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Anthropometric measurements, serum ascorbic acid and lipid levels in diabetic subjects attending Murtala Mohammed Specialist Hospital, Kano, Nigeria

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ABSTRACT: Serum total cholesterol (TC), high density lipoprotein cholesterol (HDL-CH), ascorbic acid (AA), body mass index (BMI), body surface area (BSA) were determined in 50 diabetic subjects (25 males and 25 females, aged 21 – 75 years) attending Murtala Mohammed Specialist Hospital, Kano.

Female subjects had significantly higher HDL-CH ($P < 0.025$) level than male subjects, while BSA was significantly higher ($P < 0.05$) in males than females. Serum TC level and BMI were higher in females than in males. Serum AA level was found to be higher in males than in females

Forty-six percent of the subjects fell in the BMI range normal class (BMI: 18.50 – 24.99), thirty-eight percent of the subjects fell in the BMI range overweight classes (BMI: 25.00 – 40.00). Significant differences were observed in the serum TC, HDL-CH, AA levels, BMI and BSA values with variation in the BMI-range classes.

Introduction

Diabetes mellitus, a complex metabolic disorder, results either from insulin deficiency or abnormality of insulin action and is associated with abnormal metabolism of carbohydrates, fats and proteins.

The plasma lipid and lipoprotein concentrations in diabetic patients are highly variable. This is partly due to the heterogeneity of host factors associated with diabetes that potentially influence lipid metabolism. Hypercholesterolaemia has been shown to be a recurrent finding in diabetic patients (1). However, serum total cholesterol and HDL-cholesterol levels may vary in diabetic patients from different populations. This difference has been shown to be related to differences in culture, social status and diets (2). Nigerian adult diabetics, irrespective of the type of treatment have significantly higher serum total cholesterol and HDL-cholesterol level than the healthy age matched adult (3).

Ascorbic acid or vitamin C occurs in two forms: L-ascorbic acid and L-dehydroascorbic acid. Chief sources of ascorbic acid are fresh fruits, green vegetables and vitamin C tablets. McIntosh et al. (4) reported the development of hypercholesterolaemia in marmoset monkeys deprived of ascorbic acid. Ascorbic acid deficiency in guinea pigs resulted in significant rise in very low density lipoproteins (VLDL) and a decrease in low density lipoproteins (LDL) than those of normal guinea pigs (5)

Burr et al. (6) reported a significant correlation between HDL-CH with AA and TC with age in 121 healthy female subjects. Studies (4-6) conducted on the effect of ascorbic acid and serum lipid profiles are

contradictory in nature and results from experiments carried out on laboratory animals have not improved our understanding of the effect of ascorbic acid on serum lipid profile. This study was therefore undertaken to assess the serum TC, HDL-CH and AA levels in diabetic subjects resident in Kano Metropolis. In addition, the relationship of BMI, BSA to serum TC, HDL-CH and AA levels in these subjects would be assessed.

Materials and Methods

Subjects for this study were drawn from patients (25 males and 25 females) attending the diabetic clinic, Murtala Mohammed Specialist Hospital (MMSH), Kano. Informed consent was obtained from each subject and the study had earlier been approved by the Ethical Committee, Aminu Kano Teaching Hospital, Kano.

Venous blood samples (5 ml) were collected from each subject according to standard procedure (7), after an overnight fast, and serum was separated by low speed centrifugation at room temperature for 1 – 2 hours. Serum AA (8), TC (9) and HDL-CH (10) levels were estimated according to standard procedure. Body weight and height measurements were carried out as outlined by WHO (11). These measurements were used to calculate Body Mass Index (BMI) defined as weight (kg)/height² (m) and Body Surface Area (BSA) according to the formula of Dubois and Dubois (12).

Results

A total of 50 diabetic subjects (25 males and 25 females, aged 21 – 75 years) participated in this study. The mean weight and height of male subjects was found to be 65.04 kg and 1.6m respectively and that of female subjects was 62.04 and 1.57m respectively.

Female subjects had significantly higher HDL-CH ($P < 0.025$) concentration than male subjects, while BSA value was significantly higher ($P < 0.05$) in males than in females (Table 1). Serum TC level and BMI value were higher in females than in males. Serum AA level was found to be higher in males than in females.

Table 1: Serum total cholesterol, HDL-cholesterol, ascorbic acid concentrations (mg/dl), BMI and BSA values in study subjects according to sex.

Sex	TC	HDL-CH	AA	BMI	BSA
Males (n = 25)	193.35 ± 52.40	54.50 ± 33.20	1.50 ± 0.75	23.11 ± 5.73	1.71 ± 0.22
Females (n = 25)	196.68 ± 38.05	72.34 ± 26.62	1.46 ± 0.72	25.15 ± 6.84	1.62 ± 0.21

Values are given as mean ± S.D. Figures in the same row or column bearing similar superscripts are significantly different; a – $P < 0.025$; b – $P < 0.05$.

Forty-six percent of the subjects fell in the BMI normal range class (BMI: 18.50 – 24.99), thirty-eight percent of the subjects fell in the BMI-range overweight class (BMI: 25.00 – 40.00) (Table 2). As BMI increased other parameters also changed significantly. Subjects in the grade-1-overweight class (BMI: 25.00 – 29.99) had a significantly higher ($P < 0.05$) serum TC level than subjects in the normal range class (BMI: 18.50 – 24.99). For HDL-CH level, subjects in the normal class (BMI: 18.50 – 24.99) had a significantly higher ($P < 0.05$) level than subjects in the grade-3-underweight class (BMI: < 16.00). Subjects in the grade-3-overweight class (BMI: ≥ 40.00) had a significantly higher ($P < 0.005$) AA level than subjects in the normal class (BMI: 18.50 – 24.99). BSA values differed significantly ($P < 0.025$) between grade-3-underweight (BMI: < 16.00) and grade-3-overweight classes (BMI: ≥ 40.00).

Table 2: Serum total cholesterol, HDL-cholesterol, ascorbic acid concentrations (mg/dl), BMI and BSA values in study subjects according to BMI-range classification..

BMI Range	TC	HDL-CH	AA	BSA	BSA
< 16.00 (n = 2) Grade-3- Underweight	216.06 ± 46.31a	73.54 ± 18.33b	0.50 ± 0.00	1.42 ± 0.23d,e	4
16.00 – 17.49 Grade-2- Underweight	160.33 ± 31.72	51.91 ± 24.54	2.25 ± 0.35	1.48 ± 0.15	4
17.50 – 18.49 Grade-1- Underweight	249.91 ± 56.15	57.33 ± 5.00	1.50 ± 1.15	1.49 ± 0.14	8
18.50 – 24.99 Normal	176.16 ± 28.14a	60.77 ± 32.73b	1.54 ± 0.66	1.61 ± 0.15	46
25.00 – 29.99 Grade-1- Overweight	220.91 ± 27.65	58.74 ± 32.95b	1.42 ± 0.73	1.74 ± 0.17	24
30.00 – 39.99 Grade-2- Overweight	190.36 ± 32.56	73.54 ± 18.33	1.70 ± 0.76	2.30 ± 0.04	10
≥ 40.00 Grade-3- Overweight	210.33 ± 48.75a	70.93 ± 33.73	1.75 ± 1.06	1.74 ± 0.10	4

Values are given as mean ± S.D. Figures in the same column bearing similar superscripts are significantly different.

a – P < 0.05; b – P < 0.05; c – P < 0.005; d – P < 0.025; e – P < 0.05.

Discussion

Profound variations in serum total cholesterol concentrations and, to a lesser extent, HDL-CH levels have been found to occur in different populations (2,3). The relatively higher mean serum TC and HDL-CH levels recorded for males and females in this study (Table 1) than the corresponding levels reported for healthy controls (13) agrees with the report of Aduba et al. (2). However, the levels of serum TC (247.68 mg/dl for males and 267.03 mg/dl for females) obtained by Aduba et al. (2) were higher than the corresponding levels recorded in this study (Table 1). Differences in serum TC and HDL-CH concentrations among diabetic patients from different populations have been attributed to differences in diet (14).

The consequences of ascorbic acid deficiency was recognised long before its nutritional function was known. treatment with 60 to 100 mg of ascorbic acid 3 times a day for a few days produced rapid improvement in deficient individuals. Occasionally, serum cholesterol may increase after treatment, but other studies demonstrated a reduction in the serum cholesterol concentration, especially if it was high initially (15). The mean AA level (Table 1) fell within the normal range of AA in serum (0.8 – 1.6 mg/dl). A concentration of 0.2 mg/dl is indicative of deficiency. None of the subjects had serum AA concentration

of 0.2 mg/dl or less. In some subjects (40%) the relationship between serum total cholesterol and ascorbic acid agreed with previous findings (916) which indicate that the higher the vitamin C concentration in the plasma of subjects the lower the cholesterol concentration in the plasma.

Body weight has been observed to affect the level of serum TC (17). Mean BMI and BSA values recorded in this study (Table 2) were higher than the corresponding values recorded in healthy individual (18). the relatively high distribution (38%) of subjects (Table 2) in the BMI-range overweight classes agrees with earlier reports (19) that indicate obesity as an important factor amongst type II diabetics. However, further studies are required to unravel the relationship between BMI and AA status and lipid profiles in type II diabetic subjects.

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