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PHYSICAL ACTIVITY LEVEL AND ENERGY EXPENDITURE OF CLINICAL PHYSIOTHERAPISTS AND PHYSIOTHERAPY EDUCATORS IN SELECTED TERTIARY HEALTH AND EDUCATIONAL INSTITUTIONS IN SOUTH-WEST NIGERIA

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Background: Physiotherapists are trained in the use of physical activity for health promotion, and therefore are expected to be physically active themselves.

Aim of the study: This study determined the physical activity level and energy expenditure of clinical physiotherapists and physiotherapy educators.

Material and methods: The research design is cross-sectional survey. Sixty participants were selected using the consecutive sampling technique. A pedometer (Omron) was used to measure the number of steps taken by the participants, the distance covered, and the overall energy expenditure. The number of steps was used to classify the participants' physical activity levels. The data obtained were analysed using descriptive statistics and frequency, percentages and chi-square inferential statistics, Pearson product-moment correlation, Spearman's rank correlation, independent t-tests and Mann-Whitney U tests. The alpha level was set at 0.05.

Results: The mean age and BMI of all participants were 36.81±7.86 years and 26.16±4.46kg/m^2 respectively. The average number of steps taken per day was 8002±3411 and the mean energy expenditure was 248.26±182.92kcal. This study revealed that 21.3% of the participants were sedentary, 27.7% were 'low active', 27.7% were moderately active, 10.6% were active and 12.8% were highly active. The Pearson product-moment correlation coefficient showed a significant negative relationship between the number of steps and age (r = -0.292 p= 0.047) and a significant positive relationship between the number of steps and energy expenditure (r = 0.325; p = 0.026), respectively. There was a significant inverse relationship between the number of steps, the energy expenditure and the age of the participants. There was no significant difference in the number of steps per day, PAL and energy expenditure between clinical physiotherapists and physiotherapy educators.

Conclusions: Physiotherapists should improve their physical activity levels, as most of them (76.7%) were classified in the low activity level category.

KEYWORDS: Physical activity, energy expenditure, number of steps, physiotherapists

Background

Physical activity has been described as an important factor in the prevention of chronic diseases [1] and the fact that physical activity is critical to the enhancement of one's health has been well-documented [2,3]. Physical activity is defined as any bodily movement produced by the contraction of skeletal muscles that results in a significant increase in caloric requirements beyond the typical resting energy expenditure [4]. Physical activity may consist of sports, conditioning exer-

cises, household activities, and/or other activities. The benefits of physical activity span various aspects of life including emotional, physical and mental health. Specific benefits include improvements in body composition, lower blood pressure and resting heart rate and during sub-maximal exercise, reduction in blood fat and cholesterol levels, increased glycaemia control and better immune responses. These benefits make physical activity pivotal in the management and prevention of several chronic conditions [1].

On the other hand, physical inactivity is a leading public health problem associated with decreased longevity, as well as cardiovascular disease, cancer, obesity, diabetes, and other diseases [5]. Physical inactivity is associated with 21–25% of breast and colon cancer burdens, as well as 27% of the burdens of diabetes and about 30% of ischaemic heart disease burdens in 2004 [2,6]. In 2010, physical inactivity and low physical activity accounted for 3.2 million deaths and 2.8% of Disability-Adjusted Life Years (DALYs), globally [7]. Worldwide, 31% of adults are estimated to be physically inactive and this percentage is rising. With that rise come major public health implications [8]. The World Health Organization (WHO) in 2010 [5] recommended that adults aged 18-64 years should do at least 150 minutes of moderate intensity, 75 minutes of vigorous intensity, or an equivalent combination of moderate and vigorous intensity aerobic physical activity weekly, in order to improve cardiorespiratory and muscular fitness, bone health and reduce the risk of non-communicable diseases and depression. Several modes of physical activity such as walking, cycling, swimming, muscle strengthening exercises and many others are useful in enhancing health.

Walking has been reported as the most common form of physical activity in both developed [9,10] and developing countries [11–13]. This is, in part, due to the fact that walking is a natural, inexpensive and easily accessible activity for a large portion of the general population [9] and across age groups [10]. There are fewer physical, social and psychological barriers associated with walking when compared with other forms of exercise [14]. Walking can be safely prescribed for any category of patients, or for otherwise healthy individuals. However, in order to achieve an adequate level of physical activity through walking, it is important to consider the number of steps taken per day, the distance covered per day and stride length. Energy expenditure involved in any physical activity is defined as an index of the level of a given individual's physical activity [15].

Physiotherapists have the potential to make a substantial impact on individuals, communities and general public health through their professional expertise in the use of physical activity and exercise in the management and prevention of chronic conditions, such as obesity, cardiovascular disease, ischaemic heart disease and other diseases [16]. Exercise is a core subject in the study of physiotherapy, and physiotherapists have been effective in managing chronic and non-communicable diseases with exercise [17,18]. Physiotherapists are well-positioned to assess patients with chronic conditions and tailor exercise programs to the specific needs of this complex patient population in order to help them make essential lifestyle changes. Moreover, they are the only clinicians who possess the core education and training to provide these types of assessments and exercise interventions for patient populations in acute care, rehabilitation, outpatient, complex continuing care and homecare settings [19]. It has been hypothesized that physiotherapists who themselves participate in physical activity will become more involved in prescribing physical activities as a form of intervention for their patients due to their own personal knowledge of and skills in using exercise treatments for different conditions [16]. Although physiotherapists are trained physical activity experts, there is a paucity of information on their knowledge and training being translated into effective uses for their own personal benefits.

Aim of the study

The study assessed physical activity level, physical activity parameters and energy expenditure among physiotherapists (clinicians and lecturers) and compared the physical activity level and expenditure of both clinicians and lecturers in southwest Nigeria. The following hypotheses were postulated:

1. There will be no significant relationship between the number of steps taken per day, energy expenditure and the demographic characteristics of clinical physiotherapists and physiotherapy educators in the selected tertiary health and educational institutions in southwest Nigeria.
2. There will be no significant relationship between the physical activity level and the demographic characteristics of clinical physiotherapists and physiotherapy educators in the selected tertiary health and educational institutions in southwest Nigeria.
3. There will be no significant difference in the physical activity level, physical activity parameters and energy expenditure between clinical physiotherapists and physiotherapy educators in the selected tertiary educational and health institutions in southwest Nigeria.

Material and methods

Study design

The design for this study is a cross-sectional survey.

Setting

The researchers sought and obtained ethical approval from the University of Ibadan/University College Hospital (UI/UCH) Health Research Committee with approval number UI/EC/15/0205 before the commencement of the study. The study was conducted between November 2015 and November 2016.

The consecutive sampling method was used to recruit 60 licensed physiotherapists in the selected tertiary health and educational institutions in southwest Nigeria [University College Hospital (UCH), University of Ibadan (UI), Obafemi Awolowo, University Teaching Hospital (OAUTH), Obafemi Awolowo University (OAU), Lagos University Teaching Hospital (LUTH), University of Lagos (Unilag)]. Excluded from the study were physiotherapists who were pregnant, retired physiotherapists and physiotherapy clinicians who were also post-graduate students. An informed consent form stating the purpose of the study, as well as assuring participants of confidentiality and anonymity, was attached to the provided questionnaire. The questionnaire was self-administered by the participants. Researchers obtained relevant socio-demographic information including age, gender, years of qualification, weight, and height.

Participants

The participants were physiotherapists in tertiary health and educational institutions in southwest Nigeria,including University College Hospital, Ibadan (UCH), University of Ibadan (UI), Obafemi Awolowo University Teaching Hospital, Ile-Ife (OAUTH), Obafemi Awolowo University, Ile-Ife (OAU), Lagos University Teaching Hospital, Lagos (LUTH) and University of Lagos, Lagos (Unilag). Participants were licensed physiotherapists within the selected tertiary educational and health institutions. Sixty physiotherapists were recruited from the randomly selected tertiary institutions and allowed to participate in this study. Only 47 participants had results that were valid for analysis. Of the 47 participants, 33 (70.2%) were male, while 14 (29.8%) were female. Nine (27.27%) of the male participants were physiotherapy educators while the remaining 24 (72.73%) were clinicians. Five (35.71%) of the female participants were physiotherapy educators and nine (64.29%) were clinicians.

Variables

The variables measured in this study included age, height and weight. Body mass index (BMI) was computed for each participant based on their weight and height [W/H^2 (Kg/m^2)]. Physical activity level was estimated from the number of steps taken in a day. Energy expenditure was measured with the pedometer.

Data sources / Measurement

Age: Each participant's age was recorded to the nearest whole number.

Height: This was measured with the participant standing erect, barefoot, looking straight ahead with their feet together and their back against a graduated height meter. The height was recorded to the nearest 0.01 meter.

Weight: This was measured with the participant standing erect, facing straight ahead and with their hands by their side, in light clothing and barefoot on the weighing scale. The weight was measured to the nearest kilogramme.

Body mass index: This was calculated for each participant from their measured height and weight using the formulae W/H^2 (Kg/m^2). BMI was classified into the following:

- Underweight: < 18.5
- Normal: 18.5–24.9
- Overweight: 25.0–29.9
- Obese Grade I: 30.0–34.9
- Obese Grade II: 35.0–39.9
- Obese Grade III: > 40

Physical activity level: This was assessed using the number of steps taken per day as measured by the pedometer according to Tudor-Locke, 2011 [20].

- Less than 5000 steps/day is classified as a "sedentary lifestyle index".
- 5,000-7,499 steps/day is classified as "low active".
- 7,500-9,999 steps/day likely is classified as "somewhat active".
- 10,000 steps/day indicates is classified as "active".
- More than 12, 500 steps/day is classified as "highly active".

*Energy expenditure***:** This was calculated using the number of calories per day and number of steps per day, as obtained by the pedometer. This was then compared with the estimated total daily energy expenditure using an estimated Basal Metabolic Rate (BMR) and Activity Factor of each individual. BMR can be calculated using the Mifflin – St Jeor formula [21].

- Women = (9.99 × weight in kg) + (6.25 × height in cm) – (5 × age in years) - 161
- Men = (9.99 × weight in kg) + (6.25 × height in cm) – (5 × age in years) - 5

BMR is measured in calories/day.

Table 1. Activity Factor

Amount of Exercise Exercise/Activity	Description	TDEE/ Maintenance
Sedentary	Light or no Exercise/ Desk Job	TDEE= 1.2 x BMR
Lightly active	Light Exercise/Sports 1-3 days/week	TDEE= 1.375 x BMR
Moderately active	Moderate Exercise, Sports 3-5 days/week	TDEE= 1.55 x BMR
Very active	Heavy Exercise/ Sports 6-7 days/week	TDEE= 1.725 x BMR
Extremely active	Very heavy exercise/ physical job/ training twice/day	TDEE= 1.9 x BMR

Total Daily Energy Expenditure (TDEE) = BMR X Activity Factor

The estimated TDEE and the one obtained from the pedometer were compared to see if the individual was expending energy as expected for maintaining the normal body physiology.

Bias

All of the participants were licensed physiotherapists. Physiotherapists who were also post-graduate students or were pregnant were excluded because it was believed this could affect their physical activity level.

Study size

This is a population-based study where all available and willing physiotherapists in the selected tertiary health and educational institutions who met the inclusion criteria were allowed to participate in the study.

Statistical methods

Descriptive statistics was used to summarise age, height, weight, number of steps per day, distance covered per day and energy expenditure. Chi-square analysis was used to determine the association between the physical activity level of physiotherapists and demographic characteristics. The Pearson product-moment correlation coefficient was used to determine the relationship between demographic characteristics and the number of steps, and demographic characteristics and energy expenditure. Spearman's rank correlation was used to determine the relationship between PAL and demographic characteristics. Independent t-tests were used to compare the number of steps, energy expenditure, distance covered and calories per day between the two groups. Mann-Whitney U tests were used to compare PAL between the two groups. The level of significance was set at $\alpha = 0.05$.

Results

The mean age was 36.81±7.86 years and mean BMI was 26.16±4.46kg/m^2 (Tab. 2). The average number of steps taken per day was 8,002±3,411 steps, distance covered was 4.36±3.90km and mean energy expenditure was 248.26±182.92 kcal (Tab. 2). Out of the 47 participants, only 40 (85.1%) of them responded positively to driving their cars as a means of transportation, while the remaining seven (14.9%) said they do not use their personal cars as a means of transportation (Tab. 3).

Table 2. Demographic Characteristics of the Participants

Variable	Minimum	Maximum	Mean	S.D
Age (in years)	24	60	36.81	7.86
Weight (in kg)	50.90	132.50	76.45	14.69
Height (in cm)	153.60	189.00	170.92	8.43
BMI (in kg/m^2)	19.67	38.71	26.16	4.46
Number of Steps taken per day	2,364	19,180	8,002	3,411
Distance Covered (in km)	1.21	26.33	4.36	3.90
Energy Expenditure (in kcal)	43.10	1103.33	248.26	182.92

Key: n= 47; BMI: Body Mass Index; S.D: Standard Deviation

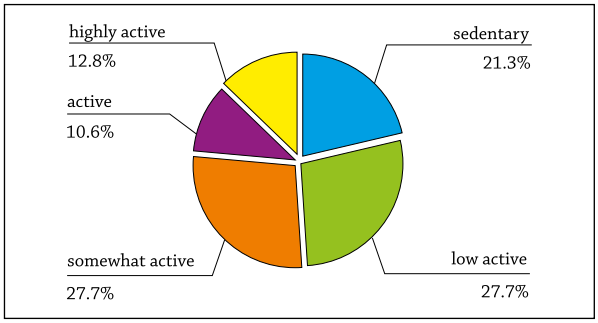

Figure 1. Physical Activity Level among physiotherapists in the selected tertiary institutions

Table 3. Frequencies and percentages of participant characteristics

	Frequency	Percentage (%)
Physiotherapist		
Clinician	33	70.2
Educator	14	29.8
Total	47	100.0
Gender		
Male	33	70.2
Female	14	29.8
Total	47	100.0
Use of private car as a means of transportation		
Yes	40	85.1
No	7	14.9
Total	47	100.0

Table 4. Association between PAL of physiotherapists and their demographic characteristics

			PAL					X^2- value	p-value	Comment
			Sedentary	Low Active	Somewhat Active	Active	Highly Active			
Gender		Male	60%	84.6%	69.2%	80.0%	50.0%	3.20	0.526	Not Significant
		Female	40%	15.4%	30.8%	20.0%	50.0%			
Use of private car as a means of transportation		Yes	100.0%	92.3%	69.2%	100.0%	6.7%	7.35	0.118	Not Significant
		No	–	7.7%	30.8%	–	33.3%			
BMI	Underweight		–	–	–	–	–	11.27	0.506	Not Significant
	Normal		20.0%	46.2%	38.5%	60.0%	50.0%			
	Overweight		70.0%	38.5%	53.8%	40.0%	16.7%			
	Obese Grade I		–	15.4%	–	–	16.7%			
	Obese Grade II		10.0%	–	7.7%	–	16.7%			

Key: PAL – Physical Activity Level; X2 – Chi-square value; BMI: Body Mass Index

Table 5. Relationship between number of steps and demographic characteristics using the Pearson product-moment correlation coefficient

		No. of steps	Age	BMI	Energy expenditure
No. of steps	r	1	- 0.292	0.058	0.325
	p	0.047	0.696	0.026	
Energy expenditure	r	0.325	- 0.009	0.063	1
	p	0.026	0.954	0.676	
	n	47	47	47	47

Key: BMI – Body Mass Index; r = Pearson product-moment correlation coefficient; p = Calculated level of significance (2-tailed); n = Total number of participants

Table 6. Relationship between PAL and Demographic Characteristics using Spearman's rank correlation

		PAL	Use of car	Gender	BMI classification
PAL	r	1	0.263	0.044	-0.127
	p		0.074	0.769	0.395
	n		47	47	47

Key: PAL – Physical Activity Level; BMI – Body Mass Index, r = Spearman Rho correlation coefficient; p = Calculated level of significance (2-tailed); n = Total number of participants

Table 7. Comparison of number of steps and energy expenditure between clinical physiotherapists and physiotherapy educators using an independent 't' test

	Clinical physiotherapist	Physiotherapy educators	
	mean ± sd n = 33	mean ± sd n = 14	p value
Number of steps/day	8,212.64 ± 3,372.64	7,504.07 ± 3,576.72	0.52
Energy expenditure	234.86 ± 136.76	281.78 ± 266.94	0.43

Key: p = Calculated level of significance (2-tailed); n = Number of participants

Table 8. Comparison of PAL between clinical physiotherapists and physiotherapy educators using a Mann-Whitney U test

	Clinical physiotherapist		Physiotherapy educators		p value
	N = 33		N = 14		
	Mean rank	sum of ranks	Mean rank	Sum of ranks	
PAL	25.03	826	21.57	302	0.42

Key: p = Calculated level of significance (2-tailed); n = 47 (total number of participants)

Discussion

A total of 47 out of 60 participants had results deemed valid for analysis. The remaining 13 were deemed invalid due to the inability of the participants to effectively use the pedometer, thereby resulting in errors with the data obtained from the device. Thirty-three (70.2%) participants were male while 14 (29.8%) were female. Fourteen (29.8%) participants were physiotherapy educators while 33 (70.2%) were clinical physiotherapists. The mean age and BMI were 36.81±7.86 years and 26.16±4.46 kg/m^2 respectively. The average number of steps taken, distance covered and energy expenditure per day were 8,002±3,411 steps, 4.36±3.90 km and 248.26±182.92 kcal, respectively. This indicates that on average, physiotherapists in the selected tertiary institutions could be defined as moderately active. Previous studies [13,20,22] have shown that 8 km, along with an energy expenditure of about 300 to 400 kcal is equivalent to the required 10,000 steps per day. Considering the average energy expenditure of physiotherapists from the selected tertiary institutions, it can be concluded that physiotherapists were not expending enough energy necessary to ensure an optimal physical fitness level. This will affect energy balance and weight control, as the mean BMI indicated that most physiotherapists were overweight. Out of the 47 participants, only 40 (85.1%) responded positively to the question of whether or not they drive their cars as a means of transportation, while the remaining seven (14.9%) said they do not. According to Tudor-Locke and Myers' [23] classification of physical activity level using the number of steps taken per day, 21.3% of physiotherapists would be considered sedentary, 27.7% were low active, 27.7% were classified as somewhat active, 10.6% as active and 12.8% were highly active. These findings show that 76.7 percent of all participants in this study were below the 'active' level.

It was shown that there was no significant association between physiotherapists' gender, use of private car as a means of transportation, BMI and physical activity level. This is probably due to the fact that physiotherapists are trained physical activity experts and have significant knowledge about the use of physical activity. Therefore, their gender, use or lack of use of their private car or BMI would not have been a barrier to the level of their physical activity.

There was both a negative and significant relationship between the number of steps taken per day and age. However, it was a weak relationship. This implies that the number of steps reduces as age increases, and these findings agree with studies conducted by Grubbs and Carter [24] and Bray and Born [25]. Most people tend to do less physical activity as they grow older [24]. This less active behaviour can begin to arise during late adolescence and into early adulthood. A decline in physical activity during these early periods may lead to physical inactivity in later years [25].

There was a positive and significant relationship between the number of steps taken per day and energy expenditure. However, the relationship was also weak. This implies that as the number of steps increases, daily energy expenditure also increases. This may be due to the fact that physical activity is defined as any bodily movement produced by the skeletal muscles that results in energy expenditure [26]. For example, steps obtained through walking result in energy expenditure. A decrease or increase in the number of steps will likewise result in a decrease or increase in energy

expenditure, respectively. Also, walking involves the contraction of antigravity muscles and the contraction of muscles requires oxygen consumption, which translates into heat production and energy expenditure. Furthermore, as the frequency of muscle contraction increases, energy expenditure also increases [27]. This means that the more an individual walks, the greater the number of steps they will take, which leads to a greater frequency of muscle contraction, which ultimately results in higher energy expenditure.

This study also showed that there was a negative but non-significant relationship between daily energy expenditure and age. This may be because lifestyle-dependent physical activity has now reduced, irrespective of age. Research has clearly shown that an increase in sedentary lifestyles is associated with physical environments, infrastructure development, urbanization and a change in individual thinking about lifestyle and the social environment [28]. Therefore, daily energy expenditure, which comes as a result of physical activity, is influenced by many factors and not necessarily age or age alone.

The relationship between physical activity level, gender and the use of a private car as a means of transportation was positive and not significant. This may be because the same requirements are expected from both male and female physiotherapists. It is desirable for physiotherapists to have a good level of physical fitness in order to meet the demands of their job. The physiotherapy profession requires the practitioner to be very active (with good muscle strength, endurance and flexibility). Therefore, expectations of physical ability are not dependent on gender; it's expected that all practitioners are physically active in order to meet the demands of the job as a whole. It is therefore necessary and important that physiotherapists, male or female, using a private car as a means of transportation or not, should be able to be classified as either active or highly physically active in order to meet the physical demands of the job.

There were no significant differences in the number of steps, daily energy expenditure and physical activity level of clinical physiotherapists and physiotherapy educators when compared to one another. This is probably due to the fact that the demands on a physiotherapist are likely to be the same, irrespective of workplace. Since the measurement of the number of steps was not limited to workplace activities only, this result implies that the lifestyles of physiotherapists in the selected tertiary institutions were relatively the same, regardless of their various workplace demands.

Pedometers measure ambulatory physical activity. Therefore the result of this study is limited to participants performing activities more specific to ambulation, which did not include other activities such as swimming, cycling and weight training that they may have also or otherwise participated in.

Conclusions

There was no significant association between the physical activity level of physiotherapists and their demographic characteristics. There was no significant difference in the number of steps taken per day, physical activity level and energy expenditure between clinical physiotherapists and physiotherapy educators. Hence, it was concluded that physiotherapists in the selected tertiary institutions were predominantly sedentary as the physical activity levels for most of them fell into the categories below 'active'. There is great need for physiotherapists (whether they be clinical physiotherapists or physiotherapy educators) to improve their physical activity levels as most of those surveyed fell into the categories of low active and somewhat active.

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