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Effect of Sedentary Work and Exercise on Lipid and Lipoprotein Metabolism in Middle-aged Male and Female African Workers

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Abstract: Lipids and lipoproteins are essential constituents of the body and their activities assist in maintenance of the body homeostasis. Sedentary lifestyle, as predisposed by sedentary work has been shown to lead to inactivity which could lead to lipid disorders. The present study is therefore designed to ascertain the effect of sedentary work on the lipid status of sedentary workers and to their predisposition to coronary heart disease (CHD). The fasting serum TC, TG, HDL-C, LDL-C and VLDL levels of 80 apparently healthy Nigerian male and female workers, living sedentary lifestyles, aged between 20 and 60 years old were analyzed. Forty age-matched non-sedentary subjects were used as control. The mean ± SD for all the groups showed a statistically significant increase ($p<0.05$) in TC, TG, LDL-C and VLDL when compared with the control subjects, while the HDL-C showed a significant decrease ($p<0.05$) when compared with the control. Test of difference in mean ± SD (gender difference) showed a statistically significant increase ($p<0.05$) in TG and LDL-C while a non significant increase ($p>0.05$) was observed in TC, HDL-C and VLDL of females in comparison to their male counterparts. A statistically significant increase ($p<0.05$) was observed in the lipid profile of sedentary workers not undergoing exercise. This study indicates that for both gender, sedentary lifestyle predisposes one to the risk of CHD and lack of exercise worsens the situation. The female participants were more at risk of CHD than the males, based on their lipid profile assessment.

Key words: Artery, assessment, coronary, gender, lifestyle, predispose and test

INTRODUCTION

A lipid profile is a battery of tests used in the diagnosing, treatment and prediction of atherosclerosis. It usually consists of four tests and some calculated values. The measured tests are total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL-C), while the calculated values are the low-density lipoprotein (LDL-C) and very low-density lipoprotein (VLDL) (Ajose *et al*., 2002).

Hyperlipidemia is defined as an increase in the fasting serum cholesterol or triglyceride levels or both. Lipid levels may be affected by diet, exercise, smoking, certain medications etc. (Elliot *et al*., 2002).

A sedentary lifestyle is a type of lifestyle common in modern (particularly western) civilizations, which is characterized by sitting most of the day, in an office or at home (Varo *et al*., 2003). Sedentary work refers to that type of work that involves sitting or spending most of the working hours in an office. It is believed to be a factor in obesity and other disorders (Myron, 2003). Individuals who expend less than 2,000 calories per week through exercise have a higher risk of heart disease than active persons (Nelson *et al*., 1994; Rockhill *et al*., 1999). Most

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African population is rapidly adopting the sedentary work pattern as a result of civilization. Having a sedentary lifestyle leads to being overweight, and this can lead to diabetes or elevated blood pressure, both of which are risk factors for coronary heart disease (Nagara *et al*., 2001).

Maintenance of physical fitness during the aging process improves blood supply to the heart, increases the amount of blood the heart can pump out per-heart beat, improves blood clotting, reduces blood pressure in hypertensive persons, normalizes blood lipid profile, reduces over weight and helps relieve psychological stress (Milne, 1998; Sherman *et al*., 1999). Due to these obvious benefits of physical fitness, there is need to assess, the lipid profile of sedentary workers (in relation to physical fitness) and compare the result with that of age-matched non-sedentary workers. This will go a long way to ascertain their possible predisposition to coronary heart disease (CHD), as will be shown by the result.

MATERIALS AND METHODS

Subjects: The subjects in this study included 120 apparently healthy volunteers, aged between 20-60 years old in Enugu metropolis of Nigeria. The test subjects were made up of 80 male and female subjects living sedentary lifestyle whereas the control subjects comprised of 40, age-matched male and female subjects that are not living sedentary lifestyles. Questionnaires were used to ascertain the actual attitude to physical activity, body weight and health status. Also information on smoking status, marital status, gender, age and weight changes were also collected. The study was carried out at the University of Nigeria Teaching Hospital UNTH, Enugu, Nigeria, between the period of October 2008 and August 2009 with due approval by the institution's ethical committee. Informed consent was dully obtained from each subject that participated being recruited for the study.

Inclusion Criteria: All the test subjects were Nigerian subjects living sedentary lifestyles whereas the control subjects were non-sedentary subjects.

Exclusion criteria: All the subjects excluded from the study were those with history of diabetes mellitus, high blood pressure, coronary heart disease, Obesity, smokers or those on any lipid suppressing drugs, such as erythromycin.

Sample collection and preparation: Fasting whole blood samples {3.0 mL each} were collected from the subjects while in the sitting position, by clean venepuncture from the median cubital vein, using a 5 ml disposable syringe and needle. The samples were collected under aseptic conditions, while avoiding haemolysis and were dispensed into labeled sterile plain tubes and allowed to clot. The clotted samples were centrifuged at 3000 rpm for 5 min and theseparated clear serum supernatants were transferred into sterile tubes. These freshly drawn serum supernatants were used for total cholesterol, triglycerides and HDL-cholesterol assays. When immediate analysis was not possible, the sera were stored frozen and the analysis was carried out within one week.

Analytical method:

- Total cholesterol (TC) assay was done by enzymatic-spectrophotometric method (Allain *et al*., 1974); while HDL-cholesterol (HDL-C) estimation was carried out using precipitation/enzymatic-spectrophotometric method (Grove, 1979).
- Enzymatic spectrophotometric method (Bucolo and David, 1973) was used for triglyceride (TG) estimation; while LDL and VLDL were calculated using Friedewald's formula (Friedewald *et al*., 1972).

All the kit reagents were supplied by Biosystems S.A, Barcelona Spain.

Statistical method: The statistical analysis (students T-test) were done using SPSS computer software package. Results are reported as mean ± standard deviation (mean ± SD).

RESULTS

The results (mean±SD) in mmol/L obtained from the study are as shown below.

Table 1 shows a significant increase ($p<0.05$) in the mean levels of TC (5.52 ± 0.80), TG (2.30 ± 0.72), LDL-C (3.44±0.96), and VLDL (1.05±0.39) and a significant decrease in the mean level of HDL-C (1.07±0.61) in all the sedentary workers when compared with the control (non-sedentary) subjects.

A significant increase ($p<0.05$) was also observed in the mean levels of TC (5.51±0.83), TG (2.27±0.73), LDL-C (3.36±1.03) and VLDL (1.02±0.33) and a significant decrease in the mean HDL-C (1.13±0.63) in male sedentary workers, when compared to male control subjects (Table 2).

The data in Table 3 shows a significant increase ($p<0.05$) in the lipids and lipoproteins TC, TG, LDL-C, and VLDL, whereas a decrease was observed in HDL-C, when female sedentary workers were compared with female control (non-sedentary) subjects.

In Table 4, a comparison of the male and female sedentary workers shows a non-significant difference ($p>0.05$) in the mean levels of TC, HDL-C and VLDL, and a significant difference ($p<0.05$) in TG and LDL-C levels in the female sedentary workers when compared to the male counterpart.

A significant increase ($p<0.05$) was also observed in all the parameters estimated in sedentary workers not undergoing exercise, when the sedentary workers undergoing exercise was compared with those not undergoing exercise (Table 5).

Table 1: Mean ± SD of lipid and lipoprotein values (mmol/L) of male and female sedentary workers and non-sedentary (control) subjects

Parameters (mmol/L)	Sedentary workers N= 80	Non-Sedentary workers (Control) N= 40	P-Value
TC	5.52 ± 0.08	4.60 ± 0.68	P<0.05
TG	2.30 ± 0.72	1.76 ± 0.60	P<0.05
HDL-C	1.07 ± 0.61	1.90 ± 0.59	P<0.05
LDL-C	3.44 ± 0.96	2.18 ± 0.88	P<0.05
VLDL-C	1.05 ± 0.39	0.79 ± 0.27	P<0.05

Table 2: Mean ± SD of lipid and lipoprotein profile (mmol/L) of male sedentary workers and male control subjects

Parameters (mmol/L)	Pmale Sedentary workers N = 46	Male Control Subjects N= 24	P-Value
TC	5.51± 0.83	4.82 ± 0.69	P<0.05
TG	2.27 ± 0.73	1.73 ± 0.65	P<0.05
HDL-C	1.13 ± 0.63	1.89 ± 0.58	P<0.05
LDL-C	3.36 ± 1.03	2.15 ± 0.88	P<0.05
VLDL-C	1.02 ± 0.33	0.78 ± 0.30	P<0.05

Table 3: Mean ± SD of lipid and lipoprotein profile (mmol/L) of female sedentary workers and female control subjects

Parameters (mmol/L)	Female Sedentary Workers N = 34	Female Control Subjects N = 16	P-Value
TC	5.53 ± 0.77	4.93 ± 0.68	P<0.05
TG	2.35 ± 0.70	1.77 ± 0.49	P<0.05
HDL-C	0.99 ± 0.58	1.91 ± 0.62	P<0.05
LDL-C	3.44 ± 0.96	2.33 ± 0.90	P<0.05
VLDL-C	1.06 ± 0.32	0.80 ± 0.22	P<0.05

Table 4: Test of difference in the Mean ± SD of lipid and lipoprotein profile (mmol/L) of male and female sedentary workers

Parameters (mmol/L)	Male Sedentary Workers N = 46	Female Sedentary Workers N = 34	P-Value
TC	5.51 ± 0.83	5.53 ± 0.77	P>0.05
TG	2.27 ± 0.73	2.35 ± 0.70	P<0.05
HDL-C	1.13 ± 0.63	0.99 ± 0.58	P>0.05
LDL-C	3.36 ± 0.63	3.44 ± 0.96	P<0.05
VLDL-C	1.02 ± 0.33	1.06 ± 0.32	P>0.05

Table 5: Mean ± SD of lipid and lipoprotein profile (mmol/l) of male and female sedentary workers undergoing exercise and those not undergoing exercise

Parameters (mmol/L)	Sedentary Workers Undergoing Exercise N = 32	Sedentary Workers Not Undergoing N = 48	P-Value
TC	4.72 ± 0.72	5.54 ± 0.63	P<0.05
TG	1.75 ± 0.59	2.28 ± 0.70	P<0.05
HDL-C	0.98 ± 0.57	1.89 ± 0.60	P<0.05
LDL-C	2.24 ± 0.85	3.30 ± 1.03	P<0.05
VLDL-C	0.75 ± 0.21	1.03 ± 0.30	P<0.05

DISCUSION

In the present study, the lipid and lipoprotein profile of sedentary male and female workers were analyzed and the results revealed a significant increase ($p<0.05$) in TC, TG, LDL-C and VLDL, whereas the level of HDL-C showed a statistically significant decrease ($P<0.05$) when compared with the control subjects. This observation is in agreement with the report of Fonseca and Moriguchi (2001).

However, a comparison of the female and male sedentary workers showed a statistically non-significant increase ($p>0.05$) in TC, HDL-C and VLDL, while a significant increase ($p<0.05$) was observed in TG and LDL-C of the female sedentary workers. This was in contrast to the previous study by Jebb and Moore (1999), who reported that females have a statistically significant decrease in LDL-C and TC and higher HDL-C levels. The observed changes may be attributed to the effect of higher estrogen levels in women, in addition to factors such as diet and exercise.

The test of difference in means of sedentary workers not undergoing exercise showed a statistically significant increase ($p<0.05$) in TC, TG, HDL-C, LDL-C and VLDL in comparison with the sedentary workers undergoing exercise. A similar study by Prabhakaran *et al.* (1999) reported significant reductions in TC, LDL-C and TC/HDL-C ratio in a group of resistance trained women, although the study examined the effects of more prolonged and intense training programme.

From the study, the abnormal findings has shown that living sedentary lifestyle can be a predisposition factor to some metabolic disorders of lipid and lipoprotein metabolism such as coronary heart disease (CHD). This condition could be further worsened when such lifestyle is unaccompanied by adequate exercise programme.

CONCLUSION

It has been observed that sedentary lifestyles of living increased the lipid and lipoprotein levels of the subjects studied. The abnormal increase in the lipid profile parameters of sedentary workers studied could be the result of lack of exercise, nature of diet and reduced level of estrogen in female subjects.

Regular, longer training programme at higher working intensity and reduced fat diet should be encouraged to evoke significant positive changes in blood lipid concentrations and other risk factors of heart disease such as blood pressure and obesity.

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