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Short communication

PLASMA CHOLESTEROL AND SODIUM IN SOME NIGERIANS

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Cholesterol moderates the fluidity of cell membrane and this in turn controls the transmembrane movement of Na^+. We have thus attempted to investigate the relationship of serum cholesterol and Na^+ concentrations in some Nigerians. Blood samples were obtained from 122 healthy adult Nigerians and the plasma cholesterol was measured using the random cholesterol kit, while the plasma Na^+ level was measured using corning flame photometer. Mean cholesterol was 197.02 ± 79.02mg/100ml and plasma Na^+ concentration was 139.93 ± 23/52meq/l. The correlation coefficient between cholesterol and Na^+ was ± 0.6008 ($p<0.001$). The results show a positive significant correlation between plasma cholesterol and Na^+ concentration.

Key Words: Plasma, Cholesterol, Na+,

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INTRODUCTION

Sources of plasma cholesterol are either through synthesis by internal organs such as the liver or from external sources through the ingestion from diets rich in cholesterol, for example, egg yolk or animal fat. A decrease in cholesterol from external sources is usually compensated for by an increase from internal sources. Thus a reduction in dietary intake of cholesterol does not significantly reduce plasma cholesterol. On the other hand an increase in intake of high neutral fat diet elevates plasma cholesterol. Current normal adult plasma cholesterol concentration range between 100-220mg/dl for Caucasian (Ganong, 1991).

The total cholesterol level in Africans was quoted to be lower than that of Caucasians and lower still in low-income groups (Taylor, 1971). This shows that the cholesterol level is related to dietary intake

In another study by Etta and Watson (1974), of 403 subjects amongst whom were University students, local soldiers and out-patients of a rural hospital in Northern Nigerian low mean serum cholesterol (mg/dl) levels were generally recorded; 152.1 Students; 189.9 Soldier and 184.4 out-patients.

The effect of high fat feeding on some haematological cells and plasma lipids was investigated by Shanmugasundaran, et al (1986). He found that subjects with high fat feeding showed increased levels of total and low-density lipoprotein (L.D.L.) Cholesterol. Due to high fat feeding erythrocyte membrane and leukocyte cholesterol and phosphoplipid contents were also increased. Erythrocyte enzyme (G6PD) and 6PGD) and leukocytes enzymes (CEH and CES) were elevated. These Cellular changes indicate alterations in structure and functions of blood Cells due to high fat diet feeding.

Main source of plasma sodium is dietary. The plasma Na^+ concentration is only about 11.2% of the total body Sodium; in Caucasians plasma Na^+ concentration is 135-145 meq/1 (Ganong, 1991). Comparative studies of plasma electrolytes concentration of some Africans and Caucasians have produced no significant differences in the plasma sodium and potassium concentrations (Ezeilo, 1972).

Although there is a dearth of information in the literature on the relationship between sodium and cholesterol concentration in the plasma, each of them has been separately linked with hypertension (Theodore et al 1991). We have attempted to establish a correlation between plasma cholesterol and sodium in some Nigerians.

MATERIALS AND METHODS

Subjects and Sample Collection

Blood samples were collected from 122 healthy adult Nigerians in Benin and Lagos. Plasma was then extracted from the blood by centrifuging and the plasma cholesterol and Na^+ concentrations determined.

Plasma cholesterol was measured using randox cholesterol kit while the plasma Na^+

level was measured using the corning flame photometric method.

Each serum sample was diluted by pippeting 10ml into 100ml of reagent in a test tube. A standard solution was then prepared by mixing 10ml of standard with 1000ml of reagent. Each sample was then mixed and incubated for 10 minutes at 25^{o} C or 5 minutes at 37^{o}C. A blank was prepared with only 1000ml of reagent. The absorbance of sample (A sample) and of the standard (A standard) was then read against that of the blank reagent. The concentration of cholesterol in plasma was calculated from the absorbance of both the sample and standard and the concentration of standard.

The blood samples were diluted 200 times with an automatic diluter. The flame photometer was then switched on for 15 minutes to equilibrate using luminous distinct cone. The sodium concentration was estimated using the Na^{+} filter. During the analysis the Na^{+} standard was used to standardize the photometer at intervals. The cones in mMols were displayed in digital forms and were recorded correspondingly.

Analysis of Data

The data obtained were then subjected to analysis on the computer using the statistical package or social sciences (SPSS). The histogram, mean, range, standard deviation and Pearson correlation were determined.

RESULTS

Table 1 shows mean plasma Na^{+} and cholesterol concentrations indicating the range in 122 subjects. There was a highly significant positive correlation between plasma Na^{+} and cholesterol ($r = 0.6008$, $P<0.001$). Mean Na^{+} concentration was 139.93 $\pm$ 23.5 meq/1 whilst the mean cholesterol concentration was 197.02 $\pm$ 79.02 meq/1.

Table 1.
Mean Plasma Sodium and Cholesterol concentrations indicating the range in 122 subjects

Variables	Range	Mean
Na+ (mEq/L)	88 – 384	139.3 ± 23.52*
Cholesterol (mg/dl)	78 – 536	197.02 ± 70.02*

r = 0.6008 (P < 0.001)

Most subjects had cholesterol concentration of between 93 and 327mg/dl, mode 171 mg/dl. 37 subjects had cholesterol concentration of 171 mg/dl. (Figure 1). Plasma Na^{+} concentration ranged from 128-164 meq/L. Only 3 subjects were outside this range (Figure 2).

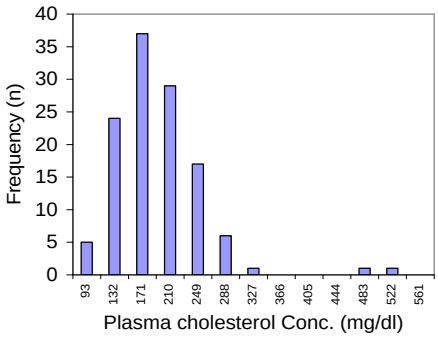

Fig. 1
Distribution pattern of Plasma Cholesterol in Sample Population

DISCUSSION

There is a wide range of plasma cholesterol obtained among our subjects who were young adult males. Similarly in a study carried out by Taylor (1971), this wide range was observed. Taylor had established variations in the plasmas cholesterol levels of Nigerians with sex, age, and income bracket. Therefore it is possible that some of these young adults with high cholesterol levels whose social status were not taken into consideration in this study are from high income bracket with a predominantly high fatty diet (Connors et al 1974).

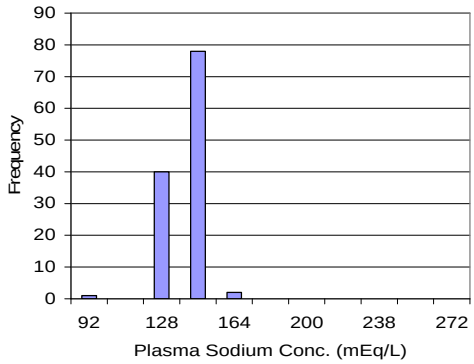

Fig. 2.
Distribution pattern of Plasma Sodiuml in Sample Population

The highly significant positive correlation between serum Na^{+} and cholesterol can be explained by the fact that cholesterol is a key regulator of fluidity of membrane (Lubert, 1988). Its presence in the membrane makes molecules of hospholipids pack move closely together. Cholesterol contains a bulky steroid nucleus with a hydrocarbon at one end.

In different lipoprotein membranes the molecular proportions of different kinds of Lipids vary considerably. For example, in the plasma membrane of intestinal mucosa hospholipids and cholesterol molecules are present in approximately equimolecular proportions, while in liver, mitochondria and endoplasmic reticulum hospholipids molecules outnumber those of cholesterol by eight to one (Edwards & Hassal 1971). Therefore in cells with high concentration of cholesterol, e.g. leukocytes and erythrocytes membrane (Shanmugasundaran, et al 1986) the membrane is less fluidy. This affects the transmembrane movement of Na^+, an indication that cholesterol plays a modulatory role in transmembrane transport. A high plasma lipid concentration will reduce influx of Na^+ into the cell cytosol, therefore resulting in an increase in plasma Na^+ concentration, suggesting that Na^+ /K^+ ATPase might not be the sole regulator of plasma Na^+ concentration.

Hypercholesterolemia is known to increase the risk of hypertension. A reduction of transmembrane movement of Na^+, for example, in the cardiac cells by plasma cholesterol therefore may affect cardiac contractility by affecting cardiac action potential and therefore excitability. Increases in both plasma Na^+ and cholesterol concentrations are known to both elevate blood pressure. The modulatory role played by cholesterol as indicated by this study may throw more light into the role of cholesterol in hypertension. Nwanze and Oforofuo (1988) reported increased total plasma cholesterol and intraerythrocyte Na^+ and a decreased Na^+/K^+ ATPpase activity in Nigerian hypertensives. If this is applicable to cardiac cells, cardiac excitability is likely to increase, further potentiating the development of hypertension.

In summary hypercholesterolemia has been found to be associated with an increase in plasma Na^+ concentration in some Nigerians. This group is at the risk of developing hypertension.

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