese.

After obtaining written consent fasting blood sample of about 8 ml was drawn from the cases and controls. Serum was separated and analysed for Total Cholesterol (TC) ,Triglycerides (TGL) and Automated High Density Lipoprotein (A-HDL) using the Siemens Dimension autoanalyser. Total cholesterol was estimated by using cholesterol esterase and oxidase method. Serum triglycerides estimated by Glycerol kinase and peroxidase method The A-HDL assay measures High density lipoprotein cholesterol (HDL-C) levels directly.

Table 2 Students t test for newly diagnosed hypertensives and normotensives

Measurements	Cases			Controls				
	Mean ± SD	p value	95% Confidence Interval		Mean±SD	p value	95% Confidence Interval	
			Upper	Lower			Upper	Lower
Weight (kg)	69.34 ± 10.57	<0.0001	66.34	72.34	64.14 ± 7.21	<0.0001	62.09	66.12
Height (cm)	156.87 ± 7.95	<0.0001	154.61	159.12	155.24 ± 5.26	<0.0001	153.75	156.73
BMI(kg/m ²)	28.26 ± 4.31	<0.0001	27.04	29.49	26.62 ± 2.76	<0.0001	27.04	29.49
Systolic BP (mm Hg)	145.24 ± 13.07	<0.0001	141.52	148.96	111.2 ± 7.60	<0.0001	109.04	113.36
Diastolic BP (mm Hg)	94.9 ± 4.68	<0.0001	93.57	96.23	75 ± 4.84	<0.0001	73.62	76.38
TC (mg/dl)	188 ± 42.51	<0.0001	175.92	200.08	162.38 ± 34.14	<0.0001	152.68	172.08
TGL(mg/dl)	148.84 ± 83.05	<0.0001	125.24	172.44	112.1 ± 48.40	<0.0001	98.34	125.86
HDL-C(mg/dl)	42.14 ± 9.12	<0.0001	39.55	44.73	40.6 ± 10.11	<0.0001	37.73	43.47
LDL-C(mg/dl)	116.78 ± 37.21	<0.0001	106.20	127.35	99.16 ± 27.69	<0.0001	91.29	107.02
TC / HDL-C ratio	4.57 ± 1.03	<0.0001	4.28	4.86	4.13 ± 1.03	<0.0001	3.85	4.43

Note : Cases =newly diagnosed hypertensives ;Controls =normotensives <0.0001 was found to be highly significant in all the parameters

p value

During the study period, 355 asymptomatic volunteered individuals in the age group of 40 – 60 years were screened for hypertension. Blood Pressure of the individuals was recorded with the help of a sphygmomanometer by the prime investigator. Individuals who had blood pressure of more than 140 / 90 mm Hg on two successive occasions with an interval of 5 minutes were classified a hypertensives. Individuals suffering from diabetic mellitus, cardiac and renal disorders are excluded.

The HDL-C is oxidized to hydrogen peroxide which forms a coloured dye whose intensity is proportional to serum HDL-C concentration ⁷.

Very low density lipoprotein cholesterol (VLDL-C) and Low density lipoprotein cholesterol (LDL-C) were calculated using the Friedwald equation, (LDL-C= TC – HDL-C – VLDL-C); VLDL-C=TGL/5 ⁸

All the data was fed into a MS Excel and analysed by using IBM SPSS for Windows Version 22. Mean and Standard Deviations were estimated for continuous variables. Paired t-test for cases and controls was used to test statistical significance for the continuous variables and Chi2 test for categorical data. $p < 0.05$ was considered to be significant.

Table 3 Paired t test between newly diagnosed hypertensives and normotensives

Biochemical parameters and blood pressure	Mean difference ± standard deviation	p value	Confidence interval of the difference	
			Lower	Upper
TC (mg/dl)	25.62 ± 56.18	0.002 (<0.01)	9.65	41.59
TGL(mg/dl)	36.74 ± 95.36	0.009 (<0.01)	9.64	63.84
HDL-C(mg/dl)	1.54 ± 14.45	0.455	-2.57	5.65
LDL-C(mg/dl)	17.62 ± 46.04	0.009 (<0.01)	4.53	30.70
TC/ HDL-C ratio	0.43 ± 1.42	0.038 (<0.05)	0.026	0.834
SystolicBP (mm of Hg)	34.04 ± 15.35	<0.0001	29.6	38.4
DiastolicBP (mm of Hg)	19.9 ± 6.185	<0.0001	18.14	21.66

Note: Cases =newly diagnosed hypertensives ;Controls = normotensives

In Paired t test TC,TGL,LDL-C and TC/HDL –C ratio were found to be significantly elevated in newly diagnosed hypertensives when compared to normotensives.

Table 4 Chi square statistic analysis of altered lipid parameters in newly diagnosed hypertensives and normotensives

	Number of altered lipid parameters		Chi square statistic	p value	Odds ratio
	Cases	Controls			
Elevated TC	30	14	3.730	0.05	2.633
Elevated TGL	36	16	5.198	0.023	2.953
Decreased HDL-C	12	13	0.053	0.817	0.899
Elevated LDL-C	2	0	1.010	0.315	0.980

Note: Cases=newly diagnosed hypertensives ,Controls = normotensives.

The Chi Square ,p value and odds ratio were significant for elevated TC and TGL between cases and controls

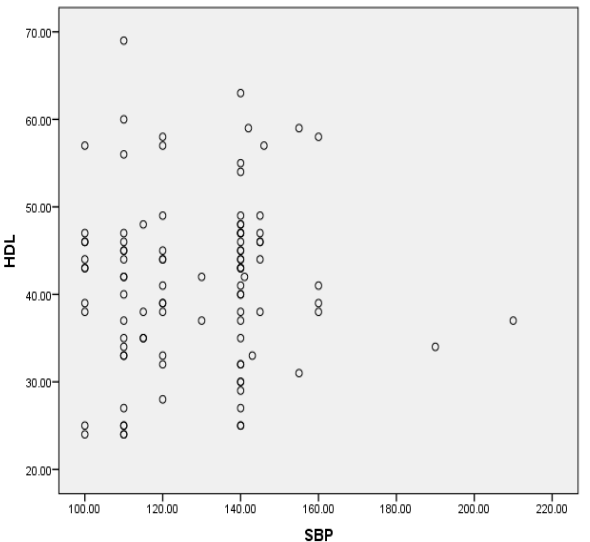
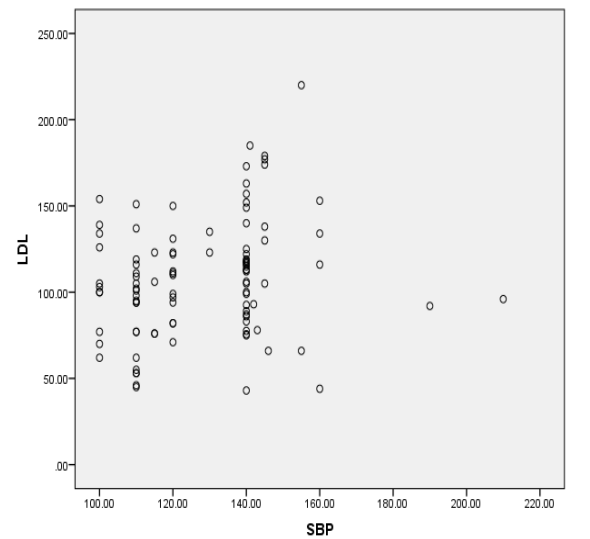
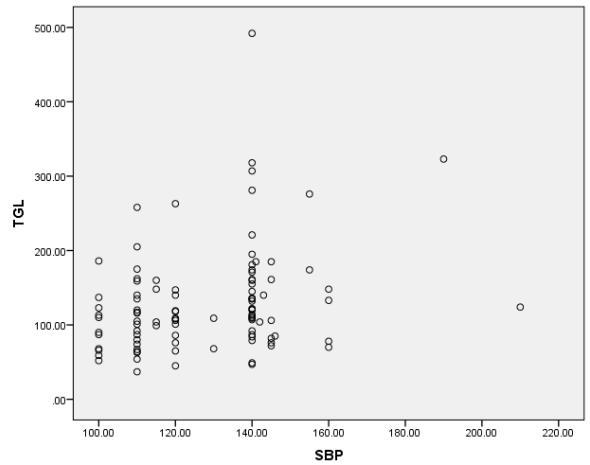
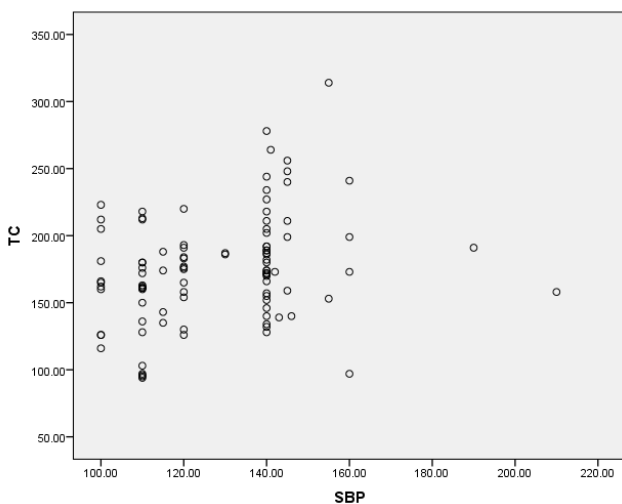


Fig 1 Pearsons r data analysis between various lipid parameters and systolic blood pressure (SBP)

Note: TC,TGL and LDL-C were weakly correlated positively withsystolic blood pressure TC and SBP ($r=0.273,p=0.006$); TGL and SBP ($r=0.275,p=0.006$); LDL-C and SBP($r=0.203,p=0.043$)



No correlation was found between HDL-C and SBP ($r=0.60, p=0.555$)

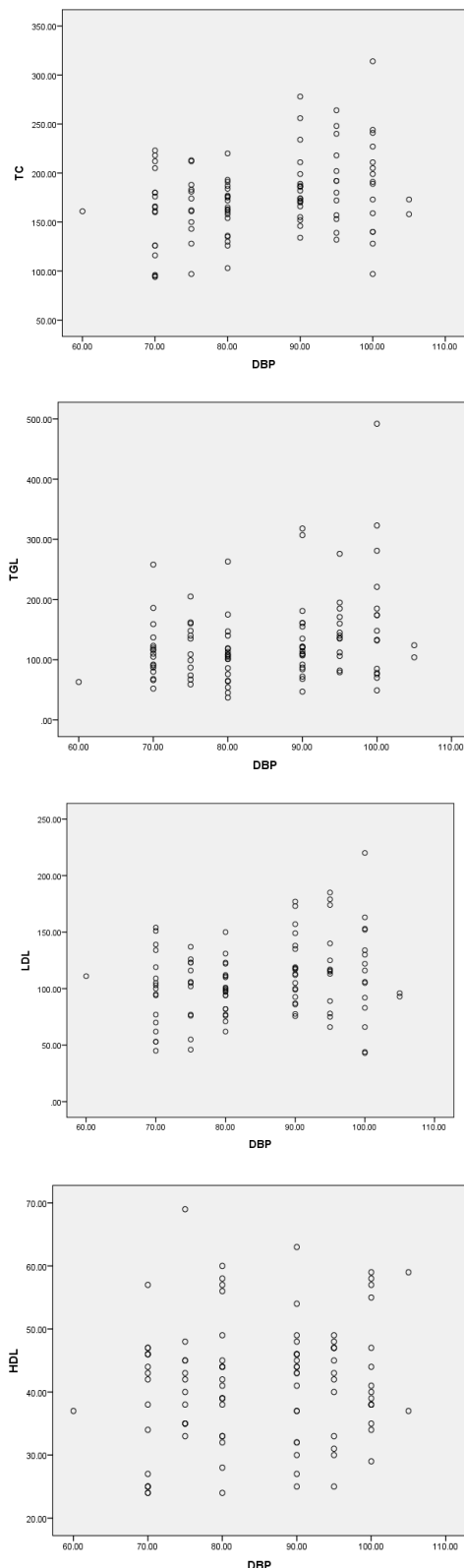


Fig 2 Pearson's r data analysis between various lipid parameters and diastolic blood pressure (DBP)

Note : TC,TGL and LDL-C were weakly correlated positively with diastolic blood pressure TC and DBP ($r=0.296, p=0.003$); TGL and DBP ($r=0.296, p=0.273$) ; LDL-C and DBP ($r=0.219, p=0.028$) No correlation was found between HDL-C and DBP ($r=0.143, p=0.155$)

DISCUSSION

The etiology of most cases of adult hypertension is still unknown despite extensive research over several decades. Preventing and treating hypertension is an important public health challenge due to the increasing morbidity and mortality⁹. Hypertension is known to be associated with alterations in lipid metabolism which gives rise to abnormalities in serum lipid and lipoprotein levels. It has also been documented that presence of hyperlipidaemia substantially worsens the prognosis in hypertensive patients¹⁰. In hypertension there is activation of the rennin angiotensin system. This in turn activates mechanisms that leads to dyslipidemia, inflammation and thrombosis. Endothelial dysfunction causes an increase in vascular permeability to LDL-C which then becomes oxidized LDL in the arterial walls. Proinflammatory and prothrombotic proteins synthesis is increased while nitric oxide (NO) levels are decreased.¹¹ In a Nigeria study of lipid profile in newly diagnosed hypertensives it was found that the cases had higher body mass index, waist circumference, and waist-hip ratio. Also the mean TC, TGL, and LDL-C were significantly higher among the hypertensives. The mean HDL-C was comparable⁹

In his study KN Choudhary revealed that the mean values of serum TC, TGL, and LDL-C were significantly higher and statistically significant among the hypertensive patients compared to normotensives. The mean HDL-C level was lower in the hypertensives compared to normotensives and was statistically significant⁴. Karaa H Bonaa's study of a large population with varied age groups found an increase in total cholesterol among hypertensives and thereby he suggested that an atherogenic lipid profile can increase the risk of myocardial infarction among hypertensive patients¹¹.

Similar results were obtained in the study conducted on prehypertensives and normotensives by Hitesh A Jani .He noticed an increase in TC,TGL,LDL-C and VLDL-C in prehypertensives with no difference in HDL-C levels between the two groups¹².

In our study the newly diagnosed hypertensives or cases had a mean systolic BP of 145.24 ± 13.07 mm Hg and mean diastolic BP of 94.9 ± 4.68 mm Hg while the normotensives or controls had a mean systolic BP of 111.2 ± 7.60 mm Hg and a mean diastolic BP of 75 ± 4.84 mm Hg. These values are statistically significant with a p value <0.0001 . There was a statistically significant increase in the height, weight and BMI of the cases when compared to the controls .The mean TC ,TGL, LDL-C and TC/HDL-C ratio of the cases was also significantly higher when compared to the controls with a p value of 0.0001 . This data is similar to the studies done by Kanwar¹⁰, Bonaa¹¹ and Jain¹².

However two studies by Akintude¹³ and Lepira¹⁴ showed that TC, TGL and LDL-C of newly diagnosed hypertensives did not differ significantly from that of control subjects. Meanwhile in our study the controls had a lower mean HDL-C when compared to the cases. This finding is not observed in most studies but, Akintude and Odenigbo¹⁵ have demonstrated isolated low HDL-C in healthy normotensives.

Hence from this study it is concluded that increased TC, TGL, LDL-C are found in newly diagnosed hypertensives when compared to normotensives and this altered lipid profile may be a risk factor for arterial diseases. The increase in HDL-C in cases when compared to controls may not be significant enough to protect from vascular diseases. Limitations of this study is the small sample size and general lipid profile biochemical parameters.

This study can be improved by extending the area of study and by analyzing specific atherogenic biochemical parameters like Apo A 1 and Oxidised LDL.

Bibliography

1. Eighth Joint National Committee (JNC-8) Guidelines and the outpatient management of hypertension in the African American population. Nicole Abel, Krysta Contino, Navjot Jain, N Am J Med Sci 2015 Oct 7(10) 438-445.
2. Rajeev Mahajan, Joint National Committee 8 report: How it differ from JNC-7. International Journal of Applied Basic Medical Research. 2014 Jul-Dec; 4(2): 61-62
3. Raksha Goyal, Nandini Sarwate, A Correlative study of hypertension with lipid profile vol 2 issue 2 Feb 2014, 143-150
4. Study of lipid profile in newly diagnosed hypertensive patients. MAK Akanda, KN Choudhary, MZ Ali, LA Sayami. Cardiovasc. J 2014, 6(2): 112-115
5. Tomori Sugiura, Yasuaki Dohi et al, Impact of lipid profile and high blood pressure on endothelial damage. *Journal of Clinical Lipidology* vol 5 issue 6 460-466
6. <http://ninindia.org/NNMB%20Urban%20Nutrition%20survey%20%20report-Final%2025-09-2017.pdf>
7. Burtis, CA, Ashwood ER, Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 4th ed, Philadelphia, W.B. Saunders Co 2006, 41-45.
8. Friedwald WT, Levy RI, Fredricson DS. Estimation of concentration of low density lipoprotein in plasma without use of preparative ultracentrifuge. *Clin Chem*. 1972; 18(6):499-502.
9. Serum lipid profile of newly diagnosed hypertensive patients in Nnewi, South East Nigeria *International journal of hypertension* volume 2012 article id 710486, 7 pages
10. Gulab Kanwar, Neelam Jain, Surekha Kirad et al. A study on serum lipid profile in hypertensive patients of Hadoti region. *International Journal of Research in Applied Natural and Social Sciences* 2321-8851; vol 2, issue 8, Aug 2014, 53-60
11. K H Bona and D S Thelle, Association between blood pressure and serum lipids in a population. The Tromso study. *Circulation* 1991; 83: 1305-1314
12. Hitesh A. Jani, Priti C. Bhandari. Comparative study of serum lipid profile between prehypertensives and normotensive. *International Journal of Research in Medical Sciences* 2014 Nov; 2(4):1648-1651
13. Akintunde AA. Epidemiology of conventional cardiovascular risk factors among hypertensive subjects with normal and impaired fasting glucose. *South African Medical Journal*. 2010; 100(9):594-597.
14. Lepira FB, M'Buyamba-Kabangu JR, Kayembe KP, Nseka MN. Correlates of serum lipids and lipoproteins in Congolese patients with arterial hypertension. *Cardiovascular Journal of South Africa*. 2005; 16(5):249-255
15. Odenigbo et al; Prevalence of dyslipidemia in apparently healthy professionals in Asaba, South Nigeria. *Niger J Clin Pract* 2008 Dec, 11(4):330-5

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