

Original article:

Lipid profile and gender difference among some secondary school teachers in SAGAMU

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Abstracts:

Objectives: The levels of cholesterol are affected by the educational status and gender difference of individuals in an environment. Therefore this study was designed to assess the lipid profile and gender difference among secondary school teachers in Sagamu.

Design: For this study, secondary school teachers in Sagamu, aged 20 to 60 years, were selected using convenience sampling method. Students were exempted. The weight in kg and height in meters of each subjects were measured. Their body mass index (kg/m²) (B.M.I) was calculated. Fasting lipid profile was also measured using Cholesterol kit. Data were analyzed using descriptive statistic.

Results: The total number of subjects was 130. The subjects with age between 30 and 39 years constitute the highest group 62(47.7%). There were 33(50.8%) males and 29(40.0%) females in this age group. The average total cholesterol was 256.21mg/dl± 14.37 in female teachers and 209.45±15.70 in male teachers (p<0.05). The HDL ratio was 4.02±0.30 in male and 3.84± 0.25 in female teachers.

Conclusions: The lipid profile of teachers and their gender difference obtained from this study can be used as baseline for future study.

Key words: BMI, Weight, LDL, HDL

Introduction

Low-density lipoprotein cholesterol (LDL-cholesterol) is one of the major atherogenic lipoproteins and has been identified by the National Cholesterol Educational Program (NCEP) Expert Panel as a primary target for prevention of coronary heart disease ^{1,2}.

Previous studies (Lui et al, 2006³, Everett et al, 2006⁴) showed that high concentrations of LDL-cholesterol were associated with increased risk of coronary heart disease mainly for obese populations with higher concentrations of LDL-cholesterol, whereas little evidence is available for less obese populations with lower concentrations of LDL-cholesterol. It therefore remains unclear whether a similar association as for obese populations is also observed at lower ranges of LDL-cholesterol levels.

As the metabolism of obese populations is affected by different environmental factors than those affecting less obese population, it is of major importance to examine the effect of LDL-cholesterol on the risk of coronary heart disease for populations with its lower ranges. First, it is difficult to examine the threshold values in the lower ranges of

LDL-cholesterol amongst obese populations, because of their higher concentrations of LDL-cholesterol. Seven countries study confirmed the positive association between total cholesterol and mortality from coronary heart disease for high cholesterol populations, including Americans, but not for Japanese, who had the lowest population mean levels of total cholesterol levels⁵. Previous studies (Lui et al, 2006³, Everett et al, 2006⁴) of participants with a higher mean level of LDL-cholesterol could not examine the effect of LDL-cholesterol amongst individuals in the lower LDL-cholesterol ranges. Thus, the report of Adults Treatment Panel III (ATP III) could not make any recommendations for further reduction of LDL-cholesterol for populations with low mean LDL-cholesterol levels² Women in westernized countries have a much lower incidence of coronary heart than do men⁶. Determinants of these sex differentials have been receiving increased attention⁷ and evidence suggests that it might be, in part, because of male/ female differences in the levels of lipids and lipoproteins. Although the standard risk factors for coronary heart disease (CHD) are at least as important among women⁷. Although obesity is an important determinant of lipoprotein levels, the distribution of body fat is also critical⁶.

There is paucity of knowledge on the level cholesterol with relationship to gender difference in this environment. Many previous studies obtained from literature search are from the Western world and none were from this region. Our eating habits and culture differ, coupled with the variant degree of obesity we observe in Sagamu.

The aim of this study is to determine the level of cholesterol among secondary school teachers and gender differences if any. This will serve as a basis for advice against the development of CHD in the nearest future.

Methods

This study involved cross-sectional selection of 130 secondary school teachers in four secondary schools in Sagamu, Ogun state, South-West, Nigeria, aged between 20 and 60 years. Students were exempted from this study because they were not part of the study groups.

The weight in kg of subjects were recorded in kilograms (to the nearest 1.0 kg) without them wearing any heavy clothing like a coat, jacket, shoes or agbada, using a calibrated bathroom scale (Soehnle Waagen GmbH and Co. KG,D 71540 Murrhardt/Germany) positioned on a firm horizontal surface.

Height in meters of subjects were measured (to the nearest 0.1m) using a stadiometer. Subjects stood erect, without shoes and headgears, on a flat surface with the heels and occiput in contact with the stadiometer (Prestige HM0016D) (India) and to the nearest 0.1 meter.

The body mass index (B.M.I) was subsequently calculated using the formula: weigh (kg)/ height² (metres²). Estimation of lipid levels were done in each of the subject as described below.

Blood samples were obtained after an overnight fasting for determination of lipid profile levels using standard methods at baseline, two week, four week, six week and eight week, respectively. The LP determined from the fasting lipid Profile was measured spectrophotometrically using standard laboratory kits supplied by BIOLABO, France. Data were analyzed using descriptive statistic and repeated ANOVA with significant at $p < 0.05$

Determination of Total Cholesterol

Total cholesterol level was measured spectrophotometrically using standard laboratory supplied by BIOLABO, France. Cholesterol esters in the presence of cholesterol esterase cholesterol and free fatty acids. The cholesterol formed reacts with oxygen in the presence of cholesterol oxidase to form cholesten-4-one-3 and hydrogen peroxide.

The hydrogen peroxide formed reacts with phenol and 4-amino-antipyrine in the presence of peroxidase to give aminoneimine (pinkish in colour) and water. The intensity of the pink/red colour formed is proportional to the cholesterol concentration. The procedure employed was as follows:

The reagent was prepared by adding 5ml of the buffer (1.75mol/L Amino-2-methyl-2-propanol-1) to 5ml of the Chromogen mixture (76µmol/L 0-Cresolphthalein Complexon, 3.36mmol/L 8-Hydroxy-Quinoline, 3.36mmol/L 8-Hydroxy-Quinoline, 25mmol/L HCl) and allowed to stand for an hour at room temperature.

The reagent solution was prepared by adding equal volumes of the buffer and 5mmol/L Chloro-4-phenol) and the enzyme mixture (100U/L Cholesterol oxidase, 70U/L Cholesterol esterase, 1200U/L peroxidase, 2mmol/L Cholic acid Sodium salt, 0.3mmol Amino antipyrine) and allowed to stand for 5 – 10 minutes while mixing gently at room temperature.

To 10µL of each test sample or standard (5.17mmol/L Cholesterol) was added 1ml of the reagent mixture. This was incubated at 37°C for 5 minutes. The absorbance of the mixture was taken against the blank at a wavelength of 500nm. The blank was made up of 10µL of distilled water and 1ml of the reagent mixture. The cholesterol concentration was determined as follows.

$$\text{Total cholesterol concentration (mg/dl)} = \frac{\text{Absorbance}_{\text{sample}}}{\text{Absorbance}_{\text{standard}}} \times \text{Standard concentration}$$

Determination of HDL Cholesterol

HDL cholesterol level was measured spectrophotometrically using standard lab kits supplied by BIOLABO, France. Low density lipoproteins (LDL) contained in serum are precipitated by addition of phosphotungstic acid and magnesium chloride. High density lipoproteins (HDL) which remain in the supernatant (obtained after centrifugation) react with the cholesterol reagent and proportionally with the cholesterol standard.

The procedure followed was as follows: equal volumes of the serum and reagent mixture (13.9mmol/L phosphotungstic acid and 570mmol/L magnesium chloride) were mixed together and allowed to stand for 10 minutes at room temperature. The reaction mixture was then centrifuged for 10 minutes at 4000g to get a clear supernatant. This supernatant was used as sample to get the HDL cholesterol concentration in the serum sample. 1000µl of the Cholesterol reagent was added to test tubes labeled blank, standard and sample containing 50µl water, 50µl of the cholesterol standard and 50µl of the sample respectively. This was well mixed and incubated for 10mins at 37°C. The absorbance of the end sample against the blank was taken at 505nm.

$$\text{HDL cholesterol concentration (mg/dl)} = \frac{\text{Absorbance}_{\text{sample}}}{\text{Absorbance}_{\text{standard}}} \times \text{Standard concentration}$$

Determination of Triglycerides Level

Triglycerides level was measured spectrophotometrically using standard lab kits supplied BIOLABO, France. Triglycerides in the presence of lipase form glycerol free fatty acids. Glycerol formed reacts reversibly with adenosine triphosphate (ATP) in the presence of glycerol lipase to form glycerol- 3 – phosphate and ADP. The glycerol 3 phosphate also reacts reversibly with oxygen in the presence of glycerol – 3- phosphate oxidase to form dihydroxyacetone phosphate and hydrogen peroxide. The hydrogen peroxide then reacts with chlorophenol and amino antipyrine in the presence of peroxidase to form quinoneimine (pink) and water. The intensity of the pink/red colour formed is proportional to the triglyceride concentration.

The reagent solution was prepared by adding equal volumes of the buffer (3.5mmol/Lchloro-4-phenol, 6mmol/L Magnesium chloride 100mmol/L PIPES) and the enzyme mixture 500U/l Lipase, 1800U/l peroxidase, 400U/l Glycerol 3-phosphate oxidase, 1000U/l Glycerol (lipase, 0.30mmol 4 Amino antipyrine, 1.72mmol/l Adenosine triphosphate Na) and allowed to stand for 5 – 10minutes. To 10µL of each test sample of standard (Glycerol 200mg/dl) was added 1ml of the reagent mixture. This was incubated at 37°C for 5minutes. The absorbance of the mixture was taken against the blank at a wavelength of 500nm. The blank was made up of 10µL of distilled H₂O and 1ml of the reagent mixture. The triglyceride concentration was determined as follows.

$$\text{Triglyceride concentration (mg/dl)} = \frac{\text{Absorbance}_{\text{sample}} \times \text{Standard concentration}}{\text{Absorbance}_{\text{standard}}}$$

All values were recorded in recording book. The TC and HDL ratio was calculated. Data were analyzed using descriptive statistic.

Study procedure

The following definitions were utilized:

BMI category

- Underweight: BMI <18.5 kg/m²
- Normal weight: BMI 18.5-24.9 kg/m²
- Overweight: BMI 25.0-29.9 kg/m²
- Obesity: BMI ≥30 kg/m²

Ethical Approval and Informed Consent

Ethical clearance for the study was obtained from the Health Research Ethics Committee (HREC) of Olabisi Onabanjo University Teaching Hospital (OOUTH), Sagamu All participants (130) of this study signed an informed consent form, in accordance to the committee regulations, before answering the questionnaire and taking their anthropometric measurements. The use of proforma was adopted.

Statistical analysis:

Student t test was used to compare variability between male and female. The data obtained was analyzed using the computer statistical programme package SPSS version 25.0 Probability value of **P** less than 0.05 was considered statistically significant.

Results

As shown in table 1, the age between 30 and 39 years constituted the highest group 62(47.7%). There were 33(50.8%) females and 29(40.0%) male teachers in the age group. Four (3.1%) of the study group were obese. Three (4.6%) female and 1(1.5%) male teachers were obese. 4(6.2%) female and 2(3.1%) male teachers were overweight. Underweight subjects constituted 2.3% (n=3) of the study group.

As shown in table 2, the average total cholesterol of 256.21mg/dl± 14.37 in female teachers was significantly different from 209.45mg/dl±15.70 in male teachers(p<0.05). The mean BMI of 19.35kg/m²±0.65 in male teachers was not significantly different from that of female teachers 20.15kg/m²±0.97. The mean triglyceride (TG) was 154.78mg/dl±12.64 in male teachers and 139.72mg/dl±11.68 in female teachers. The mean low density lipoprotein (LDL) was 133.68mg/dl±14.82 in male teachers and 132.44mg/dl± 14.26 in female teachers. The TG and LDL were not significantly different in both sex groups. The mean High Density Lipoprotein (HDL) was 64.32mg/dl±3.88 in female teachers which was higher than 54.33mg/dl±3.53 in male teachers. The HDL ratio was 4.02±0.30 in male and 3.84± 0.25 in female teachers. Both values were not significantly different.

Table 1: Demographic characteristics of the study groups

Variable	Categories	Total (n=130)	Male teachers (n=65)	Female teachers (n=65)
Age(years)	20-29	10 (7.7%)	3 (4.6%)	7 (10.8%)
	30-39	62 (47.7%)	29 (44.6%)	33 (50.8%)
	40-49	47 (36.1%)	26 (40.0%)	21 (32.3%)
	50-60	11 (8.5%)	7 (10.8%)	4 (6.1%)
Gender	Male	65 (50.0%)	65 (100.0%)	-
	Female	65 (50.0%)	-	65 (100.0%)
BMI	Underweight	3 (2.3%)	3 (4.6%)	0 (0.0%)
	Normal weight	117 (90.0%)	59 (90.8%)	58 (89.2%)
	Overweight	6 (4.6%)	2 (3.1%)	4 (6.2%)
	Obese	4 (3.1%)	1 (1.5%)	3 (4.6%)

Table 2: Lipid Profile of the study group

Variable	Male Teachers (n=65)	Female Teachers (n=65)	T	P
Age (years)	41.47±6.42	40.09±8.86	0.1261	0.899
BMI	19.35±0.65	20.15±0.97	0.6851	0.495
TG (mg/dl)	154.78±12.64	139.72±11.68	0.8751	0.383
LDL (mg/dl)	133.68±14.82	132.44±14.26	0.0603	0.952
TC (mg/dl)	209.45±15.70	256.21±14.37	2.1679	0.032*
HDL (mg/dl)	54.33±3.53	64.32±3.88	1.9045	0.060
TC/HDL	4.02±0.30	3.84±0.25	0.4609	0.646

*Significant at p<0.05

Discussions

In this study, the effect of Gender on lipid profile was investigated. HDL-C level was also associated with age. The result obtained from this research showed that HDL-C, Total Cholesterol, were higher in females than in males. Compared to several researches has shown that lipid profile distribution differed by ethnicity and gender (Kim *et al.*, 2011)⁸. Davis *et al* (1996)⁹ assessed the sex difference in HDL-C level of six countries and showed that women had higher HDL-C level than men; the difference was the highest in Canada and USA as high as 15.5 mg/dL, and the lowest in China at as low as 2.3 mg/dL. Kesteloot *et al.*, (2006)¹⁰ also demonstrated that gender difference was higher in Belgium as compared to China, confirming previous findings. This result was also similar to the difference in China but far less than those expected in USA or Europe.

The higher HDL-C level in women partly explained the lower mortality from cardiovascular disease in women. Furthermore, countries with lower gender difference in HDL-C level have a lower cardiovascular mortality and a lower gender difference in mortality¹¹.

Mascitelli and Pezzett, (2006)¹² suggested that the same level of HDL-C in men would not only reduce the gender differences in cardiovascular mortality, but also lower the overall mortality. Gender difference in HDL-C is partly explained by estrogen. Estrogen is known to reduce the metabolic activity of macrophage by lipid accumulation, while testosterone promotes it¹¹. In this study, Total cholesterol, Triglyceride and Total-Cholesterol/HDL Ratio were higher in male when compared to female teacher subjects. On average, women develop heart disease some 10–15 years later than men. This raises the question of whether there is some aspect of ‘femaleness’ which reduces risk, or whether there is some aspect of ‘maleness’ that raises risk. To date, most attention has been focused on the hypothesis that endogenous estrogen is cardioprotective in women¹³. Rising rates of coronary heart disease (CHD) after the menopause, and after oophorectomy, are among the strands of evidence in humans that endogenous

estrogen may prevent CHD¹⁴. However, upon closer examination this evidence is not persuasive, and in fact the evidence is amenable to alternative explanations.

During the first 3 decades of adult life, low-density lipoprotein (LDL) cholesterol levels are lower in women than men, and this may contribute to the delayed onset of CHD in women. A more widely held explanation for the later onset of CHD in women is their higher high-density lipoprotein (HDL) cholesterol levels, attributed to higher endogenous estrogen levels in women. However, the difference in HDL cholesterol between women and men is an androgen effect, not an estrogen effect. Up to puberty, young men and women have similar HDL cholesterol levels¹¹. At puberty, concurrent with the rise in endogenous testosterone levels, the HDL cholesterol levels in young men decline to the adult level¹⁵. A 20% difference in HDL cholesterol levels predicts at least a 20% difference in CHD rates in the short term, and may predict even larger differences in CHD rates over a lifetime¹⁵.

Limitations of the study:

Prospective study over years and inability to measure the lipid profile over long period of time and the other underlying health challenges in the subjects which were not identified at the time of study may be confounding variables. This is an interesting issue for future investigations. However, continuous research is needed to validate our findings.

Conclusions

The variations in lipid profile of teachers are related to their gender. The lipid profile of teachers and gender difference obtained from this study can be used as baseline for future study. Males and females not only differ in their levels of sex hormones, the effects of those sex hormones also differ by gender. It appears likely that more research will reveal that the gender difference has male as well as female components.

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