OPEN ACCESS
Global Journal of Research in Medical Sciences
ISSN: 2583-3960 (Online)
Volume 04 | Issue 04 | July-Aug. | 2024
Journal homepage: https://gjrpublication.com/gjrms/
Research Article

Evaluation of Insulin and Vanillylmandelic concentrations in hypertensive subjects undergoing care at Federal Teaching Hospital, Owerri

[1]Nwanguma Eberechi Doris*, [1]Nwanjo Harrison, [1]Nwosu Dennis, [2]Ude Ugonmma Agwu, [1]Nnodim Johnkennedy and [1]Edward Ukamaka

[1]Department of Medical Laboratory Science Imo State University Owerri
[2]Department of Medical Laboratory Science Ebonyi State University Abakaliki

DOI: 10.5281/zenodo.12735362 Submission Date: 28 May 2024 | Published Date: 13 July 2024

*Corresponding author: Nwanguma Eberechi Doris
Department of Medical Laboratory Science Imo State University Owerri

Abstract
A Cross-Sectional study to evaluate the levels of insulin and vanillylmandelic acid in hypertensives attending clinic at Federal University Teaching Hospital, Owerri was carried out. A total of subjects comprising 104 hypertensives (54 males, 50 females) on treatment, 52 hypertensives not on treatment and 52 normotensives who served as control and within the ages of 25 and 72 years were recruited for the study. The serum obtained was used for the determination of insulin and vanillylmandelic acid using Enzyme linked immunosorbent assay techniques. All kits were commercially purchased and the manufacturer's standard operational procedures were strictly followed. Data was analyzed using the software statistical package for social sciences version 21, windows 9, values were expressed as mean ± standard deviation, student t-test and analysis of variance were used to analyze the difference in experimental variables. There were significant lower levels of insulin and vanillylmandelic acid in hypertensive on treatment compared to hypertensive not on treatment From the findings, the inclusion of insulin and vanillylmandelic acid in the routine laboratory investigations of conditions related to obesity, myocardial infarction, coronary heart disease, artherosclerotic disease, dyslipidaemia, vascular hypertrophy and other complications of hypertension in these patients will be useful in the prediction, management and risk assessment of this disease and may subsequently improve treatment outcome.

Keywords: insulin and vanillylmandelic acid, Hypertensive.

INTRODUCTION
Worldwide, hypertension is a major cause of morbidity and mortality as well as a major public health concern [1]. This is explained by the risk it carries for harming important body organs like the kidneys, heart, and brain [2]. The worldwide hypertension epidemic has not spared Nigeria, a growing nation in West Africa, and this is linked to an alarmingly high rate of obesity, physical inactivity, diabetes, and increased salt consumption among Nigerians [3]. A global study to determine the prevalence of hypertension worldwide found that 72 million people (26.4%) were estimated to have the disease, and that number is expected to rise to 1.56 billion by 2025 [4]. With an overall prevalence of 46% in individuals 25 years of age and older for both sexes, Africa has the greatest prevalence of hypertension. However, the estimated prevalence among Nigerian adults was 28.9%, with ranges for men and women of 6.2-48.9% and 10-47.3%, respectively, as well as 30.6% and 26.4% among urban and rural people [5]. The pancreatic islets' beta cells create the peptide hormone insulin, which improves cells' absorption of glucose and metabolism.[6]. Throughout time, insulin resistance and the compensatory hyperinsulinemia that goes along with it not only cause diabetes but also dysregulate renal sodium metabolism, renin, angiotensin, aldolsterone, and the sympathetic nervous system, which in turn raises blood pressure [7].

The term "paraganglioma" in the genome refers to paraganglia tumors, independent of their location. Pheochromocytomas are the most prevalent type of paraganglioma found in the adrenal medulla. Pheochromocytomas can be diagnosed to offer a possibly curable treatment for hypertension, and their removal can save potentially fatal

hypertensive crises. [8]. Catecholamines such as dopamine, epinephrine (adrenaline), and norepinephrine (noradrenaline) are produced and stored by phenochromocytomas. The beta-1 and 2 adrenergic receptors are stimulated by epinephine. In striate muscles, beta-2 adrenergic stimulation results in vasodilation. The beta-2, alpha-1, and alpha-2 adrenergic receptors D1 and D2 are stimulated by norepinephrine. Its high concentrations in phenochromocytomas lead to vasoconstriction and a raised heart rate [9]. An end stage metabolite of catecholamines that is generated by intermediary metabolites is vanillyl mandelic acid. In timed urine tests, it is detected in the urine together with other catecholamine metabolites such as normetanephrine, metanephrine, and lomovanillic acid. Adrenal chromaffin cells first convert norepinephrine into adrenaline. Catechol-O methyl transfarase then inactivates both substances to produce normetanephrine and metanephrine.

The final byproduct of catecholamine metabolism, vanillyl mandelic acid, is then produced by converting a portion of normetamephrine and metanephrine. Pheochromocytoma mainly affects people in their third and fifth decades of life. It is characterized by the excretion of excess norepinephrine, which can result in either paroxysmal or persistent hypertension. Measuring vanillyl mandelic acid, which has a higher specificity than urine metanephrine, helps to detect pheochromocytoma patients. [10] Pathogensis and consequences from hypertension may be directly or indirectly related to abnormal levels of vanillyll mandelic acid. As a result, this study will highlight their connection to the etiology of hypertension. Understanding these underlying causes will open up a lot of opportunities for maintaining health in primary care settings, metropolitan areas with limited resources, and promoting health. It will also help control hypertension.

MATERIALS AND METHODS

Study Area

The study was carried out in the Cardiology unit of Federal Teaching Hospital, Owerri. It is a tertiary health institution involved in providing medical care to individuals with hypertension and is located along Orlu road in Owerri Municipal, Imo state.

Owerri is the capital of Imo State in South Eastern Nigeria and the indigenous ethnic group is Igbo. Its geographical coordinates are 5.48^{o} North latitude, 7.08^{o} East longitude and 150 meters above sea level. Owerri is rich in Agricultural land and has quite a number of restaurants, fast food centres, hotels, schools, markets, churches and a few industries. Owerri has many professionals, artisans, skilled and unskilled man power and there are differences in their nutritional and social lifestyles.

Ethical approval

The ethical approval of Federal Teaching Hospital Owerri was gotten and Informed consent was also obtained from prospective participants.

Subject Selection and Selection Criteria

One hundred and four (104) subjects of both sexes between the ages of twenty- five to seventy -two years and who had blood pressure of 140/90 or above for more than a week and who have been attending the hypertension clinic of Federal University Teaching Hospital, Owerri for not less than three months was recruited for the study. Test subjects were also presently on anti- hypertensive drugs only.

Fifty- two (52) hypertensive subjects who were not on anti -hypertensive drugs and 52 normotensive subjects who were staff of the hospital and whose blood pressures were below 130/80 for three weeks served as the control group.

Inclusion Criteria

The subjects were selected based on the criteria that:

a. They were hypertensive subjects who have been attending clinic for at least three months and are presently on antihypertensive drugs.
b. They met the World Health Organization Criteria of Systolic blood pressure of 140 and above and diastolic blood pressure of 90 and above for two consecutive times.
c. The were within the age of twenty -five to seventy- two years.
d. They gave consent.

Exclusion Criteria

The study excluded:

a. Those who refused to give consent.
b. Those who are hypertensive and severely ill.
c. Pregnant women.
d. Those subjects below twenty- five years and above seventy -two years of age.
e. Those who are hypertensive but have not attended clinic for up to three months.
f. Alcoholics, smokers and those on any other type of medication.

Blood Pressure Measurement

This was carried out using Omron M3 upper arm blood pressure monitor cuff sphygmomanometer (country code 25975) with the help of a clinical nurse. The cuff was placed smoothly and snugly around the upper left arm at the same vertical height as the height while seated with the arm supported. The cuff was inflated until the artery is completely occluded. With the help of a stethoscope listening to the brachial artery the pressure in the cuff was slowly released at the rate of 2mm per heartbeat. As the pressure in the cuff fails a whooshing sound was heard. When blood flow started again in the artery, the beginning sound/heart beat was recorded as the systolic blood pressure. The cuff was further released until no further heart beat could be heard; this was recorded as the diastolic blood pressure. Those with systolic blood pressure of 140 and above and diastolic blood pressure of 90 and above was considered as hypertensive.

Sample Collection

a. Collection of Blood Sample

The study subjects fasted overnight within an interval of eight to twelve hours prior to collection of samples, 5ml of blood was collected aseptically from each subject by venipuncture of the antecubital vein using sterile syringe and needle. The blood sample was placed in a clean plain dry tube, allowed to clot, retracted and centrifuged at 3000rpm for 10 minutes using wisperfuge (model 1384) centrifuge (Sampson, Holland) after which the serum sample was obtained.

The serum was separated using a pasteur pipette and placed in another dry plain tube for the estimation of troponins I, T and C, Apolipoprotein B and A1. All samples were stored at - 20^{o}c prior to analysis.

Laboratory Procedures

a. Determination of Insulin
   This was determined using Enzyme Iinked Immunosorbent Assay Technology as modified by Assay Genie Sandwish ELISA kit, (Dublin, Ireland) (Catalog number HUF100306).
b. Determination of VanillylMandelic Acid (VMA).
   This was determined using Enzyme Linked Immunosorbent Assay technique (Wybenga and Pileggi, 1967), as modified by Assay Genie (Dublin, Ireland) (catalogue number HU E100687).

Statistical Analysis

Data was analyzed using software statistical package for social sciences (SPSS) version 21, windows 9.

Difference in mean values between two groups were assessed using student t-Test while difference in mean values between three groups was assessed using one- way analysis of variance (ANOVA). The level of statistical significance was set at P = 0.05 (95% confidence interval). Tests with a probability value of P<0.05 were considered statistically significant. Values were expressed as mean ± standard deviation (mean ± S.D).

RESULTS

Table 1: Mean ± standard deviation values of Insulin and Vanillylmandelic acid in hypertensive subjects on treatment versus normotensives.

Variables (Units)	Hypertensives on Treatment (n=104)	Normotensives (n=52)	t-value	P –value
Insulin (µiu/ml)	17.88 ± 8.62*	9.85 ± 3.05	4.687	0.001
VMA (mg/24hr)	8.20 ± 3.02	7.60 ± 2.26	0.891	0.413

Keys: n= number of samples
VMA= Vanillylmandelic acid

Table 1 shows the mean ± standard deviation values of insulin and vanillylmandelic acid in hypertensive subjects on treatment compared versus normotensives.

The mean ± SD values of Insulin (17.88 ± 8.62 µiu/ml) was higher which was statistically significant (p=0.001) in hypertensive subjects on treatment compared with the mean ± SD values (9.85 ± 3.05 µiu/ml) of normotensive group.

However, the mean ± SD value of Vanillylmandelic acid (8.20 ± 3.02 mg/24hr) showed no statistically significant difference (p=0.413) in hypertensive subjects on treatment compared with the mean ± SD value (7.60 ± 2.26 mg/24hr) of the normotensive group.

DISCUSSIONS

The study's findings also demonstrate that, in comparison to normotensives, the levels of insulin were much greater in hypertensive patients receiving treatment. Insulin levels did not significantly differ between hypertensives receiving therapy and those who were not. Additionally, there was no discernible difference in the treatment outcomes of male and female hypertensives. Additionally, there was no age-related increase in insulin that was progressive. The findings of this study, which showed larger waist circumference and body mass index in hypertensives compared to normotensives, combined with hyperinsulinemia, would support the idea of metabolic syndrome, which is characterized by the clustering of several cardiovascular risk factors [11].

Due to the ability of high blood pressure to modify the delivery of insulin and glucose to skeletal muscle cells, resulting in impaired glucose uptake by impairing vasodilation of skeletal muscle as a result of vascular structural changes caused by vascular rare faction and increased penpheral vascular resistance, the high insulin levels seen in this study may therefore suggest that there is insulin resistance among these subjects leading to compensatory hyperinsulemia. [12, 13, 14]

Hypertension and insulin resistance have been linked, and it has been proposed that insulin resistance plays a pathogenetic role in the development of hypertension. This is due to the fact that hyperinsulaemia, which raises arterial blood pressure by inducing renal sodium retention and elevated sympathetic activity, is a result of insulin resistance. [15]. Additionally, renin-angiotensin system activation and intracellular calcium buildup in vascular smooth muscle might occur from insulin resistance and the hyperinsulinemia that follows, both of which can raise blood pressure [16]. Additionally, it raises aldosterone levels [17]. According to a study by [18], African people with essential hypertension have higher levels of hyperinsulinemia and insulin resistance than people with normotension. The relationship between blood pressure, insulin levels, and obesity is confirmed by the correlation between body mass index, systolic blood pressure, and diastolic blood pressure with insulin.

Additionally, the mean ± standard deviation value of vanillymondelic acid in hypertension participants was not statistically different from that in normotensive subjects, according to the study. When comparing the mean value of vanillylmandelic acid between hypertensive participants receiving therapy and those who were not, there was no discernible difference. There was no discernible pregressive rise in vanillylmandelic acid with advancing age. Additionally, there was no discernible statistically significant variation in vanillyl mandelic acid with respect to sex. On the other hand, VMA and both the systolic and diastolic blood pressures showed favorable associations [19]. Even though there was no statistically significant increase in VMA in hypertensive subjects compared to normotensives in this study, a positive correlation between systolic and diastolic blood pressure and vanillylmandelic acid has indicated an association between blood pressure and serum vanillylmandelic acid in hypertensive subjects [20]. This could be the result of noncompliance with the study's requirement for a 24-hour urine sample collection. The study's findings of hyperinsulinemia point to insulin resistance as a potential risk factor for type 2 diabetes [21].

In order to stop the onset of inflammatory disorders and their consequences, such as stroke, heart attack, kidney disease, diabetes mellitus, and vascular hypertrophy, these factors should be used in the risk assessment and monitoring of hypertensive cases.

REFERENCE

1. Braith, R.W., Mill, R.M., Wilcox, C.S., Davis, G.L A, and Wood, C.E. (2023). Breakdown of blood pressure and body fluid homeostasis in heart transplant recipients. Journal of American college of Cardiolology; 27:375–383.
2. Alexandre, A.D., Jussara, M.D., Yuan, L., Zhen, W., Alan, J.M. and John E.H. (2020). The role of hyperinsulinemia and insulin resistance in hypertension: Metabolic Syndrome Revised; 36(5):671-682.
3. Voet, D., Voet, J.G. (2011). Insulin metabolism in Biochemistry (4th ed.). Wiley publishers, New York:pg 56-78.
4. Walsh, J.B. (2018). "Hypertensive retinopathy. Description, classification, and prognosis". Ophthalmology. 89 (10): 1127–1131.
5. Anagnostis, P. (2023). "Metabolic Syndrome". Biomedical journal; 34:24-35
6. Bavishi, C., Goel S., Messer, F.H. (2016): Isolated systolic hypertension: an update after sprint. American Journal of Medicine; 129 (12): 1251-1258.
7. Whelton, P.K., Carey, R.M., Aronow, W.S., Casey, D.E., Collins, K.J., Himmelfarb, C.D. (2017): ACC/AHA 2017 guidelines for the prevention, detection, evaluation and management of high blood pressure in adults. A report of the American college of cardiology/American Heart Association task force on clinical practise guidelines. Journal of American Cell Cardiology; 71(19):127-248.
8. Huang, X., and Yang, Z. (2010). Resistins, obesity and Insulin Resistance. The continuing disconnect between rodents and humans. Journal of Endocrinology investment; 39; 609-615.

9. James, L. (2022). Signs and symptoms of hypertension. Journal of Molecular Novo, S., Lunetta, M., Evola, S., Novo, G., (2019). "Role of ARBs in the blood hypertension therapy and prevention of cardiovascular events". Current Drug Targets. 10 (1): 20–25.
10. Yusuf S and Huang K (2019): Modifiable risk factors, cardiovascular disease and mortality in 155,722 individuals from 21 high-income, middle income and low-income countries (PURE). A prospective cohort ;25(7):234-245
11. Tagi, V.M., Mainieri, F., Chiarelli, F. (2022). Hypertension in patients with insulin resistance: Etiopathogenesis and Management in children. International Journal of Molecular Science; 23(10):5814.
12. Cain, A, E., Khahil, R.A., (2019). Pathophysiology of Essential Hypertension: role of pump the vessel and kidney. Seminar Nephrology; 22:3-12.
13. Whelton (2018) Guideline for the prevention, detection, evaluation and management of high blood pressure in adults. A report of the American College of Cardiology Heart Association Task Force on Chemical Practise. Guidelines. Circulation 138:484-594
14. Jiang Y. Lu L., Hu Y., Li Q., An C., Yu X., Shu L., Chen A., Niu C., Zhou L., Yang Z. (2016). Resistin indices hypertension and insulin resistance in mice via a TLR 4 dependent pathway. Journal of cardiology; 6:22193.
15. Krzesinski, J.M., Cohen, E.P. (2017). "Hypertension and the kidney". Acta Clinica Belgica. 62 (1): 5–14.
16. Wenzel, U.O., Ehmke, H., Bodi, M. (2021): Immune mechanisms in arterial hypertension. Recent advances. Cell and tissue research;385(2): 393-404.
17. Yang B.Y, Virdis A and Cai Y (2018) Global association between ambient air pollution and blood pressure. A systematic review and meta-analysis. Environmental pollution 235:576-588
18. Falaschetti E, Mindell J, Knott C and Poulter N (2014) Hypertension management. Lancet 383, 1912-1919.
19. Herpin. D. (2018). "[Impact of arterial hypertension on the heart]". La Revue du praticien (in French). 49 (5): 491–493.
20. Weaver C.M, Stone M.S, Lobene A.J, Cladis A.P and Hodges J.K (2018): What is the Evidence Base for a Potassium Requirement? Nutrition Today 53(1);24-26.
21. Yokoyama Y and Nordmann AJ (2019) Vegetarian diets and blood pressure. Journal of American Association International Medicine 174:577.

CITATION
Nwanguma E.D, Nwanjo H., Nwosu D., Ude U.A, Nnodim J., & Edward U. (2024). Evaluation of Insulin and Vanillylmandelic concentrations in hypertensive subjects undergoing care at Federal Teaching Hospital, Owerri. In Global Journal of Research in Medical Sciences (Vol. 4, Number 4, pp. 34–38).
https://doi.org/10.5281/zenodo.12735362