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Differences by age and marital status in hypertensive patients in Enugu

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Abstract

Hypertension is a well-established risk factor for cardiovascular disease and is known to increase with age across all populations. Lipid abnormalities often co-occur with hypertension, further compounding cardiovascular risk. This study assessed the influence of age and marital status on lipid profiles among hypertensive patients in Enugu, Nigeria. A total of 70 hypertensive patients aged 30–70 years receiving treatment at Enugu State University Teaching Hospital were enrolled. Demographic data, including age and marital status, were collected using a structured questionnaire. Blood pressure was measured, and fasting lipid profiles—including total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL)—were analyzed from serum samples using standard laboratory methods. Data were analyzed using Analysis of Variance (ANOVA) and Pearson correlation coefficients. The study population consisted of 54.3% married women (n=38), 30.0% married men (n=21), and 15.7% unmarried individuals (n=11). Married men had significantly lower HDL levels (0.857 ± 0.183 mmol/L) compared to married women (1.021 ± 0.243 mmol/L; p=0.015). Among married men, diastolic blood pressure showed a significant positive correlation with total cholesterol (r=0.468, p<0.05) and LDL cholesterol (r=0.438, p<0.05). The findings suggest that marital status, particularly among men, may influence lipid metabolism in hypertensive individuals. Married men exhibited lower HDL levels and a significant association between diastolic blood pressure and both total cholesterol and LDL, indicating a potentially heightened cardiovascular risk profile.

Keywords: Age; married; Lipoprotein; Men; Women; Density

1. Introduction

Hypertension has been identified as a significant public health matter on a global scale, with about 1.39 billion persons affected and over 10.8 million deaths ascribed to the condition annually [1, 2]. In Nigeria, hypertension prevalence has been rising for number of years now, with current estimates ranging from 22% to 44%, which differs by region [3]. In Nigeria, hypertension continues to be a significant cause of general morbidity and mortality, and of a major public health matter [4, 5]. Hypertension is known to escalate the chances of peripheral vascular disease, sudden cardiac death, congestive heart failure, stroke, myocardial infarction and renal insufficiency [6-9]. Previous studies has emphasized that the incident of hypertension is simply determined by biological factors like overweight or obesity, age [10, 11] and blood lipid levels [12], but can also be controlled by behavioral patterns and lifestyle choices [13, 14, 15]. It has been widely known that cardiovascular diseases constitute 24% of all deaths among adults (25-69 years) [16]. Hypertension is known to increase with age across all populations: 22.4% (aged 18–39), 54.5% (40–59), and 74.5% (60 and over) [17]. Marriage, since olden days, has always been a core social institution and plays a critical role in the lives of many people [18]. Over the past fifty years, several studies from different countries have examined relationship between marital status and different aspects of health, such as immune, cardiovascular and psychiatric. However, results on the

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relationship between marital status and health or mortality have been contradictory [19]. An expeditious increase in coronary heart disease (CHD) burden has also been reported in various developing countries [20]. Dyslipidemia is observed to be closely linked with the pathophysiology of coronary heart disease. It is regarded as a major, independent, and modifiable risk factor for coronary heart disease. The possible relation between marital status, age differences and blood pressure levels has been widely studied in Nigeria, but the findings are inconsistent [21, 22]. The aim of the current study was to determine age and marital differences on lipid profile of hypertensive patients.

2. Material and methods

2.1. Study population

A simple random sampling technique was used to select study participants. A total of 70 hypertensive subjects visiting Enugu State University Teaching Hospital for treatment were recruited and were required to meet the following inclusion criteria: (1) age 30 years or above; (2) living in the Enugu for more than six months (3) completing a questionnaire and taking blood samples (4) with a history of hypertension.

2.2. Ethics statement

The study was approved by the Research Ethics Committee of Enugu State University Teaching Hospital (ESUT/HREC/2024/09/130). Informed consent form was signed by all participants for participating in the study.

2.3. Biochemical measurement and physical examination

2.3.1. Sample collection

Five milliliters of blood samples were taken from participants following an overnight fast of a minimum of 8 hours. The blood samples were centrifuged at 3000 rpm for 10 minutes and serum were analyzed for levels of total cholesterol, triglycerides, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol using enzymatic colorimetric method. Patient's blood pressure was measured with standard sphygmomanometer. Data was collected from the patients through questionnaire, which included age and marital status.

2.3.2. Determination of total cholesterol

Total cholesterol levels were determined using the enzymatic endpoint method as described by Richmond (23). Cholesterol esters are first converted to cholesterol and fatty acids. Next, cholesterol is oxidized with O_2 to form cholesten-3-one + H_2O_2. Lastly, the hydrogen peroxide reacted with 4-aminoantipyrine and p-HBS to yield quinoneimine (red dye) and water. The absorption measured at 520 nm, is proportional to the concentration of cholesterol in the sample.

2.3.3. Determination of triglycerides

The triglycerides levels were measured using a colorimetric method as described by Trinder [24]. The triglyceride (TG) colorimetric assay uses the enzymatic hydrolysis of the triglycerides by lipase to glycerol and free fatty acids. The glycerol released is subsequently measured by a coupled enzymatic reaction system. The glycerol formed is phosphorylated to glycerol-3-phosphate in a reaction catalysed by glycerol kinase. The glycerol-3-phosphate is oxidized by glycerol phosphate oxidase producing dihydoxyacetone phosphate and hydrogen peroxide. Peroxidase catalyzes the redox-coupled reaction of H_20_2 with 4-aminoantipyrine (4-AAP) and N-Ethyl –N-(3-sulfopropyl)-M-anisidine (ESPA), producing a brilliant purple color. The absorbance is measured at 540nm.

2.3.4. Determination of High Density Lipoprotein-cholesterol

High Density Lipoprotein Cholesterol was measured using the precipitation method described by Lopes-Virella [25].Low density lipoproteins (LDL) and very low density lipoprotein (VLDL) and chylomicron fractions are precipitated quantitatively by the addition of phosphotungstic acid in the presence of magnesium ions. After centrifugation, the cholesterol concentration in the high density lipoprotein (HDL) fraction, which remains in the supernatant, is determined.

2.3.5. Determination of Low Density Lipoprotein

Low Density Lipoprotein (LDL) was calculated from friedewald formula (LDL = Tc − HDL − TG/5.0 (mg/dL) [26]

2.4. Statistical analysis

Data was analyzed using SPSS version 25. Analysis of variance was used to compare the measurement data. Pearson correlation was also applied. The statistical significance was set at $p<0.05$.

3. Results

Table 3.1 showed mean ± SD of lipid parameters and blood pressure according to marital status of the patients. There was statistically significant difference in high density lipoprotein ($p<0.05$).

Table 1 Mean ± SD of lipid parameters and blood pressure according to marital status of the patients

	Tc (mmol/L)	**TG (mmol/L)**	**HDL (mmol/L)**	**VLDL (mmol/L)**	**LDL (mmol/L)**	**SYS (mmHg)**	**DIA (mmHg)**
Marital status							
Married men (N=21)	4.97±1.43	1.19±0.56	0.85±0.18	0.56±0.25	3.57±1.38	130.66±10.24	83.33±7.03
Married women (N=38)	5.92±1.55	1.27±0.78	1.02±0.24	0.58±0.35	4.31±1.52	135.76±15.25	86.84±10.57
Unmarried (N=11)	5.75±1.92	1.19±0.72	1.01±0.30	0.55±0.32	4.27±2.21	138.27±15.27	87.72±12.16
F(p value)	2.52(0.08)	0.13 (0.87)	3.30(0.04*)	0.06(0.93)	1.55(0.22)	1.34 (0.26)	1.06(0.35)

Table 3.2 showed post hoc test of lipid parameters and blood pressure according to marital status of the patients. High density lipoprotein of married men (0.857 ± 0.183) was significantly lower compared to married women (1.021±0.248) ($p = 0.015$).

Table 2 Post hoc test of lipid parameters and blood pressure according to marital status of the patients

	Tc (mmol/L)	**TG (mmol/L)**	**HDL(mmol/L)**	**VLDL(mmol/L)**	**LDL(mmol/L)**	**SYS(mmHg)**	**DIA(mmHg)**
Marital status							
Married men/married women	0.056	0.869	0.015 *	0.973	0.146	0.280	0.282
Married men /unmarried	0.475	1.000	0.314	0.981	0.615	0.325	0.527
Married women/unmarried	0.961	0.934	0.993	0.937	0.998	0.882	0.974

Table 3.3 shows correlation between lipid profile and blood pressure in married men and women. Significant positive correlation was found between total cholesterol, low density lipoprotein (LDL) and diastolic blood pressure in married men ($p<0.05$).

Table 3 Correlation of lipid parameters and blood pressure according to marital status

Marital status	variable	systolic (mmHg)		diastolic (mm/Hg)		
		r	p	r	p	n
married men	TC	0.068	0.771	0.468*	0.032	21
	TG	0.187	0.416	0.115	0.619	21
	HDL	0.088	0.705	0.215	0.344	21
	VLDL	-0.175	0.448	0.064	0.782	21
	LDL	0.090	0.699	0.438*	0.047	21
Married women	TC	0.143	0.384	0.004	0.982	38
	VLDL	0.263	0.106	-0.070	0.670	38
	TG	0.250	0.125	-0.065	0.695	38
	HDL	0.258	0.113	-0.141	0.392	38
	LDL	0.043	0.795	0.043	0.794	38

Table 3.4 showed mean ± SD of lipid parameters and blood pressure according to age of the patients. There was significant difference between the two age range (p= <0.001). The diastolic blood pressure of patients less than 50 years (89.89±9.94) was significantly higher compared to 51 -70 years (84.26±9.98) (p=0.002)

Table 4 Mean ± SD of lipid parameters and blood pressure according to age of the patients

Parameters	30-50 years (N=21)	51-70 years(N=49)	p-value
TC(mmol/L)	5.93±1.77	5.45±1.51	0.125
TG (mmol/L)	1.34±0.74	1.22±0.72	0.376
HDL (mmol/L)	0.93±0.19	0.97±0.26	0.278
VLDL (mmol/L)	0.61±0.34	0.57±0.32	0.523
LDL (mmol/L)	4.45±1.96	3.91±1.41	0.117
Systolic (mmHg)	133.91±9.94	134.77±15.48	0.752
Diastolic (mmHg)	89.89±9.07	84.26±9.98	0.002*
Age	41.21±6.41	61.50 ±5.90	<0.001*

4. Discussion

Cholesterol is essential for every cell of the body and has many functions. Cholesterol is a type of lipid that carries out many important tasks in the body. Cholesterol moves through the blood in substances called lipoproteins. Low density lipoprotein (LDL) also known as bad cholesterol and high density lipoprotein also known as good cholesterol are the two type of lipoprotein that carry cholesterol [27]. Stress or tension can happen when a person undergoes pressure especially when certain changes occur to an individual. Circumstances that can lead to stress include a traumatic event, illness and low household income. When a person encounters stress, positive physiological reactions take place. Reactions include changes in levels of hormones and components in the blood. Both of these incidents might lead to increase in LDL or HDL-cholesterol [28].This study determined marital status and age differences in lipid profile of hypertensive patients. High density lipoprotein cholesterol is used to evaluate patient's health. Again, Low HDL cholesterol is used to assess metabolic syndrome, a group of risk factors that increase the risk for heart disease. Study had shown that low HDL cholesterol prevalence was higher among men (45%) than women (23%) [29]. The study is in line with the result of the present study that found lower HDL cholesterol among married men compared to married women. This study also agreed with previous studies that found significant different in HDL among men and women (30, 31). Because of the health impacts of HDL-cholesterol, reaching the HDL-c serum level is highly recommended. We

found that LDL-cholesterol was higher in patients that are 30 to 50 years compared to those above 50 years, though not statistically significant. This finding is in agreement with result obtained in Malaysia that found that highest mean of LDL-c were in individual aged 30 to 59 years [32]. Similar finding was also reported among Malaysian adults and Chinese population [33, 34]. In this study, we found a significant positive correlation of total cholesterol and LDL-c with levels of diastolic blood pressure in married men. Also in this study, there was not significant association between levels of systolic pressure with total cholesterol, triglycerides, HDL-c and LDL-c in married women. In Austria, Lautsch*et al*. studied a total of 7496 outpatients with arterial hypertension and in that study men and women had similar systolic and diastolic blood pressure and similar non-HDL- C values but they found a correlation of non-HDL- C and blood pressure in hypertensive men of all age groups [35]. Similar study by Martin *et al*. found a significant relationship between measures of morning blood pressure surge and LDL-cholesterol [36]. This could account for higher prevalence of hypertension in the males than females irrespective of the age.

5. Conclusion

In married men, HDL significantly decreased compared to married women. Also in married men, diastolic blood pressure significantly correlated to total cholesterol and low density lipoprotein, indicating a potentially heightened cardiovascular risk profile.

Compliance with ethical standards

Disclosure of conflict of interest

Authors declared that no competing interests exist.

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Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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