Plasma Lipid Profile of Moderate and Severe Hypertensive Patients

Ibikunle Akinlua, Akinwumi T. Ogundajo, Olufisayo G. Oyebanji, Babajide O. Arobasalu

ABSTRACT

Hypertension is the most prevalent and treatable risk factors for cardiovascular diseases and a major cause of morbidity and mortality worldwide. Elevated levels of lipid in the blood also known as hyperlipidaemia or dyslipidemia have been implicated in the development of atherosclerosis and most cardiovascular diseases including hypertension. This study was designed to evaluate the plasma level of lipid profile in mild and severe hypertensive patients with a view to provide information on the link between these parameters and the development and severity of hypertension. Blood samples were collected from 120 freshly diagnosed hypertensive patients consisting of 60 mild and 60 severe hypertensive patients at Wesley Guide Hospital of Obafemi Awolowo University teaching Hospital Ilesa Osun state and 60 relatively healthy subjects as control. Plasma level of lipid profile [namely High density lipoprotein cholesterol (HDLc), low density lipoprotein cholesterol (LDLc), triglycerides (TG), total cholesterol (TC)] in the blood sample of both patients and control subjects were analyzed using standard methods. The results obtained were subjected to statistical analysis ($p < 0.05$). The results of lipid profile in mild and severe hypertensive patients was compared to the control subjects. The results in mild hypertensive patients were also compared with the severe ones. There was a significant increase ($P < 0.05$) in the plasma level of TC and LDLc in both mild and severe hypertensive patients when compared with the control subjects. Similarly a significant increase ($p < 0.05$) was recorded in the plasma level of the both TC and LDLc in severe hypertensive patients when compared with mild hypertensive patients. However, the plasma level of HDLc in moderate and severe hypertensive patients was slightly lowered but not significant ($p < 0.05$) while plasma TG level was not significantly different when compared with the control subjects. This study reveals a progressive increase in the plasma level of TC and LDLc from mild to severe hypertensive patients which could be a pointer to the fact that abnormalities in lipid metabolism might plays a significant role in the development and severity of hypertension.

Keywords: hypertension, Lipid Profile, Moderate hypertension, Severe hypertension.

Published Online: July 16, 2020

ISSN: 2684-5199

DOI :10.24018/ejbio.2020.1.4.48

I. Akinlua*

Ekiti State University, Nigeria.

(e-mail: ibikunle.akinlua@eksu.edu.ng)

A. T. Ogundajo

Obafemi Awolowo University, Nigeria.

(e-mail: adetap@yahoo.com)

O. G. Oyebanji

Ekiti State University, Nigeria.

(e-mail: talktofisayo@yahoo.com)

B. O. Arobasalu

Ekiti State University, Nigeria.

(e-mail: jidexsegun@gmail.com)

*Corresponding Author

I. INTRODUCTION

Hypertension, also known as high blood pressure (HBP), is a long-term medical condition in which the blood pressure in the arteries is persistently elevated. Systolic blood pressure (SBP) between 120-139 mmHg and diastolic blood pressure (DBP) between 80-89 mmHg is considered as prehypertension or moderate hypertension while SBP above 140 and DBP above 90 is considered as high and risky. High blood pressure typically does not show symptoms but when it occurs on a Long-term however is a major risk factor for metabolic disorders such as coronary artery disease, stroke,

heart failure, atrial fibrillation, peripheral arterial disease, vision loss, chronic kidney disease, and dementia [1], [2].

High blood pressure can be classified into four categories: normal (Systolic less than 120 mm Hg and diastolic less than 80 mm Hg.), prehypertension (mild) (Systolic between 120 and 139 mm Hg or a diastolic between 80 and 89 mm Hg.), stage 1 (moderate) (Systolic between 140 and 159 mm Hg or diastolic 90 and 99 mm Hg.) and stage 2 (severe) (Systolic 160 mm Hg or higher or diastolic 100 mm Hg or higher). This classification is intended to identify those individuals in whom early intervention by adoption of healthy lifestyles could reduce BP, decrease the rate of progression of BP to

hypertensive levels with age, or prevent hypertension entirely [3].

Hypertension is known to be associated with alterations in lipid metabolism which gives rise to abnormalities in serum lipid and lipoprotein levels. Lipid abnormalities like hypertriglyceridemia, hypercholesterolemia, and low density lipoprotein influences the etiology and pathogenesis of hypertension [4]. Though no specific pattern of dyslipidemia has been consistently reported among hypertensive individuals, many studies have shown that total cholesterol (TC), triglycerides (TG), and virtually all fractions of lipoproteins tend to be more frequently abnormal among hypertensive patients than in the general population [5], [6].

The scientific community recognizes the association between blood lipids levels and risk of cardiovascular disease. Strong association has been found between high levels of serum cholesterol especially of low-density lipoprotein (LDL) cholesterol and the development of atherosclerosis, while elevated levels of high-density lipoprotein (HDL) cholesterol seem to play a protective role [7]. There is paucity of information on the association of these parameters with the severity of hypertension which is the focus of this study.

II. MATERIALS AND METHODS

A. Participants

The subjects were an hundred and twenty freshly diagnosed hypertensive patients consisting of sixty mild and sixty severe hypertensive patients at Wesley Guide Hospital, Obafemi Awolowo University Teaching Hospital, Ilesa, Osun State while sixty apparently healthy individual without hypertension serve as control subjects.

B. Data Collection

The ethical clearance was sought from Specialist Hospital Osogbo Health Research Ethics Committee (SHOHREC) with protocol number HREC/27/04/2015/SSHO/58. Informed consent was obtained from the participants (subjects and control) after the study guidelines had been explained to them before clinical history was taken and anthropometric indices using structured questionnaire.

C. Sample Collection

Venous blood samples were collected from each subject and distributed into anticoagulated

bottles. The samples were spun using bucket centrifuge at 4000 rpm for 3 minutes and the supernatant (plasma) was collected and analysed for biochemical profile of blood.

III. BIOCHEMICAL ANALYSIS

A. Estimation of Plasma total Cholesterol (TC) Concentration

Estimation of total cholesterol in the entire sample collected from the various subject was done by the Cholesterol CHOD-PAP end point method as described by Trinder, (1988) [8].

B. Determination of Plasma LDL-Cholesterol Concentration

LDLc concentration in the sample was determined using the relationship described by Friedewald *et. al.*, (1972) [9].

C. Estimation of High Density Lipoprotein Cholesterol

HDLc in the sample was by precipitation through the procedure developed by Lopes-Virella (1977) [10].

D. Estimation of Triacylglyceride (TG) Concentration

Estimation of Triacylglyceride was carried out using GPO-PAP method of Randox diagnostic kit described by Trinder, (1988) [7].

E. Statistical Analysis

The data collected from the results was analyzed using one - way Analysis of Variance (ANOVA) followed by post-hoc Duncan test, and expressed as mean $\pm$ SEM (standard error of mean) with P value less than 0.05 ($p < 0.05$) considered to be statistically significant. The test for statistical significance was carried out at 95% confidence limit. The analysis was done using Statistical Package for Social Sciences (SPSS), version 22.

IV. RESULTS

TABLE 1: PARAMETERS SHOWING: THE ANTHROPOMETRIC MEASUREMENT OF MODERATE AND SEVERE HYPERTENSIVE PATIENTS AND CONTROL SUBJECTS

Parameters	Control	Moderate hypertensive patients	Severe hypertensive patients	P – value
AGE (YRS)	23.40 $\pm$ 1.14	69.60 $\pm$ 1.14*	65.20 $\pm$ 14.11*	0.000
WEIGHT (KG)	54.40 $\pm$ 7.93	71.20 $\pm$ 9.42*	80.00 $\pm$ 22.64*	0.048
HEIGHT (M)	1.63 $\pm$ 0.04	1.63 $\pm$ 0.08	1.63 $\pm$ 0.05	0.979
B/PSYS (mm/HG)	99.40 $\pm$ 20.51	151.80 $\pm$ 7.99*	168.60 $\pm$ 12.72*	0.000
B/PDIA (mm/HG)	57.60 $\pm$ 11.63	73.80 $\pm$ 7.99*	102 $\pm$ 9.33*	0.001
BMI (KG/M2)	20.4 $\pm$ 3.20	26.88 $\pm$ 2.31*	30.060 $\pm$ 8.10*	0.035

Results are presented as means $\pm$ standard deviation. $p < 0.05$, superscript * indicate significant difference.

B/P= Systolic Blood Pressure;

B/P= Diastolic Blood Pressure;

BMI= Body Mass Index.

TABLE II: PARAMETERS SHOWING THE MEAN $\pm$ SD OF TC, TG, HDLC AND LDLC IN BLOOD PLASMA OF NORMOTENSIVE, MODERATE AND SEVERE HYPERTENSIVE PATIENTS

Parameters	Control	Moderate hypertensive patients	Severe hypertensive patients	P –value
TC (mmol/L)	3.16 $\pm$ 0.34	4.760 $\pm$ 1.5*	5.46 $\pm$ 1.04*	0.001
TG (mmol/L)	1.02 $\pm$ 0.32	1.78 $\pm$ 0.88	1.24 $\pm$ 0.55	0.183
HDLc (mmol/L)	1.42 $\pm$ 0.30	1.18 $\pm$ 0.41	1.18 $\pm$ 0.52	0.592
LDLc (mmol/L)	1.26 $\pm$ 0.31	2.58 $\pm$ 0.82*	3.64 $\pm$ 1.04*	0.002

Result are presented as mean $\pm$ Standard Deviation $p < 0.05$,

Superscript*Indicate significant difference.

TC=Total cholesterol; TG=Triglycerides; HDLc=High density lipoprotein cholesterol; LDLc= Low density lipoprotein cholesterol.

V. DISCUSSION

Hypertension remain a major risk factor for various cardiovascular complications which account for most death and mortality worldwide. Information on metabolic processes that predisposes to this disease and its severity could help in reducing the complication arising from it and its effects. The result of this study shown in table 1 reveals that severity of hypertension correlate with advancing age, overweight and obesity. Age is an important risk factor in developing cardiovascular or heart diseases. The explanations proposed to explain this is related to serum cholesterol level which in most populations was reported to increase as age increases [11]. Shu-Zhong et al. [12] reported overweight and obesity as a major risk factor for essential hypertension which may be due to tubular re-absorption to impair pressure natriuresis which cause volume expansion via the activation of sympathetic nervous system(SNS) and the rennin angiotensin system(RAS).

The result of the study as shown in Table II reveals a significant increase ($p < 0.05$) in TC and LDLc in both moderate and severe hypertensive patients when compared with the control subjects. Similarly there is a significant increase ($p < 0.05$) in TC and LDLc in severe hypertensive patients when compared with the moderate ones.

The plasma level of HDLc in moderate and severe hypertensive patients was slightly lowered but not significant ($p < 0.05$) while plasma TG level was not significantly different ($p < 0.05$) when compared with the control subjects.

The high plasma TC and LDLc and low HDLc levels in these patients was also reported in previous studies by [13], [14], [15], but not consistent with the report [16] and [17] who reported no significant changes in TC, LDLc in newly diagnosed hypertensive patients when compared with the control subjects.

The significant increase in plasma TC and LDLc in severe hypertensive patients compared with moderate hypertensive patients as revealed in this study could implicate this parameters not only in the etiology of hypertension but also in its severity.

Conclusively, this study reveals progressive increase in the levels of some lipids parameters namely TC and LDLc as blood pressure increases which when properly monitored and controlled through proper diet could help in reducing severity of this disease and its associated complications.

ACKNOWLEDGEMENTS

We appreciate the contributions of Dr Ogundajo A.T. and the entire staff of the outpatient department of Wesley Guide Hospital, Obafemi Awolowo University Teaching Hospital, Ilesa, Osun State.

REFERENCES

- [1] D.T. Lackland, M.A. Weber. (2015). Global burden of cardiovascular disease and stroke: hypertension at the core. *The Canadian Journal of Cardiology*, 31(5) pp569–71.
- [2] I. Hernandorena, E. Duron, J.S. Vidal, O. Hanon. Treatment options and considerations for hypertensive patients to prevent dementia. *Expert Opinion on Pharmacotherapy (Review)*. 18 (10) pp 989–1000, 2017.
- [3] The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *JAMA* 289:25 2003, pp 60–71.
- [4] A.R. Arshad, H.N. Tipu, A.I. Paracha. (2016). The impact of hypertension on lipid parameters in type 2 diabetes. *J Pak Med Assoc.* 66 (10) pp 1262-1266.
- [5] R.O. Halperin, H.D. Sesso, J. Ma, J.E. Buring, M.J. Stampfer, J.M. Gaziano. (2006). Dyslipidemia and the risk of incident hypertension in men. *Hypertension*. 47 (1) pp 45–50.
- [6] C.U. Osuji, E.G. Omejua, E.I Onwubuya, G.I. Ahaneku. (2012). Serum lipid profile of newly diagnosed hypertensive patients in nnewi, South-East Nigeria. *Int J Hypertens*. 2012:710486.
- [7] J.D. Brunzell, M. Davidson, C.D. Furberg, R.B. Goldberg, B.V. Howard, J.H. Stein. J.L. Witztum “Lipoprotein management in patients with cardiometabolic risk” Consensus conference report from the American Diabetes Association and the American College of Cardiology Foundation. *J Am Coll Cardiol* 51: pp 1512-1524, April 15th, 2008.
- [8] P.Trinder. (1988). Report of the National Cholesterol Educational Program. Expert Panel on detection, evaluation and treatment of high blood cholesterol in adults. *Archives of Internal Medicine* 148: pp36-391.
- [9] W.T.Frieldewald, R.S. Levy, D.S. Friedricksen. (1972). Estimation of concentration of low density lipoprotein cholesterol in plasma without rise of preparative ultracentrifuge. *Clinical Chemistry*; 18: pp499–502.
- [10] M.F. Lopes-Virella, P. Stone, S.Ellis, J.A. Colwell. Cholesterol determination in high- density lipoproteins separated by three different methods. *Clinical Chemistry* vol 23 no5 pp 882-4, 1977.
- [11] V. Jousilahti, P.Tuomilehto (1999). "Sex, Age, Cardiovascular Risk Factors, and coronary heart disease". *Circulation*, 99 (9) pp 1165–1172.
- [12] J.Shu-Zhong, L. Wen, Z. Xue-Feng, R.Hong-Yun, L.Yi. (2016). Obesity and Hypertension *Exp Ther. Med.* 12(4) pp 2396-2399.
- [13] J.M. Harvey, D.G. Beevers.(1990). Biochemical investigation of hypertension. *Annals of Clinical Biochemistry*. 27 (4) pp 287–296.
- [14] P. Pavithran, H. Nandeesh, Madanmohan, et al.(2007). Dyslipidemia antedates occurrence of clinical hypertension in non-diabetic, non-obese male subjects. *Indian Journal of Physiology and Pharmacology*. vol 51 no1, pp 96–98.
- [15] K.N. Choudhury, A.K. Mainuddin, M. Wahiduzzaman, S.M. Islam. (2014). Serum lipid profile and its association with hypertension in Bangladesh. *Vasc Health Risk Manag.* 10, pp 327–332.
- [16] F. B. J. Lepira, R. M'Buyamba -Kabangu, K. P. Kayembe, M. N. Nseka. (2005). "Correlates of serum lipids and lipoproteins in Congolese patients with arterial hypertension," *Cardiovascular Journal of South Africa*, 16(5), pp 249–255.
- [17] A. A. Akintunde. "Epidemiology of conventional cardiovascular risk factors among hypertensive subjects with normal and impaired fasting glucose" 2010 , 100(9) pp. 594-597.

Akinlua Ibikunle

PROFILE: BTech Industrial Biochemistry, (FUTA, Nigeria).

MTech. Applied Biochemistry, (FUTA, Nigeria), PhD Clinical Biochemistry (EKSU, Nigeria). Presently Lecturer at EKSU, Nigeria.

Ogundajo Akinwumi.T0sin,

PROFILE: BSc Medical Laboratory Science (AAUE, Nigeria). MTech Biochemistry (FUTA, Nigeria). PhD Clinical Biochemistry, (EKSU, Nigeria).

Oyebanji Olufisayo Grace: Lecturer Biochemistry.
BSc. (EKSU, Nigeria), MSc. (CU, Ota, Nigeria),
PhD. (In progress, EKSU, Nigeria)

Arobasalu B.O.
PROFILE: BSc Biochemistry (Achiever University,
Owo, Nigeria), MSc Biochemistry (EKSU, Nigeria in
progress).