Physical activity parameters and Body Mass Index among Public Secondary School Teachers, Oyo State. Nigeria

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Summary

Introduction: Physical inactivity is an important contributor to obesity epidemic. In Nigeria, public secondary school teachers are prone to sedentary lifestyle. This study determined physical activity parameters and Body mass index (BMI) among public secondary school teachers in Ibadan North Local Government Area of Oyo State. It also compared physical activity parameters and BMI between male and female teachers.

Materials and methods: This study is a cross sectional survey and 101 (65 females and 36 males) public secondary school teachers participated. Physical activity parameters (number of steps, distance covered and energy expenditure) were assessed using pedometer while the Body Mass Index (BMI) was computed from participant's height and weight. Data were analyzed using descriptive (percentage, mean, standard deviation) and inferential (Independent 't' test and Pearson product moment correlation coefficient) statistics. Alpha level was set at $p<0.05$.

Results: Participants mean age, BMI, number of steps and energy expenditure were 43.67±9.49 years, 26.70±5.55 kg/m^2, 7429.06±5469.6 steps per day and 185.26± 158.64 kcal/day respectively. There was a negative, non-significant correlation between number of steps and BMI ($r = -0.004$, $p = 0.969$), a significant positive correlation between Energy Expenditure and number of steps taken ($r = 0.766$, $p = 0.001$) and a positive, non-significant correlation between Energy Expenditure and BMI ($r = 0.150$, $p = 0.135$). Females had significantly higher body weight and BMI than male teachers.

Conclusions: Body weight and BMI was significantly higher among female than male participants. Men were physically active more than women but not significantly.

Keywords: Physical activity parameters, Body mass index; school teachers

Introduction

Physical activity (PA) plays a very crucial role in preventing chronic diseases such as coronary heart disease, hypertension, osteoporosis, obesity and diabetes [1]. Studies have shown that physical inactivity over time has a cumulative negative effect on the health of an individual with the possibility of early development of chronic disease [2]. Embracing a lifestyle of regular physical activities such as walking, dancing, gardening, or jogging has the potential of improving an individual's general health, capability and quality of life [3]. However, for PA to have a good impact on both the physical health and well-being of the individual, the required intensity, duration and frequency of PA the participant will need to adhere to has been documented by World Health Organisation [4].

A study done in Malaysia showed that the level of physical activity amongst its population has decreased drastically with an unfortunate increase in non-communicable diseases most especially diabetes [5]. Countries located in the Middle East have also seen a remarkable rise in physical inactivity of their populaces with Saudi Arabia having the highest prevalence rate [6]. Reasons for this rise within the Gulf region is blamed on adoption of Western lifestyles which includes reduced walking with increased dependence on the modern transportation system, increased sitting hours due to entertainment via the internet or television and, poor eating habits [7]. Investigations into the levels of PA amongst healthcare providers in Nigeria revealed that most workers were below the WHO recommendation for daily PA with overweight and obesity highly associated with physical inactivity [8].

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Walking is an effective form of PA which is inexpensive, easy to perform, less prone to injuries and can easily be implemented by people of all ages [9]. A few studies have shown that walking is the preferred activity when compared to other forms of PA [10], probably due to its convenience to perform and lack of special skill required. Walking as a form of PA is proven to be inversely associated with body mass index (BMI) 11 and has been incorporated to help reduce body fat and increased body mass index (BMI) and reduced PA are well-known independent risk factors in the development of non-communicable diseases [12].

Secondary school teachers may also be prone to living a sedentary lifestyle which may affect their BMI. Hence, the aim of this study was to determine the relationship between physical activity parameters and body mass index among public secondary school teachers in Ibadan North Local Government Area of Oyo State.

Materials and methods

Procedure

Ethical approval for this study was obtained from the University of Ibadan/ University College Hospital (UI/UCH) Health Research Committee, Ibadan, Nigeria with number UI/EC/15/0198. Permission to conduct this study in schools was obtained from the Ministry of Education, Ibadan North Local Government Area (LGA), Oyo State. A letter of introduction explaining the nature and purpose of the study was given to each willing participant. In addition, the procedure for this study was explained to the participants. All participants read and signed a written informed consent form.

Participants

This study is a cross-sectional survey design. Participants for this study were 101 consenting public secondary school teachers offering teaching services in schools in Ibadan North local government area, Oyo State. Random sampling technique was used to select nine secondary schools and a purposive sampling technique was used to select all consenting teachers who have met the inclusion criteria. Eligible for participation include teachers between ages of 20 and 60 years and independently ambulant. Excluded from the study were participants who were undergoing cancer treatment, pregnant women and any other indications of health challenges for example cardiovascular diseases.

Instruments

The following instruments were used for data collection:

Pedometer: The Pedometer (YamaxDidi-Walker SW-701) is an affordable, valid and reliable portable device, used to measure an individual's ambulatory profile during the day [13]. Participants who met the inclusion criteria and gave consent were recruited to participate in this study for 5 consecutive working days (Monday–Friday) during which the pedometer was worn. Participants were instructed to record the total number of steps taken, distance and energy expenditure at the end of each day in a physical activity log prior to retiring to bed. However, if the participant forgot (or for any other reason) to wear the pedometer on any day, they were instructed to leave the activity log blank for that day, indicating non-compliance. The pedometer was worn attached to the waist band of their clothing during waking hours, except when bathing or swimming. Participants were encouraged not to alter their usual physical activity habits during the 5 study days. Participants were contacted by telephone twice daily or occasionally face-to-face once during the 5-day study to check for compliance. Text messages were also sent to remind each participant to wear their pedometers appropriately in the morning and a reminder at night to record daily data in the activity log sheet before retiring to bed. Random calls and visits were made to some of the participants during the 5-day study to ask and confirm if they have been complying with the protocol of the research. At the end of the study, Participants returned both the pedometers and the physical activity logs to the researcher and the logs were checked by the researcher for completeness, comprehension and compliance**.**

In order for the portable device to measure the total distance covered by an individual for that day, the participant's average step length was measured and imputed into the pedometer. This is because the pedometer calculates the total distance covered by multiplying the average step length of an individual by the number of steps taken. For the purpose of this study, the following number of steps represented the respective activity profiles:

i. Highly Active – Greater than 12,500 steps
ii. Active – 10,000–12,500 steps
iii. Moderate Active – 7,500–9,999 steps
iv. Low Active – 5,000–7,499 steps
v. Sedentary – Less than 5,000 steps. [14]

Tape Measure: This was used to measure participant's step length and recorded in centimeters (cm). The participant was asked to walk at their normal pace, making marks on the floor and the tape measure was used to measure the distance from the heel of one foot to the heal of the other foot.

Height: The height meter manufactured in Germany by SECA with model number 220 was used to measure the height of each participant in centimeters and recorded to the nearest 0.1 meters. Participants were instructed to stand erect on the height meter, barefoot and making sure their occiput touches the vertical metal rod. The perpendicular arm (lever of the height meter) was then placed on the vertex of the participants head with a slight pressure applied to the participants head. The height was then measured to the neatest meter.

Weight: The weighing scale manufactured in Ireland by Hanson (calibrated from 0–220 Kg) was used to measure the body weight of each participant in kilograms (Kg). Participants were instructed to stand erect on the weighing scale, with their shoes off, while wearing light apparel. The reading was taken while

the participants looked forward. The body weight was read to the nearest kilogram.

Body Mass Index (BMI) – Participant's body mass index was calculated in kilogram per meter squared (Kg/m^2). The participant's appropriate weight in kilograms was divided by the square of the appropriate height in meters. BMI is used to screen for weight categories that may result in health challenges. BMI measured categories are classified as follows:

i. Underweight – < 18.50
ii. Normal – 18.50–24.99
iii. Overweight – 25.00–29.99
iv. Obese – 30.00 and above [15]

Step Length – The step length of each participant was measured by asking the participant to take few steps at his/her usual pace then starting from a marked line he makes 10 more steps and an end line is marked. The distance between marked lines was measured and divided by the number of steps taken. The participant was then asked to repeat this procedure thrice. An average of the three trials was used to determine the participant's step length.

Energy Expenditure: Each participant's energy expenditure was estimated using the pedometer and expressed in Kilocalories

Data Form: This form was used to document each participant's personal information and measurement of variables such as age, gender, height, weight, BMI, and step length.

Data analysis

Descriptive statistics of mean, range, standard deviation, frequency, and percentages were used to summarize data. Inferential statistics of Pearson product moment correlation coefficient was used to determine the relationship between energy expenditure, BMI, and number of steps and Independent 't' test was used to compare Physical activity paramenters and BMI between male and female participants. Level of significance was set at $p<0.05$.

Results

A total of one hundred and twenty-one teachers in public schools participated in this study. However, only one hundred and one (65 females (64.4%) and 36 males (35.6%)) with valid data were analyzed. Female participants were aged between 20 to 56 years with a mean age of 43.08±8.97 years while their male counterparts were aged between 21 to 58 years with a mean age of 44.75±10.43 years.

Table 1 shows the demographic and physical activity parameters of the participants.

Table 1.
Demographic and Ambulatory Profile Characteristic of the study participants

Variable	Range	Mean±SD
Age (years)	20-58	43.67±9.49
Weight (Kg)	41.3–118.3	72.49±14.31
Height (m)	1.46–1.83	1.65±0.84
BMI (Kg/m^2)	18–44	26.70±5.55
Energy Expenditure (Kcal)	4.3–876.4	185.26±158.64
Number of steps (steps/day)	379–29342	7429.06±5469.6

BMI – Body Mass Index; Kcal – Kilocalories; SD – Standard Deviation

Table 2 shows the level of activity profile based on BMI classification and 43(42.6%) participants were of normal weight, 30 (29.7%) were overweight, while 27 (26.7%) were obese. Furthermore, in accordance with Tudor-Locke classification based on the number of steps participants took, forty-four (43.6%) of them were living a sedentary lifestyle while 12 (11.9%) were regarded as highly active.

Table 3 shows the distribution of participants activity profile based on gender. Thirty-one (47.7%) females were classified as sedentary when compared with 13(36.1%) of their male counterparts. Furthermore, 7(19.4%) males were classified active when compared with 5 (7.703%) of female counterparts. Out of 65 women who participated in this study 24 (36.9%) of them were obese while 23 (35.4%) were of a normal weight while out

Table 2.
A cross tabulation of Activity Profile and BMI classification

BMI Class	Activity Profile				
	Sed n(%)	Low Act n(%)	Mod Act n(%)	Act n(%)	Highly Act n(%)
Underweight	1(1%)	-	-	1(8.3%)	-
Normal	43(42.6%)	19(43.2%)	5(31.2%)	10(58.8%)	4(33.3%)
Overweight	30(29.7%)	12(27.3%)	9(56.2%)	3(17.6%)	2(16.7%)
Obese	27(26.7%)	13(29.5%)	2(12.5%)	4(23.5%)	6(50.0%)
Total	101(100%)	44(100%) 43.6%	16(100%) 15.8%	17(100%) 16.8%	12(100%) 11.9%

BMI Class – Body Mass Index Classification; Sed – Sedentary; Low Act – Low Activity; Mod Act – Moderate Activity; Act – Active; Highly Act – Highly Active

of 36 men only 3 (8.3%) were obese while 20 (55.6%) were of a normal weight. Furthermore, 31 (47.7%) out of the total women (65) were of a sedentary activity profile while 13 (36.1%) out of the total men (36) were of a sedentary activity profile.

Table 3.
Cross tabulation of sex and BMI, Activity profile of participants

	Male n (%)	Female n (%)
BMI		
Underweight	-	1(1.5%)
Normal	20(55.6%)	23(35.4%)
Overweight	13(36.1%)	17(26.2)
Obese	3(8.3%)	24(36.9%)
ACTIVITY PROFILE		
Sedentary	13(36.1%)	31(47.7%)
Low activity	8(22.2%)	8(12.3%)
Moderate activity	5(13.9%)	12(18.5%)
Active	7(19.4%)	5(7.7%)
Highly active	3(8.3%)	9(13.8%)
Total	36(100%)	65(100%)

BMI – Body Mass Index

Table 4 shows the relationship between ambulatory profiles and BMI. Pearson's product moment correlation (r) between BMI and number of steps was negative but not significant (r = – 0.004, p = 0.969) while the relationship between energy expenditure and BMI was positive and not significant (r = 0.150, p = 0.135).

Table 4.
Correlation between Ambulatory Profile and Body Mass Index of study participantss

Variables		Energy expenditure	Number of steps	BMI
Energy expenditure	r	-	0.766	0.150
	p	1.000	0.001*	0.135
Number of steps	r	0.766	-	- 0.004
	p	0.001*	1.000	0.969
BMI	r	0.150	- 0.004	-
	p	0.135	0.969	1.000

* – significant correlation; BMI – Body Mass Index

Table 5 showed comparison of physical activity parameters between male and female participants. Body weight and BMI was significantly higher among females than males.

Discussion

The aim of this study was to determine physical activity parameters and BMI among public secondary school teachers and also compare the same between male and female teachers. Participants mean BMI, energy expenditure and number of steps taken were 26.70±5.55Kg/m^2, 185.26±158.64Kcal/day, 7429.06±5469.60 steps/day respectively. This may imply that on an average, public secondary teachers were both overweight and with a low active on physical activity profile and these findings are in agreement with Bogaert et al [16]. The World Health Organization has expressed concerns about how overweight and obesity are fast becoming a global epidemic [17].

Table 5.
Gender comparison of PA parameters and BMI using independent 't' test among the participants

Variable	male mean±sd n=36	female mean±sd n= 65	p value
Age (years)	44.78±10.40	43.22±8.66	0.386
Weight (Kg)	72.15±9.89	72.68±16.32	0.001*
Height (m)	1.72±0.07	1.61±0.68	0.977
BMI (Kg/m^2)	24.56± 3.87	27.85±5.90	0016
Energy Expenditure (Kcal	209.56±174.95	171.88±148.59	0.428
Number of steps (steps/ day)	7452.89±4405.64	7431.92±6002.78	0.192
Distance covered	4.44±2.90	3.78±2.82	0.937

BMI – Body Mass Index; sd – Standard Deviation n-sample size
* significant

This study showed that out of the thirty overweight and twenty-seven obese teachers, 21 (70%) and 15 (55.6%) teachers respectively lived either a sedentary or low active lifestyle. This sedentary lifestyle may be as a result of long sitting hours the secondary school teachers are mostly engaged in, due to the nature of their work. Teachers do stand up to teach but they mostly sit to explain the subject to their students. Teachers also assume sitting position while marking students answer scripts, planning for the next lecture and during teacher to teacher conversation. This study also showed that, out of forty-three normal weight teachers, 24 (55.8%) lived either a sedentary or low active lifestyle indicating that some teachers (despite been normal weight) from this study are not at the recommended level of physical activity and hence are at risk of developing non-communicable diseases in which obesity is included.

Interestingly, out of the thirty overweight and twenty-seven obese teachers, 6 (20%) and 8 (29.6%) teachers respectively lived an active and highly active lifestyle. There is a possibility that these group of teachers were aware of the health risks associated with high BMI and made conscious efforts to actively reduce their body weight by engaging in physical activities (like walking). In order to prevent weight gain, the amount of energy intake needs to be counter balanced by the amount of energy expended [18].

More female from this study, were obese (36.9%) when compared to their male (8.3%) counterparts. However, studies have shown that in well-resourced countries, the obesity rates in both

male and females are similar, but as for the developing countries, females were seen to be more obese as compared to their male counterparts [19]. Low socioeconomic status may not entirely be the reason for obesity been more prevalent in females, there is a strong indication that higher estrogen levels are partly responsible for obesity seen in women [20].

The percentage of active (moderate to highly active) males (41.7%) to female (40%) from this study was almost the same. However, this means that more teachers (of both sexes) were equally below the daily minimum requirement for physical activity. This is in contrast to the result of Kirunda et al, [21] in Uganda that reported that more females were physically inactive than their male counterparts. A possible explanation for this discrepancy may have to do with the women's occupation. In our study, all the women were secondary school teachers while in Kirunda's study women who were domestic workers were also included. This means that this group of women from the latter did not have to walk far, but rather walked within the confines of the house they were employed to work in.

There was an inverse and non-significant relationship between number of steps taken and BMI amongst secondary school teachers. However, Salin et al, [22] found a significant inverse relationship between steps taken and BMI. In this study, participants were given the pedometer and log book to fill for just a week. However, in Salin's study, participants used the pedometer for a week with data recorded and stored, then after four years, the pedometer was given to the same participants to use and their new data recorded and differences analyzed. The relationship between energy expenditure and number of steps taken from this study revealed a significant positive correlation. This result was in agreement with the outcome of a study done by Oliver [23]. Finally, a positive but non-significant relationship between Energy Expenditure and BMI was observed amongst secondary school teachers. This is in contrast to a study done by Bandini et al, [24] which found a significant correlation. Again the discrepancies found could be explained by the method of collating the BMI. This study measured for participants' height and weight to determine their BMI only once. However, in Bandini's study, participants BMI were determined and data stored until four years later were the same participants were recruited, their BMI re-determined and differences analyzed.

Previous studies observed that females were less active compared with male counterparts [25]. The outcome of this study showed that female were less active than males but not significantly.

Limitation of the study

The pedometer used in this study only measures activity restricted to walking. Many teachers were unwilling to participate in this study.

Conclusion

Female participants had significantly higher weight and BMI. Male participants were more physically active though not significantly. Ambulatory profile from this study was not significantly associated with BMI. This may be due to other contributory factors such as sex, genetics, and diet that affect BMI independent of physical activity. Enhancing participation in physical activity may help in reducing prevalence of obesity especially among the female participants.

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