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Effect of Physical Activity Level on Lipid Profile of Adults Working in Tertiary Institutions in Abeokuta, South-Western Nigeria

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Abstract: A sedentary lifestyle is a risk factor for Cardiovascular Diseases (CVDs). Engaging in regular Physical Activity (PA) has been reported to avert or slow down processes leading to the development of CVDs. This study cross-sectionally examined the effect of different levels of PA on lipid profile of workers in two tertiary institutions in Abeokuta, Ogun State, Nigeria. About 375 apparently healthy workers (147 males and 228 females) were included in the analysis. A validated questionnaire was used to collect demographic, socio-economic, lifestyle and PA information. Based on the information collected, participants were categorized into intense, medium and low PA group. Total Cholesterol (TC), Low Density Lipoprotein Cholesterol (LDL-C), High Density Lipoprotein Cholesterol (HDL-C) and Triglycerides (TG) were analyzed using standard procedures. Men in the intense PA group had a significantly ($p<0.05$) lower TC and LDL-C and a higher HDL-C than those in the low PA group. LDL-C was significantly lower ($p<0.05$) in women in the intense PA group compared to those in the low PA group. The beneficial effect of regular PA in lowering blood lipid of sedentary workers is confirmed.

Key words: Physical activity, lipid profile, cardiovascular disease, adults, PA group, Nigeria

INTRODUCTION

Cardiovascular Diseases (CVDs) are the leading cause of mortality globally. The prevalence of CVDs is highest in developed countries however, the prevalence of CVDs is on the increase in developing countries due to adoption of western lifestyle (Yusuf *et al*., 2001). Dyslipidaemia is undoubtedly a major risk factor for CVDs (Stein, 1990). Elevated concentrations of plasma Total Cholesterol (TC), Low Density Lipoprotein Cholesterol (LDL-C) and Triglyceride (TG) and reduced concentrations of plasma High Density Lipoprotein Cholesterol (HDL-C) have been positively associated with increased risk for CVDs (Criqui *et al*., 1993).

Furthermore, research has identified sedentary lifestyle as an important risk factor for CVDs (Gordon *et al*., 1977). Regular physical exercise has been reported to prevent or delay the onset of CVDs (Shephard and Balady, 1999). The mechanisms underlying the association between physical activity and a decreased CVD event is not clear but is thought that physical activity may act by modulating total body fat or body fat distribution (Despres and Lamarche, 1993). There is some evidence that physical activity lowers the level of C-reactive protein, a marker of inflammation (Ford, 2002).

Work patterns in African countries are becoming sedentary due to improvement in technology and civilization (Ebele *et al*., 2009). Regulations define sedentary work as involving lifting no >10 pounds at a time and occasionally lifting or carrying articles like docket files, ledgers and small tools (SSR 83-10). Jobs are sedentary if walking and standing are required occasionally and other sedentary criteria are met (Varo *et al*., 2003). Job in tertiary institutions could be considered as a sedentary job because it basically involves sitting and spending many hours in the office (Adegun and Konwea, 2009). This has been recognized as a risk factor for many cardiovascular and metabolic disorders (Nelson *et al*., 1994; Rockhill *et al*., 1999). Due to the awareness of the benefits of regular exercise among African populations, some workers in tertiary institutions now engage in regular exercise during leisure hours. It is therefore, important to assess if there is a beneficial effect of regular exercise in this population. In addition, exercise has been reported to have a dose-dependent effect on

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lipid profile. Intense physical activity would be expected to have a more noticeable decrease in levels of CVD risk factors than low or moderate Physical Activity (PA). In view of this, the present study was conducted with the aim of examining the effect of different levels of PA on lipid profile of tertiary institution workers.

MATERIALS AND METHODS

Subjects and design: This study is a cross-sectional study conducted in two tertiary institutions: University of Agriculture, Abeokuta, Alabata (UNAAB) and Federal College of Education, Osiele (FCE) in Abeokuta, Ogun State, Nigeria. The study was conducted in February 2010 in adults age 20-45 years. A total of four hundred and eight questionnaires were administered, only three hundred and seventy five were completely filled and analyzed (147 males and 228 females). A probability proportional to size sampling procedure was used. This means that sample size was determined based on the population in each institution while ensuring that every staff has the same probability of being selected. Individuals who were taking chronic medications and smokers were excluded from the study. Each participant filled out and signed an informed consent form.

Questionnaires: A validated structured questionnaire was used to collect demographic, socio-economic, lifestyle information and physical activity pattern during individual interview by the researchers. Participants were asked to recall their PA pattern in the last 6 months.

Physical activity: Based on the information collected in the questionnaires, participants were categorized into low, moderate and intense physical activity group. The following describes the type of activity in each category:

Low PA level: Reading, standing, driving or walking for <15 min day^{-1}.

Moderate PA level: Reading, standing, driving, house chores (sweeping and washing), walking for at least 15 min day^{-1} and exercise once in awhile.

Intense PA level: Reading, standing, driving, walking for at least 15 min day^{-1}, house chores (sweeping and washing) and jogging/running/swimming/skipping at least 30 min once a week.

Blood sampling: Blood was obtained from antecubital vein of individuals by placing a tourniquet on the upper arm and tightening it sufficiently to prevent venous return. The sites were cleansed with 70% alcohol and dried with sterile gauze. The vein was punctured with sterile needle attached to a syringe. After the vein was entered, the procedure was completed; sterile gauze was used to apply pressure over the punctured site to stop bleeding. The needle was removed from the syringe and the blood was transferred into a lithium heparinized tube and the blood was mixed gently by inverting the stoppered tube several times. Samples were separated within 1 h into plasma and Red Blood Cells (RBC) by centrifuging whole blood at 5000 rpm for 10 min. The plasma samples were stored at -20°C until analyzed. The samples were collected by an authorized health technologist.

Plasma lipids: TC, HDL-C and TG were determined in plasma samples by enzymatic spectrophotometric method as described by Allain *et al.* (1974), Grove (1979) and Bucolo and David (1973), respectively while LDL was calculated using Friedewald's formula (Friedewald *et al.*, 1972). Cromatest® diagnostic kits supplied by Biosystems S.A., Barcelona Spain were used for all assays.

Anthropometric measurement: Height was taken using a wooden graduated length-measuring height meter graduated to measure up to 2 m. Participants were allowed to stand erect with the back of their feet touching the meter and without shoes. Height was gauged with a flat ruler while readings were taken at eye level. Height measurements were taken to the nearest 0.1 cm. Weight of each subject was measured using a digital bathroom weighing scale. The participants were made to stand erect on the scale, barefooted and with light clothing. The weight measurements were read to the nearest 0.1 kg. Body Mass Index (BMI) was calculated by diving weight in kilogram by the square of the height in meter.

Statistical analyses: Data were analyzed using Statistical Package for Social Sciences (SPSS) Version 17. Associations between plasma lipids and PA level was examined using Pearson correlation test while Partial Correlation test was used to examine associations between variables after adjusting for age and BMI. Significant differences in the level of lipids of participant in different PA group were examined using a multivariate analysis of variance. Significance was set at $p<0.05$.

RESULTS

Table 1 shows the characteristics of participants in this study. There was no significant difference in the age of the men and women. Women were significantly

Table 1: Mean+SD Characteristics of participants by gender

Variables	Men (n = 147)	Women (n = 228)	p-value (adjusting for BMI)	
			Before	After
Age (years)	39.18±5.610	36.43±4.810	0.627	-
BMI (kg m^{-2})	25.14±4.830	27.80±3.130	0.001	-
TC (mg dL^{-1})	179.27±38.60	162.31±56.00	0.478	0.041
TG (mg dL^{-1})	119.06±22.88	111.81±15.12	0.115	0.232
LDL-C (mg dL^{-1})	126.58±42.60	106.50±47.75	0.012	0.001
HDL-C (mg dL^{-1})	45.25±13.15	49.19±11.03	0.318	0.045

BMI: Body Mass Index, TC: Total Cholesterol, TG: Triglyceride, LDL-C: Low Density Lipoprotein Cholesterol, HDL-C: High Density Lipoprotein Cholesterol

Table 2: Comparison of lipid concentrations according to physical activity level in men

Variables	Low PA level (n = 87)	Moderate PA level (n = 20)	Intense PA level (n = 40)
TC (mg dL^{-1})	170.23±50.22	160.86±28.23	151.40±33.24*†
TG (mg dL^{-1})	120.54±20.11	109.30±2.640	101.11±16.78*
LDL-C (mg dL^{-1})	135.07±38.96	122.10±4.450*	101.33±35.20*#†
HDL-C	40.53±5.760	40.56±8.870	60.01±11.12*#†

Table 3: Comparison of lipid concentrations according to Physical Activity (PA) level in women

Variables	Low PA level (n = 131)	Moderate PA level (n = 79)	Intense PA level (n = 18)
TC (mg dL^{-1})	182.81+43.14	178.32+23.32	173.39+41.17*
TG (mg dL^{-1})	125.86+12.55	119.44+17.96	110.67+11.08*
LDL-C (mg dL^{-1})	134.08+44.31	138.31+19.03	120.01+21.56*†
HDL-C	47.00+9.110	46.92+4.530	56.12+10.12*#

PA: Physical Activity, TC: Total Cholesterol, TG: Triglyceride, LDL-C: Low Density Lipoprotein Cholesterol, HDL-C: High Density Lipoprotein Cholesterol. *Significantly different from low physical activity group before adjusting for age and BMI ($p<0.05$), #Significantly different from moderate physical activity group ($p<0.05$) before adjusting for BMI ($p<0.05$), †Significantly different from low physical activity group after adjusting for BMI ($p<0.05$)

overweight compared to men ($p<0.001$). Women had significantly lower concentrations of TC and LDL-C and a higher concentration of HDL-C than men ($p<0.05$) after adjusting for BMI. However, the mean lipid concentration of this population fall within recommended reference values for low risk of developing CVDs with the exception of HDL-C. HDL-C concentration is lower than the recommended values of ≥55 mg dL^{-1} for women and ≥60 mg dL^{-1} for men (De Backer *et al*., 2003).

The mean±SD of lipids according to different PA level in men is shown in Table 2. TC and LDL-C were significantly lower in the intense PA group than the low PA group after adjusting for BMI ($p<0.05$). In addition, HDL-C level was higher in the intense PA group than the low PA group after adjusting for BMI ($p<0.05$).

Lipid levels are compared according to PA levels in women (Table 3). LDL-C was significantly lower in the intense PA group compared to the low PA group ($p<0.05$). The HDL-C concentration of men and women in the intense PA level group (Table 2 and 3) fall within reference ranges as compared to those in the low and medium PA level group or even the general population.

DISCUSSION

The present study examined the effects of different PA level on the lipid concentrations of adults working in tertiary institutions. The results showed that intense PA group has a significantly lower TC and LDL-C levels than the low PA group in men. HDL-C level in the intense PA group was significantly higher compared to the low PA group in the men. As for women, only LDL-C level was significantly reduced in the intense PA group compared to the low PA group.

Several studies have reported the beneficial effect of PA on lipids (Ebele *et al*., 2009; Fonseca and Moriguchi 2001; Gandapur *et al*., 2001). Oyelola and Rufai (1993) reported a significant reduction in concentrations of TC and LDL-C of male athletes (average age 22 years) at a Nigerian University when compared to their non-athlete counterpart. In a similar study by Prabhakaran *et al*. (1999), significant reductions in TC and LDL-C in a group of resistance trained women was reported. Furthermore, Gordon *et al*. (2008) conducted a study in diabetic patients, TC significantly reduced in the group exposed to conventional physical training for 6 months.

Regular exercise improves myocardial contraction its electrical stability and stroke volume leading to a higher maximal cardiac output (Bouchard, 1997). It stimulates lipid oxidation during activity and in post-exercise recovery (Bouchard *et al*., 1993). Regular exercise increases the ratio of HDL-C to LDL-C during lipid transport, lipoprotein lipase activity leading to an increased utilization of circulating triglycerides as fuel.

Moreover, recent studies (Abramson and Vaccarino, 2002; Ford, 2002) have found that increasing levels of physical activity are associated with reduced levels of C-reactive protein, a marker of systemic inflammation.

Since, elevated levels of this marker have been shown to be an important predictor of future cardiovascular event (Ridker *et al*., 2002) these suggest that the association between exercise and a reduced risk of cardiovascular events may also be mediated by the anti-inflammatory effects of physical activity.

The effect of physical activity on lipid levels is influenced by gender (Habib *et al*., 2005). Pre-menopausal women usually have a favourable lipid profile compared to men within the same age group (Habib *et al*., 2005). This has been attributed to the lipid lowering effect of oestrogen hormone present in women (Miller, 1990). The results of the present study corroborate this finding as women had a significantly lower TC, TG and LDL-C and a higher HDL-C than men after adjusting for age and BMI.

Conversely, Ademuyiwa *et al*. (2008) reported that men had a more favorable lipid profile than women which is contrast to the finding of the present study. Though, these two studies were conducted in the same city of Abeokuta, the population could be considered as different. While Ademuyiwa *et al*. (2008) included the general community in his study, the present study was limited to people working in tertiary institutions. The general community of Abeokuta has been reported to live an active the same cannot be said of people working in tertiary institutions. However, the results of the present investigation confirm previous findings (Glew *et al*., 2001, 2002, 2004; Ademuyiwa *et al*., 2005) that cholesterol levels in Nigerian population are significantly lower than that of their American counterparts.

The present study examined the beneficial effect of regular exercise on lipid profile. It took care (statistically) of the possible modulatory effect of body weight in the relationship between lipids and physical activity. Despite the relevance of this study, some limitations are worthy of note.

The classification into the different physical activity group was based on the results gathered in this population and as such what is considered as intense PA in this study may be less than the recommended intense PA level (>6 m or a minimum of 7.5 kcal min^{-1} or working at a minimum of 70% of maximum heart rate or 70% of VO2max (American College of Sports Medicine, 2002; Morris, 1994). Moreover, this study did not account for how long the participants have been practicing the lifestyle of engaging in regular exercise.

CONCLUSION

The results of the present study confirm the beneficial effect of regular PA on lipid profile of workers in a sedentary environment as that obtainable in tertiary institutions.

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