ISSN: 2476-8642 (Print)
ISSN: 2536-6149 (Online)
www.annalsofhealthresearch.com
African Index Medicus, Crossref, African Journals Online & Google Scholar
C.O.P.E & Directory of Open Access Journals

Annals of Health Research

VOLUME 9
NO. 1
JAN. - MAR., 2023

IN THIS ISSUE

PUBLISHED BY THE MEDICAL AND DENTAL CONSULTANTS ASSOCIATION OF NIGERIA, OOUTH, SAGAMU, NIGERIA.
www.mdcan.oouth.org.ng

Annals of Health Research
Volume 9, Issue No 1: 69-82
March 2023
doi:10.30442/ahr.0901-08-192

ORIGINAL RESEARCH

Patterns of Physical Activity Among Adults in Southern Nigeria

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Abstract

Background: Adequate physical activity enhances sound health, while inactivity often leads to adverse health conditions that undermine the overall quality of life.
Objective: To assess the pattern of physical activity (PA), including domains, sub-types and levels among adults in two states in Southern Nigeria.
Methods: In a descriptive, cross-sectional study, the International PA Questionnaire was used to obtain information from 1320 adults aged 20 to 64. Activity scores, reported in metabolic equivalents (METs), in minutes/week (METs-minutes/week), were computed for work-related, domestic/garden-related, transport-related, leisure time-related PA (LTPA) domains, and activity sub-types – walking, vigorous-intensity and moderate-intensity PA.
Results: The median values for total, work-related, domestic/garden-related, transport-related and LTPA were 4306.0 METs-minutes/week, 1510.0 METs-minutes/week, 915.0 METs-minutes/week, 396.0 METs-minutes/week and 0.0 METs-minutes/week, respectively. Walking, vigorous-intensity and moderate-intensity activity scores were 726.0 METs-minutes/week, 240.0 METs-minutes/week and 1800.0 METs-minutes/week, respectively. About 9.6%, 29.7% and 60.7% of adults had low, moderate and high PA levels, respectively. Following bivariate analyses, physical activity levels differed significantly between urban and rural settings ($p = 0.043$) and educational levels ($p = 0.001$). In logistic regression, males with secondary education had a higher likelihood of attaining higher PA levels (AOR = 4.12; CI: 1.36, 12.43; $p = 0.012$), while females with tertiary education were less likely to attain higher PA levels (AOR = 0.12; CI: 0.01, 0.94; $p = 0.044$) when compared with uneducated adults.
Conclusion: Transport-related and leisure time-related PAs were low in this study. Physical activity in all domains should be promoted to ensure maximum health benefits.

Keywords: Adults, International Physical Activity Questionnaire, Moderate-intensity activity, Nigeria, Physical activity domains.

Introduction

The World Health Organization (WHO) defines physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure. [1] Furthermore, physical activity positively impacts numerous aspects of health without necessarily causing harm, making it more desirable. Its health-enhancing impacts are seen in cardiorespiratory, musculoskeletal, emotional and psychological outcomes and healthy metabolic profiles. [1 - 3] Physical inactivity constitutes a significant health concern

worldwide, accounting for 6% of annual deaths and constituting the fourth leading risk factor for global mortality. [1] Sedentary behaviours consist of physical inactivity that is characterised by long periods of sitting and are becoming popular even in the adult population. [4] Both physical inactivity and sedentary lifestyles constitute major risk factors for chronic diseases, including coronary heart disease, cancers (including breast and colon cancers), musculoskeletal disorders, and metabolic disorders such as diabetes mellitus, hypertension, and dyslipidaemia. [4, 5] The wide range of adverse impacts of physical inactivity also includes mortality from all causes and those resulting from cardiovascular diseases. [4]

Unfortunately, the proportion of physically inactive people is rising globally, creating a preventable hurdle against the global fight to mitigate the impacts of non-communicable diseases and other health problems. [1, 6] Close to 25% of adults and 85% of adolescents worldwide are physically inactive. [6] A systematic review of the literature revealed activity levels and types and time spent in sufficient physical activity that differed across regions in Europe. [7] Reports from African settings, including Nigeria, Tanzania and Ghana, revealed patterns consistent with adequate physical activity. [8 - 11]

All frequency, duration, intensity and type of activity are important determinants of the health benefits of physical activity. [2] These have all been captured in the global recommendations on physical activity for adults 18 to 64 years. [12] Moreover, the relevance of different activity domains in overall physical activity patterns and accrued health benefits have been documented. [13 - 15] Four principal domains are often considered – work-related, transport-related, domestic/garden-related and leisure time-related physical activities. [16] These details are rarely captured in studies on physical activity in Nigeria. Also, most information on physical activity in Nigeria are available from institution-based studies, which do not describe individuals' physical activity in the general population. [17 - 19] Assessing physical activity in Nigeria to report on different domains and activity sub-types can reveal areas of need and provide direction on appropriate policy recommendations for improved health-related quality of life among adults. This study was designed to assess physical activity among adults in two states in southern Nigeria.

Methods

Study design and participants

This descriptive, cross-sectional study assessed physical activity patterns among adults in Akwa Ibom and Cross River States, situated within the South-south geo-political zone of Nigeria. The participants were selected using multistage sampling techniques and from households, selected randomly within communities from urban and rural settings across the three senatorial districts in each state. They were eligible if they were between 20 to 64 years old, and were not professional athletes, provided they had been resident in the region for at least the previous two years. Adults with physical disabilities (especially those with impaired mobility, such as those using wheelchairs and clutches to aid movement) and those whose habitual physical activities were altered within the immediate past seven days by any factor, such as ill-health, were excluded from the study.

Sample size determination

Using the 22.0% prevalence of physical inactivity reported among adult Nigerians, [8] a 95% confidence interval, a precision level of 2.25% (0.0225), and a 10% non-response rate, the Cochran formula [18] was adopted to calculate the sample size for the study as follows:

$n = z^2 \times pq/d^2$

Where:

n = minimum sample size

Z = normal deviate corresponding to the desired confidence interval
p = population proportion with the key attribute under measurement
q = unaffected population
d = acceptable sampling error
Substituting for the formula: $1.96^2 \times 0.22 \times 0.78 / 0.0225 = 1302$.
After adjusting for a 10% non-response rate, the sample size was 1432.

Ethical considerations

This study was approved by the University of Ibadan/University College Hospital (UI/UCH) institutional ethics review committee, with a registration number (UI/EC/21/0098). Each participant gave written informed consent to participate in the study before the interview.

Data collection

Socio-demographic information: A semi-structured, interviewer-administered questionnaire was used to obtain information on respondents' socio-demographic characteristics, including sex, age, setting, education and employment status.
Physical activity: Findings of the validity and reliability tests on the International Physical Activity Questionnaire (IPAQ), conducted in 12 countries, revealed satisfactory measurement parameters. [21] Both long and short forms gave reproducible results, with a median rho of 0.30 for criterion validity and a Spearman's rho of roughly 0.8. The questionnaire is thus considered reliable for monitoring population-level physical activity among 18 to 65 years old adults from diverse backgrounds. In this study, IPAQ long form was adopted to obtain information on four different domains of physical activity: work-related PA, transportation-related PA, domestic/garden-related PA and leisure time-related PA (LTPA). [21] The questionnaire also provided information on three activity sub-types: walking, moderate-intensity and vigorous-intensity activities within each PA domain.

Data analyses

Physical activity analyses: Physical activity was reported in metabolic equivalents (METs) in minutes/week (METs-minutes/week), derived as the product of an activity MET score and the duration spent in performing the activity. A MET (metabolic equivalent) is defined as the amount of energy expended while sitting quietly for one hour and is equivalent to approximately 3.5 ml of oxygen/kg body weight/minute. According to the analysis guide for IPAQ long form, [21] walking at work and leisure-time activities were each assigned the MET value of 3.3; vigorous-intensity activity at work and leisure-time were each assigned a MET value of 8.0; moderate-intensity activity at work and leisure-time were assigned MET values of 6.0 each. Cycling during active transport, vigorous-intensity yard chores performed under domestic/garden-related PA and moderate-intensity inside chores performed under domestic/garden-related PA were assigned MET values of 6.0, 5.5 and 3.0, respectively. Physical activity for each activity sub-type was calculated as the product of the MET score and duration (minutes x frequency) spent performing such activity type. Scores for physical activity domains were derived as the sum of all activity sub-types under respective domains.
All entries where the sum total of scores from the three specific activity sub-types (walking, moderate-intensity and vigorous-intensity PA) exceeded 960 minutes (16 hours) were removed from the dataset since individuals were, for this study, assumed to spend an average of 8 hours per day sleeping and so not likely to perform any activities during such periods. The health benefit accrued from physical activity is only derived from activities performed beyond 10 minutes. Hence all reported activities with a duration of less than 10 minutes were recoded to zero in the calculation of MET-minutes scores [14].

Physical activity levels: Physical activity levels were determined as either high, moderate or low. High PA level was awarded under

conditions of vigorous-intensity activity performed on ≥3 days, achieving a minimum total PA score of ≥1500 MET-minutes/week OR ≥7 days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total PA score ≥3000 MET-minutes/week. Moderate PA level was assigned under the conditions of ≥3 days of vigorous-intensity activity performed for ≥ 20 minutes/day OR ≥5 days of moderate-intensity activity and/or walking of at least 30 minutes/day; OR ≥5 days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum total PA score ≥600 MET-minutes/week. A low PA level was awarded when conditions failed to meet any of the criteria for either high or moderate PA levels.

Data analyses

All data were analysed using the IBM-SPSS Statistical software package, version 20. Data cleaning was performed by running preliminary frequencies to identify values not rightly entered and outliers. The results on the individual PA domain were presented in median values with an interquartile range. Individual PA scores were classified as low, moderate or high PA levels, according to the guidelines in the IPAQ analyses guide. Results on categorical variables were reported in numbers and percentages. Differences in PA METs-minutes/week scores between the two groups were determined using Wilcoxon Mann-Whitney U Test. The Chi-Squared test was conducted to assess relationships between PA levels and socio-demographic characteristics. Physical activity levels were further regrouped into two (low PA and moderate/high PA) for logistic regression analysis to test the predictive power of socioeconomic variables on PA levels. Statistical significance was determined at $p<0.05$.

Results

General Information

After excluding entries with invalid responses (112 (7.9%)), a total of 1320 adults were included in this study. About 66.1% of participants were aged 20 to 39; the remaining were aged 40 to 64. The participants consisted of 50.4% females. About 65.0% were rural dwellers, and 95.1% attained at least a secondary school education. A total of 76.2% were employed.

Physical Activity Domains: This study's median value for total PA was 4306.0 METs-minutes/week (Table I). Work-related activity (1510.0 METs-minutes/week) contributed most to the overall weekly activity. Domestic/garden-related activity (915.0 METs-minutes/week) and transport-related activity (396.0 METs-minutes/week) contributed moderately to total physical activity. While moderate-intensity activity at work contributed most to the total work-related activity, walking, performed as means of transportation (311.9 METs-minutes/weeks), and moderate-intensity inside chores performed under domestic/garden-related PA (540.0 METs-minutes/week) contributed most to active transport-related activity and total domestic/garden-related PA, respectively. Overall, total work-related PA was significantly higher in Akwa Ibom State (1554.0 METs-minutes/week) than in Cross River State (1440.0 METs-minutes/week) ($p = 0.033$).

Total PA ($p = 0.005$), work-related PA ($p<0.001$), and LTPA ($p<0.001$) were significantly higher among males (Table I), while domestic/garden-related PA was higher among females ($p<0.001$). Males had higher activity scores in walking ($p = 0.002$) and vigorous activities at work ($p<0.001$) compared to females. While there were no gender differences in the total active transport PA domain ($p = 0.235$), females had higher activity scores for walking (346.5 METs-minutes/week) when compared to males (297.0 METs-minutes/week) ($p = 0.024$).

Table I: Socio-demographic characteristics of participants

Characteristic	*Category*	*Frequency (%)*
State	Akwa Ibom	733 (55.5)
	Cross River	587 (44.5)
Residence	Rural	858 (65.0)
	Urban	463 (35.0)
Sex	Male	655 (49.6)
	Female	665 (50.4)
Age (years)	20-39	872 (66.1)
	≥ 40	448 (33.9)
Formal Education	None	65 (4.9)
	Primary	286 (21.7)
	Secondary	688 (52.1)
	Tertiary	281 (21.3)
Employment	Yes	1006 (76.2)
	No	314 (23.8)

Table IIa: Overall physical activity domains among participants

PA Components	**Total**	
(METs-minutes/week)	**Med**	**IQR**
Total Physical Activity Score	4306.0	5660.0
Work Domain		
Vigorous-intensity PA at Work	0.0	1920.0
Moderate-intensity PA at work	140.0	960.0
Walking at Work	0.0	495.0
Total PA at Work	1510.0	4320.0
Active Transportation Domain		
Walking during Transportation	311.9	693.0
Cycling PA during Transportation	0.0	0.0
Total Transport PA	396.0	924.0
Domestic and Garden [Yard Work] Domain		
Vigorous-intensity PA during Yard Chores	0.0	660.0
Moderate-intensity PA during Inside Chores	540.0	1170.0
Total Domestic and Garden PA	915.0	1755.0
Leisure-Time Domain		
Walking at Leisure	0.0	198.0
Vigorous-intensity PA at Leisure	0.0	0.0
Moderate-intensity PA at Leisure	0.0	0.0
Total Leisure-Time PA	0.0	414.3

Table IIb: Physical activity domains among participants distributed according to states and sex

PA Components	*State*					*Sex*				
	Akwa Ibom		Cross River			Male		Female		
(METs-minutes/week)	**Med**	**IQR**	**Med**	**IQR**	**p-value**	**Med**	**IQR**	**Med**	**IQR**	**p-value**
Total Physical Activity Score	2033.5	3473.0	2070.0	3183.5	0.406	4545.0	5310.0	3991.5	4789.5	0.005*
Work Domain										
Vigorous-intensity PA at Work	0.0	1440.0	0.0	1920.0	0.005	240.0	2880.0	0.0	960.0	0.000
Moderate-intensity PA at work	320.0	960.0	0.0	720.0	0. 000	120.0	960.0	120.0	960.0	0.618
Walking at Work	0.0	495.0	0.0	445.5	0.205	0.0	495.0	0.0	408.4	0.020
Total PA at Work	1554.0	4205.0	1440.0	4178.3	0. 033	1920.0	4110.0	1015.8	3405.0	0.000
Active Transportation Domain										
Walking during Transportation	346.5	693.0	297.0	717.8	0.229	297.0	693.0	346.5	660.0	0.024
Cycling PA during Transportation	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Total Transport PA	420.0	706.0	396.0	1179.0	0.509	396.0	924.0	436.5	834.0	0.235
Domestic and Garden [Yard Work] Domain										
Vigorous-intensity PA during Yard Chores	0.0	330.0	330.0	990.0	0.000	0.0	660.0	0.0	660.0	0.727
Moderate-intensity PA during Inside Chores	630.0	1080.0	360.0	1080.0	0.000	315.0	720.0	630.0	1410.0	0.000
Total Domestic and Garden PA	810.0	1605.0	997.5	1928.8	0.242	630.0	1410.0	1260.0	2088.8	0.000
Leisure-Time Domain										
Walking at Leisure	0.0	198.0	0.0	198.0	0.905	0.0	297.0	0.0	131.2	0.000
Vigorous-intensity PA at Leisure	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Moderate-intensity PA at Leisure	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Total Leisure-Time PA	0.0	396.0	0.0	396.0	0.844	792.0	1336.5	693.0	1221.0	0.000

Med: Median
IQR: Interquartile range

Females scored higher in moderate-intensity inside chores performed under domestic/garden-related PA - 630.0 METs-minutes/week, compared with males (315.0 METs-minutes/week). Also, females had higher total domestic/garden-related PA (1260.0 METs-minutes/week) than males (630.0 METs-minutes/week). Males had significantly higher LTPA (792.0 METs-minutes/week) when compared to females (693.0 METs-minutes/week), especially during walking at leisure ($p<0.001$).

Physical Activity Intensity: Moderate-intensity PA (1800.0 METs-min/week), especially moderate-intensity inside chores performed under domestic/garden-related PA (540.0 METs-min/week), was the most common PA sub-type recorded in this study (Table II). Walking (726.0 METs-min/week), especially during active transportation (311.9 METs-min/week), was the next most crucial subtype after moderate-intensity activities. Participants rarely engaged in vigorous-intensity activities - 240.0 METs-min/week. Males scored significantly higher in walking performed at work and leisure, while females performed higher in walking performed during active transportation ($p = 0.024$) (Table II). Females had higher scores for moderate-intensity inside chores performed under domestic/garden-related PA ($p<0.001$).

Table IIIa: Overall physical activity intensity among participants

PA Components	Total	
(METs-minutes/week)	**Med**	**IQR**
Walking Physical Activity		
Walking PA at Work	0.0	495.0
Walking PA during Transportation	311.9	693.0
Walking PA at Leisure	0.0	198.0
Total Walking PA	726.0	1287.0
Moderate Intensity PA		
Moderate-intensity PA at Work	140.0	960.0
Cycling PA during Transportation	0.0	0.0
Vigorous-intensity PA during Yard Chores	0.0	660.00
Moderate-intensity PA during Inside Chores	540.0	1170.0
Moderate-intensity PA at Leisure	0.0	0.0
Total Moderate PA	1800.0	2910.0
Vigorous Intensity PA		
Vigorous-intensity PA at Work	0.0	1920.0
Vigorous-intensity PA at Leisure	0.0	0.0
Total Vigorous-intensity PA	240.0	2160.0

Med: Median
IQR: Interquartile range

Table IIIb: Physical activity intensity among participants distributed according to states

PA Components	*State*				
	Akwa Ibom		**Cross River**		
(METs-minutes/week)	**Med**	**IQR**	**Med**	**IQR**	**p-value**
Walking Physical Activity					
Walking PA at Work	0.0	495.0	0.0	445.5	0.205
Walking PA during Transportation	346.5	693.0	297.0	717.8	0.229
Walking PA at Leisure	0.0	198.0	0.0	198.0	0.905
Total Walking PA	726.0	1336.5	693.0	1369.5	0.155
Moderate Intensity PA					
Moderate-intensity PA at Work	320.0	960.0	0.0	720.0	0. 000
Cycling PA during Transportation	0.0	0.0	0.0	0.0	
Vigorous-intensity PA during Yard Chores	0.0	330.0	330.0	990.0	0.000
Moderate-intensity PA during Inside Chores	630.0	1080.0	360.0	1080.0	0.000
Moderate-intensity PA at Leisure	0.0	0.0	0.0	0.0	
Total Moderate PA	1845.0	2700.0	1800.0	3225.0	0.920
Vigorous Intensity PA					
Vigorous-intensity PA at Work	0.0	1440.0	0.0	1920.0	0.005
Vigorous-intensity PA at Leisure	0.0	0.0	0.0	0.0	
Total Vigorous-intensity PA	0.0	1920.0	480.0	2280.0	0.037

Med: Median
IQR: Interquartile range

Table IIIc: Physical activity intensity among participants distributed according to sex

PA Components	Sex				
	Male		Female		
(METs-minutes/week)	Med	IQR	Med	IQR	p-value
Walking Physical Activity					
Walking PA at Work	0.0	495.0	0.0	408.4	0.020
Walking PA during Transportation	297.0	693.0	346.5	660.0	0.024
Walking PA at Leisure	0.0	297.0	0.0	131.2	0.000
Total Walking PA	792.0	1336.5	693.0	1221.0	0.151
Moderate Intensity PA					
Moderate-intensity PA at Work	120.0	960.0	120.0	960.0	0.618
Cycling PA during Transportation	0.0	0.0	0.0	0.0	
Vigorous-intensity PA during Yard Chores	0.0	660.0	0.0	660.0	0.727
Moderate-intensity PA during Inside Chores	315.0	720.0	630.0	1410.0	0.000
Moderate-intensity PA at Leisure	0.0	0.0	0.0	0.0	
Total Moderate PA	1530.0	2675.0	2070.0	2910.0	0.001
Vigorous Intensity PA					
Vigorous-intensity PA at Work	240.00	2880.0	0.00	960.0	0.000
Vigorous-intensity PA at Leisure	0.0	0.0	0.0	0.0	
Total Vigorous-intensity PA	960.0	2880.0	0.0	1080.0	0.000

Med: Median
IQR: Interquartile range

Table IV: Distribution of physical activity levels by socio-demographic factors among participants

Characteristics	*Low PA*	*Moderate PA*	*High PA*	*p-value*
Physical Activity Level (n = 1320)	127 (9.6)	392 (29.7)	801 (60.7)	
State				
Akwa Ibom (n = 733)	61 (8.3)	223 (30.4)	449 (61.3)	0.195
Cross River (n = 587)	66 (11.2)	169 (28.8)	352 (60.0)	
Residence				
Rural (n = 858)	73 (8.5)	245 (28.6)	540 (62.9)	0.043
Urban (n = 463)	54 (11.7)	147 (31.8)	261 (56.5)	
Sex				
Male (n = 655)	63 (9.6)	179 (27.3)	413 (63.1)	0.160
Female (n = 665)	64 (9.6)	213 (32.0)	388 (58.4)	
Age (years)				
20-39 (n = 872)	79 (9.1)	258 (29.6)	535 (61.4)	0.593
≥ 40 (n = 448)	48 (10.7)	134 (29.9)	266 (59.4)	
Formal Education				
None (n = 65)	6 (9.2)	14 (21.5)	45 (69.2)	0.001
Primary (n = 286)	25 (8.7)	73 (25.5)	188 (65.7)	
Secondary (n = 688)	52 (7.6)	216 (31.4)	420 (61.1)	
Tertiary (n = 281)	44 (15.7)	89 (31.7)	148 (52.7)	
Employment				
Yes (n = 1006)	76 (7.6)	240 (23.9)	690 (68.6)	0.000
No (n = 314)	51 (16.4)	152 (48.4)	111 (35.4)	

Physical Activity levels: The prevalence of low, moderate and high PA levels were 9.6%, 29.7% and 60.7% respectively, (Table III). Physical activity levels differed significantly between urban and rural settings (p = 0.042) in bivariate analyses (Table III). Further analyses with logistic regression did not reveal any significant influence of residential settings over PA levels (Table IV).

The Chi-Squared test revealed significant associations between PA levels and education among adults in this study (p = 0.001). Further analyses with logistic regression (Table IV)

revealed that, compared to those without any formal education, the chances of attaining higher PA levels were four times higher among males with secondary education (OR = 4.12; CI: 1.36, 12.43; p = 0.012), while the reverse was the case for women with tertiary education (OR = 0.12; CI: 0.01, 0.94; p = 0.044). Physical activity levels differed significantly in relation to employment status among adults (p<0.001).

Table Va: Socio-demographic factors as predictors of physical activity level among participants

	Combined		*Men*		*Women*	
	Adjusted OR (95% CI)	**p-value**	**Adjusted OR (95% CI)**	**p-value**	**Adjusted OR (95% CI)**	**p-value**
Residence@ (Urban)	1.1 (0.5, 2.2)	0.855	0.7 (0.4, 1.2)	0.231	0.9 (0.5, 1.5)	0.629
Education (none as reference)						
Primary	0.8 (0.2, 4.0)	0.801	2.2 (0.7, 6.9)	0.193	0.3 (0.0, 2.5)	0.279
Secondary	0.6 (0.1, 2.9)	0.567	4.1 (1.4, 12.4)	0.012*	0.2 (0.0, 1.8)	0.171
Tertiary	0.5 (0.1, 2.2)	0.330	1.6 (0.5, 4.7)	0.424	0.1 (0.0, 0.9)	0.044*

Physical activity (PA) was categorised using respondents with low PA compared to respondents with moderate/high PA; Rural was also used as a reference.

Table Vb: Socio-demographic factors as predictors of physical activity level among participants

	Combined		*20 – 39 years*		*40 – 64 years*	
	Adjusted OR (95% CI)	**p-value**	**Adjusted OR (95% CI)**	**p-value**	**Adjusted OR (95% CI)**	**p-value**
Residence@ (Urban)	1.1 (0.5, 2.2)	0.855	0.6 (0.4, 1.0)	0.065	0.9 (0.5, 1.8)	0.836
Education (none as reference)						
Primary	0.8 (0.2, 4.0)	0.801	0.7 (0.2, 3.4)	0.675	1.3 (0.4, 4.5)	0.648
Secondary	0.6 (0.1, 2.9)	0.567	1.1 (0.2, 4.8)	0.922	1.1 (0.4, 3.4)	0.888
Tertiary	0.5 (0.1, 2.2)	0.330	0.4 (0.1, 1.8)	0.231	0.7 (0.2, 2.4)	0.596

Physical activity (PA) was categorised using respondents with low PA compared to respondents with moderate/high PA; Rural was also used as a reference.

Discussion

This study assessed physical activity among adults in two States in South-south Nigeria. Findings in this study revealed that work-related and domestic/garden-related PAs constituted the most important contributors to weekly PA. These observations have been documented in previous findings. [14, 15, 22 - 25] However, in addition to domestic/garden-related activities, LTPA contributed the most to PA among older adults in Brazil and France. [13, 26] As older adults, participants in the previous studies [13, 26] may have retired from most economic activities, affording more time to engage in leisure-related activities than in other PA domains. Participation in vigorous-intensity yard chores performed under domestic/garden-related PA was low, raising concerns over the possible health benefits of energy expended in domestic/garden-related PA. Household chores are often of low PA intensity, [27] resulting in fatigue and perceived exertion without attaining the level of energy expenditure compliant with PA recommendations. [14] Although transport-related activities barely contributed to the overall PA in the study, walking constituted the

most important form of active transportation, an observation reported earlier in a systematic review. [28] Walking and cycling have been considered better ways of expending energy when travelling than using cars. [28] Similar to findings from the present study, LTPA rarely forms an important component of PA in populations. [15, 22, 24, 29, 30] Selected factors, including health, younger age, time and health benefits from participation in PA, constitute significant determinants of LTPA in populations. [31, 32]

The observation of the activity types in this study, where moderate-intensity activities constituted the most popular, followed by walking and vigorous-intensity activities being the least, was reported among Italian adults in an earlier study. [25] The opportunities for individuals to engage in moderate-intensity activities present themselves more, especially in daily economic pursuits and during domestic/garden-related activities as observed in this study. Most adults fell among those with either moderate or high PA levels and can be compared to those found among adults in Italy, Asia, Tanzania and Poland. [9, 11, 22, 25, 30] This is expected as the study's participants still engage in active economic activities, contributing most to the weekly PA among adults in southern Nigeria.

There were gender differences in most individual scores in activity domains and types. The literature shows men are likelier to have higher PA scores due to higher participation in most activity types and domains. [9, 22, 25] In this study, men performed significantly better in walking, vigorous-intensity activities and all activity domains except domestic/garden-related activities. In contrast, women only surpassed men in domestic/garden-related and moderate-intensity activities. This information could justify designing programmes to increase health-enhancing PA for both sexes. For instance, females could be encouraged to participate more in LTPA and active transportation since moderate-intensity household chores mostly consist of exertion without necessarily impacting body composition. [14, 27] However, when individual PA scores were categorised into levels, no gender differences were observed across PA levels. This implies that participation in PA among men and women only differed in the types of activities engaged in but not in complying with PA recommendations. Differences in PA patterns often observed in previous studies [9, 10, 22, 25] could be attributed to cultural differences in settings where PA differs between males and females due to urban-rural differences [9] and differences in activity types and domains engaged by both sexes, as observed in this study.

Higher PA in rural settings constitutes a popular trend in relevant research findings. Similar to other findings, [11, 33] rural people attained higher PA patterns when compared to those in urban settings in this study. It has been speculated that higher PA patterns in rural settings are often attributed to labour-intensive economic activities, especially where skilled labour is prevalent. [33, 34] PA levels differed significantly by education in this study, an observation made earlier among adults in China. [35] The odds of attaining higher PA were higher among males with secondary education, whereas females with tertiary education had significantly lower odds of doing so. Those with lower education may end up with skilled labour. While skilled labour is associated with higher PA, [33, 34] more income and higher socioeconomic status can enhance physical inactivity through a sedentary lifestyle among individuals with higher education who acquired jobs with higher pay.

Limitations of the study

Cross-sectional studies often allow inferences to be drawn only on associations rather than causality. Also, the use of questionnaires in assessing physical activity is limited to describing conditions where an increase in physical activity would be more beneficial and in observing variations in population physical

activity. This study was limited to describing the physical activity patterns and examining different demographic variables for possible associations.

Conclusion

Work-related and domestic/garden-related activities, mainly moderate-intensity activities, constitute the most important activity domains among adults in southern Nigeria. Most adults engage in physical activity levels considered to be sufficient. Participation in specific activity domains and sub-types is influenced by whether the individual is a male or female. In contrast, the residential setting and education influence the likelihood of attaining higher activity levels. This study recommends intervention programmes that increase physical activity participation in domains and sub-types most likely to yield maximum health benefits to individuals. Interventions should be gender-sensitive to increase moderate- and vigorous-intensity activities among women, especially those with higher education.

Acknowledgement: Authors wish to express their gratitude to all research assistants, who invested their time in ensuring that quality data were obtained for this study. We also acknowledge Dr A. Okekunle for rendering his expertise in data analysis.

Authors' Contributions: ENN and SRA contributed to the conception and design of the research. Data collection was conducted by ENN, while both ENN and SRA performed data analysis and interpretation. ENN drafted the manuscript while SRA performed a critical review for sound intellectual content. Both authors approved the final version of the manuscript.

Conflict of Interest: None.

Funding: Self-funded.

Publication History: Submitted 03 February 2023**; Accepted** 11 March 2023.

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