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Physical activity level and its demographic and psychosocial correlates among school-going adolescents in Obollo-Afor Education Zone, south-east Nigeria: a cross-sectional study

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Abstract

Background: Physical inactivity (PA) is a modifiable risk factor for many chronic illnesses. Studies on physical activity in adolescent populationshave reported associations between PA and demographic and psychosocial factors. However, there is a limited evidence on PA level and associated factors among adolescents in south-east Nigeria. Thus, the study examined adolescents' PA level and its demographic and psychosocial correlates among school-going adolescents in Obollo-Afor Education Zone, Enugu State, South-East Nigeria.

Methods: A total of 365 randomly selected adolescents aged 12-19 years in Obollo-Afor, Enugu State, south-East Nigeria participated in the study. The Physical Activity Questionnaire for Adolescents (PAQ-A), the Physical Self-Description Questionnaire-Short Form (PSDQ-S), the Social Support and Peer Norms Scales for Physical Activity (SSPNS)were used to measure PA level, physical self-concept, social support and peer norms for PA.Data were analyzed using descriptive statistics, independent samples t -test, fixed effects ANOVA, and multiple linear regression.

Results: The mean age of the participants was 15.76 ± 1.78 years for boys and 15.65 ± 1.83 years for girls. One-third (33.3%) had low PA level, more than half of the participants had moderate PA level(58.1%) whilevery few (8.5%) had high PA level. School-going adolescents had high mean physical self-concept(16.6 ± 40), social support(2.48 ± 1.04) and peer norms(2.19 ± 1.049). Adolescents' PA level was positively related to self-concept ($r = .06$, $p > 0.05$), social support ($r = .26$, $p < 0.01$), peer norms ($r = .27$, $p < 0.01$). Social support (beta = .22, $p < .001$), peer norms received for PA (beta = .23, $p < .003$), and class of study (beta = -.047, $p < 0.05$) were significantly associated with PA level among adolescents.

Conclusions: One third of school-going adolescents had low level of PA, and low proportion had high level of PA. Also, Social support, peer norms received for PA and class of study were significantly associated with PA among adolescents. Future studies are needed to design interventions that promote PA among adolescents in Nigeria.

Background

Physical inactivity is a modifiable risk factor for many non-communicable diseases. WHO [1] defined physical inactivity as less than 150 minutes of moderate-intensity physical activity (MPA) per week, or less than 75 minutes of vigorous-intensity physical activity (VPA) per week. However, regular physical activity (PA) in childhood and adolescence is important for the prevention of several non-communicable disease risk factors [2]. Moderate-to-vigorous physical activity (MVPA) during adolescence is positively associated with a host of physiological and psychological outcomes such as cardiorespiratory fitness [3], reduced metabolic disease risk [4] and better mental health [5, 6]. Thus, an increased PA level promotes objective health outcomes among adolescents [1–4].

World Health Organization (WHO) recommends that children and adolescents aged 5 to 17 years old participate in 60 minutes of MVPA everyday [7]. However, about 20% of adolescents meet this

recommendation globally [7]. Adolescence has also been associated with declining PA levels [9, 10]. A decline in adolescents' PA level is associated with adverse outcomes such as overweight, obesity, some cancers, and pre-mature death [11–12].Although, extensive literature has resulted in precise recommendations of the PA level required to produce optimal health benefits [13–14], to date, there is limited evidence on PA levels in Nigerian adolescents. Besides the cross-cultural adaption studies on the International Physical Activity Questionnaire (IPAQ) among adult Nigerians [15–16], and another study on PA and depression among adolescents [17], there are limited studies on PA level and its correlates among adolescents in south-east Nigeria. Thus, an understanding of PA level in Nigerian adolescents is vital for development of specific interventions aimed at increasing PA levels with improved health outcomes [18–19]. Therefore, increasing PA level in adolescence is a public health concern [8].

The decline of PA level in adolescence is attributable to some factors or correlates. However, the factors associated with PA level in adolescents varied culturally and geographically. Research evidence suggests many correlates of PA exist among young people [19–21]. Examples include individual or demographic, psychological, interpersonal, social and environmental factors [19–22]. Specifically, such factors include gender, age, self-efficacy, education and social support. Psychosocial factors such as self-esteem or self-concept, self-efficacy, social support and peer norms are among the most widely analyzed and that they can best explain the variations in PA levels in adolescents [20–21]. However, none of the previous studies conducted in Nigeria focused on these factors.

Health behaviours theories such as socio-ecological model, planned behavior theory, and self-determination theory have been used to explain PA behaviour. We anchored our study on the socio-ecological model (SEM).The SEM states that behaviours including PA participation by the individuals are influenced by a host of factors [23–24]. The factors include psychological factors (physical self-concept and self-efficacy), environmental factors (e.g., neighborhood characteristics/physical environment and built environment) and social factors (e.g., social support-parental/family support, teacher's support and peer support) [25–28]. The SEM offers a crisp explanation on how multiple factors influence PA in both adult and adolescent populations. Furthermore, the SEM enables an in-depth understanding of contextual or behavioural factors that influence behaviours. Therefore, having a better understanding of specific demographic, and psychosocial factors that influence PA level among Nigerian adolescents could facilitate identification and understanding of the modifiable factors, development of effective and culturally specific interventions and credible policies to foster PA promotion among them.

As mentioned earlier, several factors are likely to influence PA in adolescents. In this study, we examined the relationships between PA level, demographic and psychosocial factors in Nigerian adolescents.Physical self-concept (PSC) has been identified as a strong predictor of global self-esteem and PA particularly in childhood and adolescents. Self-concept and self-esteem have also been used interchangeable in several studies. However, the two concepts are conceptually different [29]. Accordingly, correlates of PA, such as lack of body fat, physical fitness or motor ability have been positively linked with physical self-concept a dimension of self-concept [30–31]. Marsh et al. [33] defined PSC as the degree of satisfaction with one's own body. Regardless of developmental level and clime or country where

PSC is examined, it is consistently found to be strongly related to global self-esteem in both boys and girls [34]. Furthermore, PSC has been found to act as a mediator between PA and self-esteem in adolescents [36].The relationship between PA and PSC was examined in a previous study [37]. The study provides evidence on the extent to which potential moderating factors influence this relationship. The relationship between PA and self-concept is reciprocal or symbiotic nature [38–40]. This implies that self-concept influences PA as well as PA influences self-concept. Research evidence exists to support this notion. For instance, studies conducted in PA and sport contexts have proven that there is a reciprocal relationship between self-concept and PA [37, 41].

The Exercise and Self-esteem Model [31] provides more evidence on the relationship PA and self-concept. It posits that improvements in performance of specific activities (e,g., time taken to walk one mile) increase confidence in one's ability to complete that activity, in turn increasing perceived ability in that facet (walking speed), which in turn increases perceptions of ability in that subdomain (condition competence), and so on up to global self-esteem. The implication of this model is that interventions which promote both physical activity and self-concept may be most effective [37–40]. Understanding the relationship between PSC and PA might be a viable strategy for improving PA levels in adolescents who consider self-worth as a basic psychological need. Since research evidence indicates a positive relationship between PSC and PA in childhood and adolescence, to the best of our knowledge,noprevious study has validated this evidence among schooling adolescents in Nigerian. Hence, we hypothesized that schooling adolescents with a higher level of PSC would have a higher PA level.

Social support is another factor that is associated with PA in adolescents [23]. WHO defines social support as being both 'emotional and practical support characterizing good social relations' and a social determinant of health [41]. Social support is conceptualized as an action that helps a person adopt and/or maintain a particular practice that can occur in different ways, such as instrumental/direct (characterized by acquisition or sports equipment sharing, facilitating transport to local practices and engaging in physical activities together), psychological/emotional (transmitted through incentives, words of motivation and encouragement for practices) and instructional/informative support (characterized by acts of orientation, counseling and talks about the importance and appropriate ways of engaging in physical activities) [42–46]. Parents, family members, friends and teachers have been the most extensively investigated, because they are the main sources of support for adolescent PA [43–45, 48]. Research evidence suggests that different sources (parents, family members, teachers and friends) and types (instrumental assistance and emotional encouragement-praise) of social support may have different impacts on adolescents' PA levels [43–48]. Another objective of this study was to examine if there was a relationship between adolescents' PA level and social support. In other words, we hypothesized the adolescents with higher social support are more likely to have higher PA level.

Several studies have evaluated the role of many factors (correlates) in PA behaviors in adolescents. However, the findings of these studies are generally inconsistent. Furthermore, there is still a limited evidence on the research focusing more specifically on the relationship between psychosocial and demographic factors and PA in south-east Nigerian adolescents. Such information could provide

direction on culturally specific and effective interventions targeted at improving PA levels in adolescents. Meanwhile, to the best of our knowledge, no study has examined the PA levels of schooling adolescents and their associations with demographic and psychosocial factors in Obollo-Afor Education Zone, Enugu State.Therefore, the objectives of this study were to determine PA levels of adolescents, examine the relationshipsthat may exist amongdemographic and psychosocial factors and PA level in adolescents since studies have shown that girls have lower PA level compared to boys [47–49].

Methods

Study setting and design

We conducted aschool-based cross-sectional survey of secondary school students in Igbo-Eze North Local Government Area (LGA), Obollo-Afor Education Zone during the 2016/2017 academic session. The population of the study comprised 7,960 adolescents who enrolled during 2016/2017 academic session in Igbo-Eze North LGA (Planning, Research and statistical Department of Post Primary Schools' Board, ObolloAfor Education Zone, Enugu State). In-school adolescents aged 12–19 years old and had stayed in the school for at least 7 months, that is, two terms (January to July) were recruited. Private secondary schools were excluded from this study because they are very few in the study area coupled with low student enrollment status. Due to low socioeconomic status of many parents in the rural areas in Nigeria, parents and guardians usually enroll their children in public schools. The study duration was from April to August 2017.

Participants

School-going adolescents aged 12–19 years, who lived in Obollo-Afor town at least one year before the survey were included in the study. In each of the selected secondary schools a registered student was identified, and eligible students were randomly selected. We excluded the sick students, and those who had a disability that restricts participation in the survey.

Sample size

We used a single population proportion formula to calculate the sample size for this study. The sample size was calculated using the OpenEpi version 2.3 software [50]. We used the reported prevalence of moderate PA, P = 38.8% [17], margin of error, d = 5%, z = 1.960, and 95% level of confidence. Thus, the minimum sample size required was 365.

Sampling procedure

We used a multi-stage sampling to select the secondary schools in Obollo-Afor Education Zone, primary sampling units (schools), and the study units (school-going adolescents, aged 12–19 years). From the 3 LGAs in the study area, one was randomly selected. The selected LGA was Igbo-Eze North LGA. Second, we created a sampling frame using a list of schools obtained from the Obollo-Afor Education Zone Headquarters. There are 15 secondary schools at the time of the study. We randomly selected 10 schools out of the 15 schools. In the third stage, we purposively selected three classes that offer Physical and Health Education (PHE) as a compulsory subject (Junior Secondary Schools [JSS] 1–3 or Upper Basic Education [UBE] 7–9) in the ten schools. Systematic random sampling was used to select the primary sampling unitsusing the class register (a document/record that contains names of the registered/enrolled students in a class). Also, PHE is a compulsory subject for JSS and examination subject at the apex class (JSS 3/Upper Basic 9) as stipulated in the Universal Basic Education Commission's 2004 Policy [51–52].

Measures

Dependent variable

Physical activity

Our main dependent variable is physical activity. PA was assessed using the Physical Activity Questionnaire for Adolescents (PAQ-A).The PAQ-A is a self-administered, 7-day recall instrument. The PAQ-A was developed to assess general levels of physical activity for high school students about 13 to 19 years of age [53–54]. The PAQ-A has been validated among Nigerian adolescents by Adeniyi et al. [17] and in another clime [55]. The PAQ-A assesses frequency of PA participation such as moderate or vigorous activities that include throwing, skipping, running, and climbing. We excluded activities such as baseball, softball, in-line skating, skateboarding, street hockey, ice skating, cross-country skiing, Ice hockey/ringette that are performed in temperate regions like Canada. Thus, it was necessary to allow for differences in comprehension due to situational, cultural or semantic factors [17]. Subsequently, the questionnaire was slightly modified by removing the "strange" sporting activities and replacing them with more familiar local sporting activities such as tag, hide-and-seek, and tug of war, which are usually organized for students during PE practical sessions(Appendix 1).The PAQ-A also elicits responses from participants on PA during spare time, physical education period, lunchtime, after school, evenings and on weekends. Participants were asked to respond to the PAQ-A items on a five-point Likert scale. Each of the 8 items is scored between 1 (low PA) and 5 (high PA), and a mean score of all items constitutes the overall PAQ-A score. The 9th item of the PAQ-A that elicits information on whether the participants were sick last week, or whether anything prevented them from engaging in normal PA was excluded in the calculation of the summary PAQ-A score [53].Higher scores indicate more frequent PA participation [53]. A score between 1 to 1.9 on the PAQ-A indicates low PA level, a score between 2 to 3.9 indicates moderate PA level and a score between 4 to 5 indicates a high PA level [53].All the selected students gave informed consent and took about 5 minutes to complete the modified PAQ-A. We assessed the reliability coefficient

of the PAQ-A using Cronbach's alpha. For this study, the Cronbach's alpha coefficient was very good (α = 0.82)(Additional file 1).

Independent variables

Physical self-concept

The Physical Self-Description Questionnaire short form (PSDQ-S) was used to assess physical self-concept [56–57]. According to Marsh et al. [56–57], the 47-item PSDQ-S retains the same factor structure and reliability of the original 70-item PSDQ. They provided strong evidence for the reliability, invariance, convergent and discriminant validity of the subscales. The PSDQ-S is a multidimensional, physical self-concept instrument designed to measure 11 scales: Strength, Body Fat, Activity, Endurance/Fitness, Sports Competence, Coordination, Health, Appearance, Flexibility, Global Physical Self-concept, and Global Esteem. Each scale includes 6 or 8 items; each item is presented as a declarative statement to which subjects may respond using a 6-point true-false scale [33, 56–57]. The validity and reliability of PSDQ-S scales have been established among Chinese adolescents [58].In this study, we assessedthe reliability index of the PSDQ-S using Cronbach's alpha. Cronbach's alpha coefficient for the PSDQ-S was .70 with item-total correlations ranging from .31 to .50 (Additional file 2). It took about 5–10 minutes to complete the PSDQ-S.

Social Support and Peer Norms for PA

To measure social support, we used an 8-item Social Support Scale for Physical Activity (SPS-PA) including four response choices (never = 0, rarely = 1, sometimes = 2, and often = 3) developed and validated by Ling et al. [59]. The Social Support Scale has alpha coefficient value of .84 with inter-item correlation coefficients ranging from .50 to .66. The test-retest reliability for the Social Support Scale assessed by ICC was .78 with a 95% CI of .67-.86 [59]. Higher mean score on the scale indicates greater social support received for PA. In our study, the Social Support Scale has alpha coefficient value of .70 (Additional file 3).The peer norms were measured using a 6-item Peer Norms Scale for Physical Activity (PNS-PA) developed by Ling et al. [59]. The peer norms scale is well-validated, and its psychometric properties are within acceptable limits [59]. A higher total score indicates greater perceived close friends' prevalence of PA and positive values, attitudes, or beliefs related to the behaviour. The scale included three components: prevalence of PA (items 1–2), perceived importance of PA (items 3–4), and perceived acceptance of PA (items 5–6). Items 1 and 2 that measured perceptions of how many close friends engage in PA, were assigned a 5-point to a 4-point Likert scale as follows: none = 0, a few and some = 1, most = 2, and all = 3. Items 3 and 4, which assessed close friends' perceived importance related to PA with 3 response options of not at all important = 0, somewhat important = 1.5, and very important = 3. The response options for items 5 and 6 that measured close friends' perceived acceptance of PA ranged from disagree a lot (0) to agree a lot (3). The Cronbach's alpha coefficient for the Peer Norms Scale was .61 with item-total correlations ranging from .11 to .24 (Additional file 4).

We administered copies of the pre-tested PAQ-A, PSDQ-S, and Social Support Scale for Physical Activity (SPS-PA) to the students in JSS 1–3. All the participants gave informed consent. Confidentiality of

subject's information and data were maintained. The questionnaires were distributed during break time and instructions delivered verbally to complete the surveys. it took between 25 to 30 minutes to complete the three questionnaires.

Covariates

We included the demographic variables as covariates. The control variables for demographic characteristics include age, gender and class of study. Age was measured as a continuous variable. We further transformed age into three categories as follows: 10–13 years (coded as 1), 14–17 years (coded as 2), and ≥ 18 years (coded as 3). Gender is a binary variable (male = 1, female = 2). Class of study was categorized into three as follows: JSS 1 (coded as 1), JSS 2 (coded as 2), and JSS 3 (coded as 3).

Statistical analysis

Descriptive statistics (frequencies, percentages, mean and standard deviation) were computed for the variables. Bivariate analysis between PA level, physical self-concept, social support and peer norms were assessed using Pearson's product moment correlation. The independent samples t-test was used to compare data sets in terms of gender. Comparisons of data sets in terms of age groups and class of study were conducted using fixed effects analysis of variance. The variance of equality was checked using the Levene test. Multivariable analysis using hierarchical multiple regressions were further conducted to determine the explanatory factors that were significantly associated with PA level among the participants. Before multivariate regression analysis was conducted, multicollinearity within the independent variables was checked. The magnitude of the correlation coefficients did not exceed 0.60, indicating that multicollinearity was not present. Multicollinearity diagnostics was conducted for all the explanatory factors. None of the explanatory/independent variables had a Variance Inflation Factor (VIF) up to 10, which is required for exclusion from the regression model [60].Since evidence suggests that the association between PA levels of adolescents and psychosocial factors may differ across certain groups [12–13], preliminary analyses, examining three-way interactions between PA, self and social factors (social support and peer norms for PA) were conducted. Relationship between demographic characteristics (age, gender and class of study) of participants and PA levels was also assessed using multiple regression analysis. Strength and direction of associations between variables were interpreted using Jackson's [61] guidelines. Missing data were analyzed using the 'exclude cases listwise' option of SPSS. All statistical analyses were conducted using SPSS version 20 (IBM Corp, Armonk, New York, USA) and a p-value < .05 was considered statistically significant.

Results

Demographic characteristics

Out of the 365 participants, responses from 315 students with completed information were used for data analysis. The response rate was 86.3%. There were 105 boys (33.3%) and 210 girls (66.7%) with the

mean age of 15.76 ± 1.78 years for boys and 15.65 ± 1.83 years for girls. Further descriptive characteristics of the participants are presented in Table 1.

PA, self-concept, social support and peer norms scores

The summary PA score for male adolescents (2.90 ± 1.40) was slightly higher than those of female adolescents (2.80 ± 1.46). Male adolescents (171.66 ± 19.21) had a higher mean self-concept score than female adolescents (163.94 ± 19.98). Male adolescents received higher social support and peer norms (29.04 ± 5.55; 29.04 ± 3.12) for PA than female adolescents (28.62 ± 6.15; 28.62 ± 3.14). Younger adolescents had higher mean PA level (3.05 ± 1.33), and self-concept score (170.18 ± 23.11) than older adolescents (2.70 ± 1.51; 163.64 ± 16.95) and much older adolescents (2.79 ± 1.39; 169.18 ± 22.01). Further descriptive characteristics of the participants are presented in Table 1.

Table 1
Demographic Characteristics, PAQ-A, PSDQ-S, SSP, and PN Scoresof adolescents

Variable	Mean PAQ-A	Mean PSDQ-S	Mean SSP	Mean PN
Gender				
Male (n = 105)	2.90 ± 1.40	171.66 ± 19.21	29.04 ± 5.55	29.04 ± 3.12
Female (n = 210)	2.80 ± 1.46	163.94 ± 19.98	28.62 ± 6.15	28.62 ± 3.14
t	.588	3.318	.603	.498
p-value	.557	.001*	.547	.619
Age of respondents				
10–13 years (n = 103)	3.05 ± 1.33	170.18 ± 23.11	31.08 ± 3.84	15.58 ± 2.44
14–17 years (n = 111)	2.70 ± 1.51	163.64 ± 16.95	27.54 ± 6.38	13.89 ± 3.21
18 years & Above (n = 101)	2.79 ± 1.39	169.18 ± 22.01	27.76 ± 6.94	13.79 ± 3.64
F	1.905	3.942	13.157	11.079
p-value	.151	.020*	.000**	.000**
Class of study				
JSS 1 (n = 106)	2.97 ± 1.42	172.06 ± 19.41	29.16 ± 5.44	14.52 ± 3.12
JSS 2 (n = 171)	2.79 ± 1.48	165.50 ± 19.96	29.58 ± 5.03	14.86 ± 2.73
JSS 3 (n = 38)	2.72 ± 1.43	161.96 ± 19.58	27.47 ± 5.09	13.91 ± 3.48
F	.807	69.53	3.732	2.532
p-value	.447	.001*	.025*	.081
*p < .05, **p < .001				

PA levels of participants

One hundred and five (33.3%) had low PA level. Also, 183 (58.1%) participants had moderate PA level while 27 (8.5%) had high PA level (Table 2).

Table 2
Level of physical activity of the adolescents

PA Level	n	%
Low (1-1.9)	105	33.3
Moderate (2-3.9)	183	58.1
High (4–5)	27	8.5
*PA score, 1 = low, 5 = high [53–55].		

Physical self-concept level of adolescents

Adolescents had moderate (95.8%) and high levels (4.2%) of PSC (Table 3).

Table 3
Levelof PSC of adolescents

PSC Level	n	%
Low (47–99)	0	0.0
Moderate (100–199)	302	95.8
High (200–282)	13	4.2
*Physical self-concept score 47–99 = low, 100–199 = moderate, 200–282 = high.		
*Categorization was designed by the authors.		
The lowest and highest PSC scores on the PSDQ-S are 47 and 282 [56–58]		

Social support and peer norms for PA

Adolescents had a higher social support mean score (M = 2.48, SD = ± 1.039). This implies that adolescents received support for PA from friends, PE teachers and parents (Table 4). Similarly, adolescents had a higher peer norm mean score (M = 2.19, SD = ± 1.049). This implies that adolescents received support for PA from their friends (Table 5).

Table 4

Social Support for physical activity (SSP-PA)

Item	Mean ± SD
Someone takes me to play sports or exercise	3.23 ± .872
Someone exercises or plays active sports or games with me	2.92 ± 1.103
Someone encourages me to exercise	2.35 ± 1.186
Someone watches me exercise, play active games, or do sports	3.06 ± .986
Someone congratulates or tells me I am doing well with my exercise, physical activity, or sports.	2.76 ± 1.022
Someone plans things to help me be physically active (brings friends over)	3.15 ± .988
Someone pays money for physical activities or sports for me	3.03 ± .949
Someone buys clothes or equipment for me so I can be physically active or do sports	2.11 ± 1.205
Grand mean	2.48 ± 1.039

Table 5

Peer Norms for Physical Activity (PN-PA)

Item	Mean ± SD
How many of your close friends do you think exercise most days of the week?	2.90 ± 1.068
How many of your close friends would you say are physically active?	3.24 ± .928
How important do you think it is to your close friends to exercise most days of the week?	2.76 ± 1.022
How important do you think it is to your close friends to be physically active?	2.74 ± 1.031
My friends encourage me to be physically active.	2.15 ± 1.043
My friends would disapprove if they saw me just sitting around	2.10 ± 1.207
Grand mean	2.19 ± 1.049

Bivariate associations of PA level, physical self-concept, social support and peer norms

The relationships between PA level, physical self-concept, social support and peer norms were tested using Pearson's product moment correlation. There were statistically significant positive relationships among adolescents' PA level and PSC ($r = .06$, $p > 0.05$), social support received for PA ($r = .26$, $p < 0.01$), and peer norms received for PA ($r = .27$, $p < 0.01$). The correlation observed between PA level of adolescents, social support and peer norms received for PA further produced coefficient of determination of .068 and .073. This implies that 6.8% of total variation in PA level of adolescents could be explained by the linear relationship between social support and PA. Similarly, 7.3% of total variation in PA level of adolescents could be explained by the linear relationship between peer norms and PA (Table 6).

Table 6
Correlation analysis of PA, PSC, social support, and peer norms

	PSC	p-value	SSP	p-value	PN	p-value
Modified PAQ-A score	.06	.305	.22**	.000	.27**	.000
Modified Spare time PA checklist	.10	.081	.29**	.000	.27**	.000
PE	− .10	.078	.11	.062	.04	.492
Lunch	− .03	.663	.08	.142	.09	.121
After school	.11	.059	.08	.173	.13*	.019
Evenings	.10	.213	.03	.661	.04	.469
Weekends	− .10	.170	.15**	.006	.18**	.002
Statements	− .05	.423	− .09	.126	− .06	.322
Weekly	− .05	.440	.04	.461	.06	.270
* $p < 0.05$ ** $p < 0.001$						

Relationships among PA Levels and psychosocial and demographic factors

The positive relationships identified through bivariate analysis using PPMC informed us to further conduct multiple regression linear analyses. Hierarchical multiple linear regression was used to assess the associations between demographic factors (age, gender and class of study) and adolescents' PA level. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. Age was entered at step 1, explaining 91% of the variance in PA level ($F_{1, 313} = 3167.987$, $p < .001$). After entry of gender and the class of study at step 2, the

total variance explained by the model was also 91% of variance in PA level ($F_{3, 311}$ = 7.657, p < .001). This model explained an additional 0.3% of the variance in PA level of adolescents, after controlling for age, R squared change = .003, (F change $_{2, 311}$ = 6.111, p < .002). In the model, only class was statistically significant (beta = − .043). This showed that class of study significantly contributed to the model. For the psychosocial factors, the PSC score was entered at step 1, explaining only 0.3% of the variance in PA level ($F_{1, 313}$ = 1.005, p > .05). After entry of social support score at step 2, the total variance explained by the model was 4.7% of variance in PA level ($F_{2, 312}$ = 7.657, p < .001). This model explained an additional 4.3% of the variance in PA level of adolescents, after controlling for PSC, R squared change = .043, (F change $_{1, 312}$ = 14.214, p < .001). In the final model, peer norm score was entered and explained 7.3% of variance in PA level ($F_{3, 311}$ = 8.178, p < .001). In the model, only social support and peer norms received for PA were statistically significant, with peer norms recording a higher beta value (beta = .23, p < .003) than social support (beta = .22, p < .001). This also showed that social support and peer norms are significantly associated with PA levels in adolescents.

Table 7 Multiple regressionmodel showing relationships of PA level, demographic

Andpsychosocial factors in school-going adolescents

PA Level				
Parameter	ΔR^2	β	Standard Error	p-Value
Demographic characteristics				
Step 1	.910			
Age		.952**	.016	.000
Step 2	.003*			
Gender		.083	.031	.001
Class of Study		− .043*	.018	.081
Total R^2	.913**			
Psychosocial Factors				
Step 1	.003			
PSDQ-S score (PSC)		.011	.004	.305
Step 2	.043*			
PSDQ-S score (PSC)		.011	.004	.846
Social support		.214*	.025	.000
Step 3	.026*			
PSDQ-S score (PSC)		− .017	.004	.746
Social support		.061	.033	.423
Peer norms		.229*	.035	.003
Total R^2	.073**			
* $p < 0.05$, ** $p < 0.001$				

Discussion

Physical inactivity (PA) is a modifiable risk factor for many chronic illnesses. However, research evidence indicates that PA declines in adolescence and many risk factors are implicated in the trend. This study assessed PA levelandits relationships with demographic and psychosocial factors amongschool-going adolescents. The study found that more than one third of the adolescents reported low PA level; more

than halfhad moderate PA leveland less than one-fifth of the participants had high PA level.The finding suggests that a significant proportion of rural adolescents did not meet WHO daily recommendation of 60 minutes of MVPA for children and adolescents aged 5 to 17 years old to keep healthy [7]. The proportion of insufficiently active adolescents in this study was lower compared to a previous study [17]. The difference may be due to several factors not considered in this study such as school climate, availability of PE teachers, sport equipment and facilities in the schools, skills level of adolescents, and socioeconomic backgrounds of the adolescents. For instance, schooling adolescents in both semi-urban and rural communities compared to urban adolescents engage in farming activities which demand huge energy expenditure; engage in less motorized transport and travel long distances to get safe drinking water for their families especially during the dry season. These factors could plausibly explain a lower proportion of schooling-adolescents with low PA level in our study.However, future research is needed to confirm this hypothesis. Thus, it is imperative for inactive adolescents to engage in MVPA for 30 minutes daily to promote their health status. This could be achieved through organized PE education practical lessons by PE teachers in the schools. In addition, interventions such as provision of adequate sports and recreational facilities in the schools and neighborhoods to promote PA participation by adolescents are needed. Such interventions could possibly improve PA level with potential health benefits among adolescents.

The study also found that majority of the adolescents had moderate level of physical self-concept (PSC); received higher level of social support and peer norms for PA. Further, PA and PSC levels of adolescent males were higher than that of adolescent females, while social support and peer norms for males were higher than those of females. Younger adolescents had higher mean scores for PA, PSC; received more SSP and PN for PA than older adolescents. There were positive weak relationships between adolescents' PA levels and self-concept, social support and peer norms. Social support, peer norms and class of study were significantly associated with PA levels of adolescents. Although, there is adearth of data on the role of PSC in promoting PA levels among Nigerian adolescents, previous studies [24, 62–63] have shown that PSC contributes to improved levels of PA and skill development. The moderate level of PSC among adolescents might have accounted for the relatively low PA level observed in this study compared to the previous study [17]. This also underscores the role of PSC as a facilitator of PA and the need for health educators, PE teachers, and coaches to promote physical self-concept of adolescents for positive outcomes [24]. Previous studies have emphasized the importance of PSC interventions in increasing PA levels [62–63]. However, it cannot be claimed conclusively in this study that PSC increases PA levels of adolescents or PA level increases PSC of adolescents. Future studies using experimental and longitudinal designs can examine effect of PSC on PA level or vice versa in Nigerian adolescents.

Our finding also showed that the participants received higher level of social support and peer norms for PA. This finding is consistent with evidence in previous studies [42–46, 64–66] that family support and peers or friends' support are significant indicators of adolescents' MVPA. In Nigeria, parents, siblings, peers or friends usually support adolescents especially younger ones financially and emotionally during inter-house athletic or sport competitions, which are organized in many schools annually. However, social support and peer norms for PA should not be limited to inter-house athletic or sport competitions.

Evidence-based interventions targeted at intensifying social support types (instrumental assistance and emotional encouragement) and sources (parents, siblings and teachers) and peer norms (descriptive and subjective) should be encouraged among adolescents for improved PA levels. This can be achieved by providing adolescents especially female adolescents, easy-accessible and enjoyable sports activities in terms of timing, location, costs and level such as extra-curricular school-based sports [67–68].

Our study further showed that adolescents' PA level was positively associated with physical self-concept, social support and peer norms for PA. The finding validates the underlying constructs of SEM posit that behaviours including PA participation by the individuals are influenced by a host of factors [23–24]. For instance, psychological factors (physical self-concept and self-efficacy), environmental factors (neighborhood characteristics/physical environment and built environment) and social factors (social support-parental/family support, teacher's support and peer support) have been identified to influence PA participation in adolescents [25–28]. This finding is consistent with previous studies[14, 20, 21, 30] that reported association between PA and self-concept, social support, peer support among adolescents. Nonetheless, PE teachers, parents, school authorities, community members, Ministries of Education, Health, Youth and Sports Development should provide more support for youth participation in PA and organized national sports competitions such as National Sport Festival and Nigerian School Sports Competitions.

Also, our study showed that social support, peer norms and class of study were significantly associated with adolescents' PA level. Consistent with previous studies, association of PA level with social support and peer norms [14, 20, 21, 30, 42–46, 64–66] and class of study [17] have been reported. Thus, interventions are required to increase support for adolescents' PA while longitudinal studies are needed to examine effects of school level factors such as class of study on sustained MVPA level among adolescents in Nigeria.

Study Strength And Limitations

One of the strengths of the study was the introduction of local physical activities for adolescents in the slightly modified spare time checklist of the PAQ-A. Adeniyi et al. [17] adopted similar approach among their subjects. Furthermore, Cronbach's alpha coefficients of the slightly modified PAQ-A showed acceptable internal consistency like the original version [53–54]. However, the study has several limitations that should be enumerated. Our findings should be interpreted within the context of the study scope and limitations. The study adopted a cross-sectional design, as such, no causal relationship can be inferred between PA levels of adolescents and psychosocial factors investigated. Secondly, we relied on a self-report questionnaire for measuring the PA level of adolescents while objective measures such as accelerometers provide a more accurate assessment of PA levels in adolescent or youth population. Besides, PA level, other variables physical self-concept, social support and peer norms were measured using self-report questionnaires. Furthermore, like any other study that relied on self-report questionnaires, the participants' responses could have introduced recall bias and social desirability since the responses were not independently verified by the researchers. However, we mitigated the effects the response biases

may have on our findings by ensuring that adolescents were free to express their opinions and assurance of confidentiality. Despite the limitations of self-report questionnaires, they are often used within population surveillance studies due to their practicality, low cost, low participant burden and ability to contextualize healthy behaviours such as PA [9]. Therefore, self-report questionnaires may still be the only relevant means of assessing many constructs such as PA, PSC, social support and peer norms received for PA in adolescent populations. Thirdly, this was a school-based study, as such, adolescents were recruited in the schools. This implies that there is a limit to generalizability of the findings. For instance, out-of-school adolescents were not represented. Nevertheless, schools play significant role in the promotion of PA in adolescents [69]. Future studies should include out-of-school and schooling adolescents to determine relationships between PA levels and psychosocial factors in Nigeria. This may provide a viable opportunity for results with higher precision.

Conclusions

Regular PA in adolescence is important for the prevention of several non-communicable disease risk factors. This study determined the PA level and it psychosocial and demographic correlates among school-going adolescents in south-east Nigeria. Our findings showed that more than one third of adolescents had low PA level, more than half had moderate PA level and very few had high PA level. There were relationships among PA level, PSC SSP and PN in school-going adolescents. The findings suggest that there is a need for behavioural change intervention that focuses on improving adolescents' engagement in moderate to vigorous PA on a regular basis in the school settings. Also, such interventions should reinforce psychosocial factors that promote PA participation in adolescents especially female adolescents.

Abbreviations

PSC: Physical self-concept; PA:Physical activity; SSP:Social support; PN:Peer norm; WHO:World Health Organization

Declarations

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Authors' contributions

OSA, AC, PCIU conceptualized the study and deduced the design. OSA and AC wrote the first draft of the manuscript. FCU, BNA, ELO reviewed the final manuscript version. OSA and AC performed data analysis. GUK and AJO assisted in manuscript preparation and revising the final manuscript version. All authors have read and approved the final manuscript.

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Availability of data and materials

The authors confirm that the dataset used during the study are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate

The ethical clearance or approval was obtained from the Research Grants Committee of Faculty of Education, University Nigeria, Nsukka (Reference Number: ERA.016). Informed/verbal consent was provided from all participants before commencement of the study. The adolescent students and their parents/caregivers were also given verbal and written information. The parents/caregivers/guardians were given the informed consent forms via the adolescent students. The parents/caregivers who could not complete the consent forms gave verbal consent. Only the students whose parents/caregivers/guardians gave written/verbal consent one week before the study were enrolled. Confidentiality and anonymity were assured and confirmed. Participants were informed of their rights to withdraw from the discussion at any point. We got approval from the management (school principals) of each of the schools for the study to be conducted in their respective schools. The primary and processed data have been secured safely with limited access to the authors only.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interest.

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Appendix

Appendix 1: Slightly Modified PAQ-A Spare Time Checklist

Name: _____

Age: _____

Gender: _____

Grade/Class of Study: _____

We are trying to find out about your level of physical activity from *the last 7 days* (in the last week). This includes sports or dances that make you sweat or make your legs feel tired, or games that make you breathe hard, like tag, skipping, running, climbing, and others.

Remember:

3. There are no right and wrong answers — this is not a test.

4. Please answer all the questions as honestly and accurately as you can — this is very important.

1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Mark only one circle per row).

Spare time Physical Activity Checklist

Items	No	1-2 times	3-4 times	5-6 times	7 times or more
Skipping					
Tag/chasing & touching game					
Walking for exercise					
Bicycling					
Jogging or running					
Swimming					
Dance					
Football/Soccer					
Badminton					
Volleyball					
Basketball					
Hide-and-seek					
Tug of war					
Draught					