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Original Research Article

Correlation of lipid profile with blood pressure in apparently healthy Sudanese individuals in Northern State, Sudan

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ABSTRACT

Background: To assess the value of lipid profile on apparently healthy adult Sudanese based on the blood pressure values in Dongola town in the northern state. This study aims to correlate the lipid profile with the blood pressure to figure out their association with cardiometabolic disorders
Methods: a cross-sectional prospective study was carried out from January 2018 to November 2018 in Dongola on apparently healthy adult Sudanese.
Results: in this study 164 individuals have been tested, out of them 117 (71.34%) were females and males 47 (28.65%) respectively. Most of the study group were normal weight, females 63 (38.41%) and males 20 (12.19%) respectively. The arterial blood pressure values showed a significant positive correlation to both BMI and lipid profile (p-value≤0.05). Also, results revealed that fasting blood glucose has a strong positive correlation with lipid profile HDL and TG (p value≤0.05), TC and LDL (p value≥0.01).
Conclusions: Our results concluded that patients with hypertension are more likely than normotensive patients to exhibit dyslipidemia, including elevated TC, LDL, TG and reduced HDL cholesterol levels. Our results suggest that elevated BP may predict certain disturbances in lipoprotein metabolism.

Keywords: Blood pressure, Dongola, Lipid profile

INTRODUCTION

In elderly people, the high incidence of atherosclerosis has been suggested that the aging process may be among the factors that disturb lipid metabolism, therefore elderly subjects are at risk of developing cerebrovascular and coronary heart diseases. On the other hand, previous studies figure out that humans with exceptional longevity have a significant increase in the particle size of high-density lipoproteins (HDL) and low-density lipoproteins LDL.[1,2]

Consequently this may lead to an increase in the prevalence of hypertension, the metabolic syndrome, cerebrovascular diseases and other fatal diseases which usually causes death in elderly people.[3,4] Dyslipidemia and increased blood pressure were two clinical parameters that could be detected earlier in obese children and adolescents, which can help slow down and prevent chronic complications.[5] Dyslipidemia is more common in untreated hypertensives than normotensives and lipid levels increase as BP increases.[6]

Dyslipidemia constitutes the fundamental factor for atherogenesis and is considered one of the most important cardiovascular risk factors, being directly related to modifiable factors such as diet or lifestyle habits, as well as non-modifiable factors from each individual like genetic predisposition.[7,8] Actually, previous reports proposed that human with exceptional longevity have significantly larger HDL and low-density lipoproteins LDL particle sizes.[9,10] Ischemic heart disease is the major

cause of death in developed countries as well as in developing countries. Several studies have been conducted on the Pakistani population, which prove that the mortality due to IHD in Pakistan is as high as in developed countries.[11,12] There have been several risk factors reported like hypertension, diabetes mellitus sedentary lifestyle and dyslipidemia. Lipids and lipoproteins are well-known risk factors for ischemic heart disease. Elevated levels of triglyceride, cholesterol and LDL-C are documented as risk factors for atherogenesis.[13,14]

METHODS

This was a cross-sectional study conducted in Dongola specialized hospital, Northern state of Sudan, targeted 164 participants, to evaluate the lipid profile with blood pressure in a patently healthy adult Sudanese. Which was conducted from January 2018–November 2018.

Subjects and method

Anthropometric measures of body mass index (BMI) were calculated as weight/ height^2. Commonly the estimation of body composition in populations has been the body mass index, which was a result of the measurement of weight /height^2. The values of obese subjects consider to be ≥30 kg/m^2, the body mass index has been calculated according to the standard method which has been mentioned previously. All participants signed an informed consent approved by the National Ribat University Ethics Committee. The assessment and blood pressure measurement were done simultaneously with blood lipid examination and serum lipids analysis in all subjects 10 ml venous blood was collected from 8:00 to 9:00 a.m. after an overnight fast.

After the collection of serum by centrifugation, serum total cholesterol (TC), high-density lipoprotein cholesterol (HLDL-c), low-density lipoprotein cholesterol (LDL-c) and triglyceride (TG) were analyzed. Then blood pressure was measured twice and the mean value and pulse pressure were calculated. Fasting blood glucose, urea and creatinine were measured and the results were obtained.

Inclusion criteria

Adult 20 years old and more, none hypertensive, none diabetics, no known cardiovascular disease, no any chronic diseases.

Exclusion criteria

Age less than 20 years old, any one with hypertensive, diabetics or any chronic diseases were excluded.

Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0 software (SPSS Inc., Chicago, IL, USA). Simple descriptive statistics were used to present the demographic characteristics of the study participants. Continuous variables were presented as mean ± standard deviation and were compared using the student t-tests.

RESULTS

The total study group was 164 individuals out of them 117 (71.34%) were females and BMI was distributed among them as follows; underweight 7 (4.26%), normal weight 63 (38.41%), overweight 32 (19.51%) and obese 15 (9.09%). The rest of the study group were males 47 (28.65%), BMI was distributed among them as follows; underweight 1 (0.61%), normal weight 20 (12.19%), overweight 15 (9.14%) and obese 11 (6.70%) (Table 1). BMI was distributed among the age group as follow of the total study group; 128 (78.04%) among the age group 20-30 years, 11 (6.70%) among the age group 31-40 years, 23 (14.02%) among the age group 41-50 years, 1 (0.6%) among age group more than 51 years. BMI was maximally distributed among the age group 20-30 years, underweight was 8 (4.78%), normal weight 79 (48.78%), overweight 29 (17.68) and obese 12 (7.31%) (Table 2). The diastolic blood pressure (DBP) significantly positively correlated (p value≥0.05) with LDL and TG,) and revealed a significant positive correlation (p value≥0.05) with LDL and TG.

Meanwhile, both DBP and systolic blood pressure (SBP), as well as pulse pressure (were significantly positively correlated (P value≥0.05) with body mass index), showed a significant positive correlation (p value≥0.01) with body mass index (BMI) (Table 3 and 4). Fasting blood glucose showed a significant positive correlation with HDL and TG (P value≥0.05) and a strong positive correlation with TC and LDL (P value≥0.01). The results showed a weak correlation between the lipid profiles and blood urea and creatinine, on other hand fasting blood glucose didn't show any correlation with blood urea and creatinine (Table 5).

Table 1: BMI distribution among the sex of the study groups.

		BMI						Total
		<18	18-24.9	25-29.9	31-35	35-39.9	>40	
Gender	Female	7	63	32	10	3	2	117
	Male	1	20	15	9	1	1	47
Total		8	83	47	19	4	3	164

Table 2: BMI distribution among the age of the study groups.

		BMI						Total
		<18	18-24.9	25-29.9	30-35	>35-39.9	>40	
Age (in years)	20-30	8	79	29	8	4	0	128
	31-40	0	0	8	3	0	1	11
	41-51	0	4	9	8	2	0	23
	> 51	0	0	1	0	0	0	1
Total		8	83	47	19	4	3	164

Table 3: Correlation of blood pressure values with to lipid profile.

	Pearson correlation	DBP (Pearson correlation)	Sig. (2-tailed)
Lipid profiles	0.183	1	0.019
BMI	0.246	1	0.001
TG	-0.350	1	0.000
LDL	0.161	1	0.039

Table 4: Correlation of blood pressure values with to BMI.

	Pearson Correlation	BMI (Pearson Correlation)	Sig. (2-tailed)
Pulse	0.166	1	0.034
DBP	0.246	1	0.001
Age	0.308	1	0.000
SBP	0.284	1	0.000

Table 5: Correlation of fasting blood glucose values with lipid profile.

Lipid profiles	Pearson Correlation	FBG (Pearson Correlation)	Sig. (2-tailed)
Total cholesterol	0.316	1	0.000
TG	-0.350	1	0.000
LDL	0.405	1	0.000
HDL	-0.181	1	0.021

DISCUSSION

This study provides evidence that baseline levels of lipid profiles are associated with hypertension. Genetic and cross-sectional studies suggested a connection between dyslipidemia and hypertension. Hypertensive individuals have a higher prevalence of dyslipidemia and 12% of subjects with early-onset hypertension have an increased frequency of lipid disorders.[15] At first, smooth muscle cell hypertrophy and collagen deposition come as a consequence of high cholesterol levels leading to arterial stiffness translated to elevated systolic BP.

In addition, dyslipidemia leads to endothelial dysfunction and improper Vaso regulation, as nitric oxide production release and subsequent activity are reduced among those with high total cholesterol and low HDL-C levels. Furthermore, dyslipidemia has been associated with increased circulating levels of endothelin-116 which in turn has been linked with hypertension.[15] In addition, dyslipidemia may cause damage to the renal microvasculature with the downstream effect of hypertension.[17] Prospective studies demonstrate an association between plasma lipid levels and the risk of hypertension. In one study, 1482 adult men and women were followed up for 7 years, with 40 cases of hypertension being developed. Increases of 1 standard deviation in triglycerides (110 mg/dl (1.24 mmol/l)) and HDL-C levels (11 mg/dl (0.28 mmol/l)) had age-adjusted reference ranges of 1.42 (95% CI, 1.06-1.89) and 0.82 (95% CI, 0.59-1.15), respectively.[18] In two separate studies from the San Antonio Heart Study, subjects with higher baseline triglyceride and lower HDL-C levels had a significantly greater risk of developing hypertension, whereas higher TC and LDL-C levels were associated with non-significant increased risk.[19] These results are consistent with the findings of our study, which reported a more significant correlation between HDL levels and BP values. Most previous studies have shown that levels of triglycerides are positively associated with BMI.[20,21] In the present study, the levels of triglycerides were positively correlated with BMI.

In the present study, the prevalence of high blood pressure has a positive correlation with BMI, which was also reported by other studies.[22,23] The relationship between

prehypertension and overweight and obesity as observed in the present study has also been observed in other studies.[24,25] Individuals in the urban environment did not only show a higher prevalence of obesity but also elevated blood pressure levels. Doll et al explained obesity-associated hypertension as inadequate vasodilatation in the presence of increased blood volume and cardiac output, which are natural consequences of an increased mass.[26] Among both males and females, overweight/obesity is a risk factor, more for DBP, which is more dependent on peripheral resistance. Since DBP is closely correlated with SBP, the factors that increase DBP may thereby also increase SBP.[27] Hypertension has been characterized as a disease of civilization resulting from an incompatible interaction between a modern lifestyle and paleolithic genes.[28]

Our study has several limitations. First, the sample size was obtained from Dongola city and may not be representative of all hypertensive patients in the Northern state. Second, we could not compare the effects of lipid profile variation due to diet, physical activity, medication or other factors. thirdly, baseline information on patients' history of chronic disease and medication use was not available and its effect on dyslipidemia and hypertension incidence remains unclear.

CONCLUSION

The results of this study demonstrate that patients with hypertension are more likely than normotensive patients to exhibit dyslipidemia, including elevated TC, LDL, TG and reduced HDL cholesterol levels. Our results suggest that elevated BP may predict certain disturbances in lipoprotein metabolism. the association between elevated blood pressure and lipoprotein metabolism will help to develop future strategies for preventing both hypertension and dyslipidemia through proper lifestyle changes or medical management or by the combination of both. Hypertensive patients need measurement of BP and lipid profile at regular intervals throughout their primary health care to prevent CVD and stroke.

It is recommended to measure blood pressure and examine lipid profiles in all obese children as a prevention and protection against chronic complications as well as early intervention and better life long.

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