CONSTRAINTS TO PARTICIPATION IN PHYSICAL ACTIVITY DURING COVID-19 PANDEMIC: ENVIRONMENTAL IMPLICATIONS IN UNIVERSITY OF NIGERIA NSUKKA CAMPUS ENUGU STATE, NIGERIA

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ABSTRACT

The global increase in physical inactivity has been implicated for high death rates from non-communicable. COVID-19 presents series of constraints to participation in physical activity (PA) to people ranging from intrapersonal, interpersonal and structural constraints. This study assessed constraints to participation in PA during covid-19 pandemic and the environmental implications in University of Nigeria Nsukka Campus Enugu State, Nigeria. A cross sectional study was conducted among undergraduate students during COVID-19 pandemic. Participants (n =370) aged 18 to 30years (22.88±3.62) were recruited online through their individual school e-mail addresses. Physical activity was measured using International Physical Activity Questionnaire short-form (IPAQ-SF/LF) while constraints to PA during COVID-19 pandemic were assessed with COVID-19 scale. Data were analyzed using Mann-Whiney U test, Kruskal-Wallis test and Spearman correlation. In respect to PA level, 31.1%, 63.2% 5.7% of the participants had low, moderate and high PA Level respectively. No significant difference was found in categorized Metabolic Equivalent Task (MET) values (low, moderate and high) and overall MET value across all the demographic groups. Intrapersonal, interpersonal, structural and overall constraints were significantly associated with gender while structural constraints were significantly different across course level of participants. A significant association was found between low, moderate and high PA MET Values with the Total PA METs value. The findings reveal how COVID-19 influenced PA levels of individuals thus provides evidence to inform the university administration and policy makers to develop polices to enhance PA Levels of the undergraduate students and the masses during such future pandemic.

KEY WORDS: Physical activity, COVID-19 pandemic, Constraint, Undergraduates, University

INTRODUCTION

The global increase in physical inactivity has been implicated for high death rates from non-communicable diseases. Over 5 million deaths would have been mitigated if people of all ages are physically active; and more than one in every four adults are physically inactive (World Health Organisation [WHO], 2021). Physical activity (PA) is any bodily movement produced by skeletal muscles that require energy expenditure (WHO[b], 2020). Statistics indicate more proportion of females are more inactive than males with over 8 per cent difference (32% against 23%, (WHO, 2021). In Nigeria, 52 per cent of the population is inactive, with 55.8 per cent of females as against 49.3 per cent of men who are inactive (Adeloye *et al.*, 2021). A study on male university undergraduates before COVID -19 pandemic reveal that 16.0 per cent, 64.0 per cent and 19.8 per cent had low, moderate and

high PA levels (PAL) respectively (Ugwueze *et al.,* 2021). With the entrant of COVID-19 pandemic, it is assumed that the participants' PAL might have depreciated more as a result of lockdown measures. Low levels of PA contribute to increased risk of chronic health conditions, such as cardiovascular diseases, diabetes, cancer and other diseases (Warburton *et al.*, 2006 and Taylor, 2014). The authors added that PA short of 3.5METs (low intensity) or summation of activity below 4200KJ/week (more than three hours brisk walking per week) may not offer the expected health benefits. Engaging regularly in physical activity offers tremendous physiological, psychological (emotional and mental health) and social wellbeing (Blair and Morris, 2009). To instill active lifestyle in people worldwide, WHO (2018) came up with action plan and campaign targeted to reduce physical inactivity by 10 per cent by 2025 and 15 per cent by 2030. In order to achieve this, WHO (2018; 2021) recommended at least 150 to 300 minutes of moderate to vigorous physical activity plus 2 or more days of muscle strengthening activities involving major muscles in a week for adults. The outbreak of coronavirus disease (COVID-19) in January 2020 in Nigeria negates the actualization of WHO action plan. .

COVID-19 is a serious public health concern that threatened lives of millions of people worldwide. COVID-19 refers to a new beta coronavirus disease called 2019- novel coronavirus (SARS-Cov-2), which broke out in Wuhan city, Hubei province, China in December 2019 (Dunton *et al*., 2020). It is an infectious disease which presents symptoms such as fever, respiratory symptoms (cough, sore throat, and nasal discharge), headache, and malaise (Kutsuna, 2021). The outbreak was declared a global public health emergency on 30th January, 2020 and a pandemic on 4th March, 2020 (WHO, 2020[a]). In Sub-Saharan Africa, Nigeria was first to confirm coronavirus case on 28th February, 2020 from a Nigerian-based Italian citizen who returned from Milan (France 24, 2020). Nigeria being one of the 10 countries reported with high rate of COVID-19 infection and among five countries that constitute 70 per cent of deaths from COVID-19 (WHO, 2020[a]), quickly adopted WHO mitigation and health preventive measures, such as physical distancing, lock down of public places including fitness centres and public sports facilities as recommended (WHO, n.d and United Nations Regional Information Center Europe, 2020). People with underlining

health issues, such as cardiovascular disease, diabetes, cancer, chronic respiratory disease were reported to be more susceptible to COVID-19 infection (WHO, 2020[a]). Implementation of COVID-19 preventive health measures increased physical inactivity in people (Vancini *et al*., 2021). The confinement negatively impacted physical, mental and social health of individuals (Semo and Fissa, 2020 and Puccinelli *et al*., 2021). It reduced PAL of the active and less active individuals prior to COVID -19 pandemic and increased sedentary behaviour (Dallolio *et al.,* 2022).

COVID-19 pandemic also subjects individuals to mental health problems, such as stress, anxiety, depression, insomnia and posttraumatic disorder (Semo and Frissa, 2020). Previous studies (Semo and Frissa, 2020 and Pancha *et al.*, 2020) reported varied negative mental health cases associated with COVID-19 stay at home. In the United States (US), anxiety and stress rate was 45 per cent (Pancha *et al.*, 2020). Moreover, in the United Kingdom (UK), anxiety rate was 33 per cent (National Statistics) while in Italy anxiety rate was 20 per cent, stress (21%), depression (17%), insomnia and posttraumatic disorder (37%) (United Nations Regional Information Center Europe, 2020). These diseases are modifiable through regular engagement in PA (Mckinney *et al.*, 2016).

Moderate intensity PA boosts immune system, reduces stress (Pedersen *et al.*, 2000 and Da Silveira *et al.*, 2020), and reduces upper respiratory infection caused by viral respiratory infection, such as COVID-19 by 20 per cent to 30 per cent (Halabachi *et al.*, 2020). Increased PA improves physical fitness, bone strength, greater cognitive function and mental health (Adeloye *et al*., 2021 and Elmagd, 2016). Previous studies reported strong positive relationship between PA participation and improved mental health (Galper *et al.*, 2006; Harvey *et al.*, 2010; Smith *et al.*, 2013 and Stanton *et al.*, 2014). Physical activity ameliorates feeling of depression and stress, as well as improves mood through release of endorphins, also known as endogenous opioids (feel-good chemical) from the hypothalamus and pituitary glands (Dfarhud *et al.*, 2014; Rokade, 2011 and Stanton *et al*., 2014). Positive mood and happiness reduce hypertension and cardiovascular disease (Luppino *et al.*, 2010). To abide with social distance policy, people were compelled to engage in individual PA. Participation in individual sports is conducted within the principles of social distancing which encourages activities, such as walking,

jogging, and bike riding (Wendtlandt and Wicker, 2021). This measure made it difficult for people to continue with their favorite PA and gradual loss of interest set in, with accompanied sedentary behaviour which has the capability to reduce PAL.

Studies show that reduced PAL has strong association with constraints which may be intrapersonal, interpersonal and structural in nature as categorized by Crawford *et al.* (1991). COVID-19 presents series of constraints to participation in physical activity to people ranging from intrapersonal, interpersonal and structural constraints. Intrapersonal constraints deal with psychological factors that operate within the individual which dominates every consideration to participate in PA, such as attitude, values, belief, body image, perceived skills, attitude of reference group and socio-cultural issues on sex-stereo-type which restrict female gender assess to opportunities with belief that they should focus on domestics (Crawford *et al.*, 1991; Godbay *et al.*, 2010 and Selvaratnam *et al.*, 2021). Interpersonal constraints emanate from one's relationship and interaction with others, such as support from significant others such as parents, siblings, friends or neighbours (Crawford *et al.*, 1991 and Godfrey *et al.*, 2010), family commitment and absence of partners to participate with (Selvaratnam *et al.*, 2021). Structural constraints include environmental factors that hinder participation, such as fund, assess to facilities, availability of time, transportation and programme scheduling (Crawford *et al.*, 1991; Godfrey *et al.*, 2010 and Selvaratnam *et al.*, 2021). These three categories of constraints exert negative influences capable of preventing individuals from participation in PA. These factors may vary in intensity or priority within different countries, culture, personality, gender, physiological attribute, and so forth. The critical question is whether the individual in question attach value to the leisure activity and whether he or she can appropriately participate, enjoy, and experience success.

It is therefore pertinent to investigate PAL of university undergraduate regular exercisers and their constraints to participation in leisure physical activity during COVID-19 pandemic. This study therefore investigated PA level of undergraduate students based on demographic variables of gender, residence, age and academic level during COVID-19 pandemic and relationship between PAL and COVID-19 constraints to PA in University of Nigeria, Nsukka. Relationship between them may provide evidence-based information on health promotion strategies to employ during similar pandemic.

METHODS

Study design, setting and population

The study was a across sectional survey conducted between April and August, 2021 among 36,000 undergraduate students enrolled during 2020/2021 academic session in University of Nigeria, Nsukka (UNN [Sulhazan, 2020]). The UNN has four campuses: Nsukka, Enugu, Ituku-Ozara and Aba, but Nsukka campus was used for the study. University of Nigeria, Nsukka campus has nine faculties which include Biological Sciences, Education, Engineering, Arts, Agriculture, Pharmaceutical Sciences, Veterinary Medicine, Social Sciences and Physical Sciences.

Sample size determination and procedure

The sample size (n = 384) was determined using Charan and Biswas (2013) formula (Z_1-α/2^2 SD/d_2) for quantitative survey study. Participants' ages range from 18-30 years. Students who enrolled for Diploma programme, sub-degree programme (Joint Universities Preliminary Examination Board-JUPEB), foreign students and those who had completed first degree were not part of the study.

Measures

All participants were requested to complete self-report questionnaires. These include their demographic information about their age, gender, course level and residence (hostel or off-campus), the International Physical Activity Questionnaires (IPAQ-SF/LF) and COVID-19 Physical Activity Participation Constraint Questionnaire.

Physical activity

Participants supplied demographic information about their age, gender, course level and residence (hostel or off-campus). Participant's physical activity was measured using International Physical Activity Questionnaire short-form (IPAQ-SF/LF) assessed from www.ipaq.ki.se. The IPAQ short form is a self-reported questionnaire that measures duration of PA on four categories including vigorous, moderate walking (low) and sitting. Each category of PA was assigned Metabolic Equivalent Task (MET) such as 3.3 METs for walking or low PA,

4 METs for moderate PA and 8 METs for Vigorous PA. Estimation of energy expenditure for each category was calculated by multiplying the MET value for the category X duration/minutes X number of times such activity was performed in a week. This study focused on Leisure Time Physical Activity (LTPA), hence a combination of walking/ low intensity, moderate-intensity or vigorous-intensity activities were summed to at least achieve 3,000 MET-min/week (IPAQ, 2004). Participants who achieved less than 600 MET-min/week were classified as low PA (insufficiently active), e" 600 METs to < 3,000 MET-min/week as moderate, and e" 3,000 MET-min/week high PA (health enhancing PA level [IPAQ, 2004]). The IPAQ correlation was 0.80 for reliability and 0.30 for validity (Marshall *et al.*, 2003). Previous studies in Nigeria established reliability of IPAQ-SF/LF as .79 (Oyeyemi *et al.*, 2013 and Ugwueze *et al.*, 2021).

Constraints to participation in physical activity

Constraints to leisure physical activity was measured using 10 items COVID-19 constraints scale modified by Kim *et al.* (2020) from Crawford *et al.* (1991) as well as the scale used in Kim *et al.* (2020). The COVID-19 leisure constraint was categorized into intrapersonal constraints, interpersonal constraints and structural constraints. The authors modified the original constraint scale (Crawford *et al.*, 1991) to align with COVID-19 pandemic. For instance, intrapersonal constraint item statement such as "I will not engage in leisure activities that I feel uncomfortable with" was transcribed to "I feel uncomfortable participating in leisure activities during the COVID-19 pandemic". Interpersonal constraint item such as "I do not have friends or partners with whom I can participate in leisure activities" was modified to "I do not have friends or partners with whom I can participate in leisure activities during the COVID-19 pandemic". In structural constraint scale item such as "I lack information on leisure activity" was transcribed to "there is a lack of information regarding the leisure sports activities in which I can participate during the COVID-19 pandemic. The COVID-19 leisure constraints scale by Kim *et al.* contains 10 items, all measured in a five –point Likert scale (1 = "strongly disagree", 5 = strongly agree), with a higher score indicating higher constraint. The overall reliability of Kim *et al.* (2020) scale using Cronbach alpha (α) was 0.84, which indicated high reliability. In this study, the overall reliability coefficient using Cronbach α

was 0.822, structural was 0.705, intrapersonal was 0.418 and interpersonal was 0.625.

Procedure for data collection

The research was carried out in line with the Declaration of Helsinki 1964 of the 18th World Medical Association, as updated by the 29th World Medical Assembly in Tokyo in 1975 (Declaration of Helsinki, 1975). The University of Nigeria Ethics Committee authorized the study with permission number UNN/FE/REC/21/096. Approval was sought from the Director of Information and Communication Technology unit of University of Nigeria, Nsukka to forward questionnaires (IPAQ-SF/LF and COVID-19 constraints) to the university undergraduate students through their respective e-mail addresses. Eligible participants were 36,000 students enrolled during 2020/2021 academic session in University of Nigeria, Nsukka (Sulhazan, 2020) and who participated in PA at least twice on weekly bases before COVID-19 pandemic. The purpose of the study was explained as a preamble in the online questionnaire. Students were informed that that they were not compelled to be part of the study, thus responding to the questionnaires was indicative of their consent to be part of the study. Online responses from eligible participants were received in order of submission until 384 responses were gathered to tally with the study sample.

Data analysis

Data analysis was conducted using SPSS version 23. Coding and data cleaning were done and test of normality conducted using Kolmogorov-Smirnov statistics. Demographic variables were reported in frequencies and percentages. The normality test was significant which indicated violation of the assumption of normality thus in line with 1PAQ (2004) that MET values are not normally distributed. This necessitated the application of Mann-Whitney-U test and Kruskal-Wallis test in determining relationship between dependent and independent variables. Pearson X^2 and ANOVA were used to determine differences in total categorized PA scores (i.e., total MET-min/week of low, moderate and high PAL) in respect to COVID-19 constraints to PA. Spearman Rank Order Correlation was used to determine inter correlation between PA level and constraints to participation in physical activity and its dimensions. The effect size criteria of .1= small effect, .3 = medium effect, .5 and above large effect was used (Cohen, 1988).

RESULTS

Descriptive Statistics and Spearman correlation

Out of 384 online responses to the questionnaires received, 370 contained required information. This gave a return rate of 96.35 per cent. The sample size consisted of 41 per cent males and 59 per cent females. Average ages of the participants were 22.88±3.62. The summary of demographic characteristics of participants is presented in Table 1. The findings of descriptive statistics such as mean

rank, median and spearman correlation for determining relationship between PA levels and constraints to PA and the sub-divisions are presented in Tables 2, 3, 4 and 5. The result on PA showed that 31.1 per cent, 63.2 per cent and 5.7 per cent of the participants had low, moderate and high PA level/health enhancing PA respectively (Table 2).

There was no significant difference in PA Level in the entire demographic variable (Table 2 and 3). A Mann-Whitney U test revealed a significant difference only on gender in intra-personal, interpersonal and structural constraints respectively. In intrapersonal males (Md = 11, n = 151) and females (Md = 10, n = 219), U = 15746.00, Z = -2.86, p = .000, r = -0.15 (small effect). In interpersonal constraint, males (Md = 11, n = 151) and females (Md = 12, n = 219), U = 13433, Z = -3.11, p = .000, r = -0.16 (small effect size). In structural males (Md = 8, n = 151) and females (Md = 9, n = 219), U = 11439.50, Z = -5.089, p = .00, r = -0.27 (small effect size). A Kruskal-Wallis test on course level revealed a statistical significant difference in structural constraint across the five groups (Grp1, n = 92: year 1, Grp2, n = 91: year 2, Grp3, n = 78: year3, Grp4, n = 81: year 4, Grp5, n = 8: year5), X^2 (4, n = 370) = 1632, p = .003. The year 5(Grp5) recorded a higher median score (Md = 8) than the other groups with

Table 1. Demographic Characteristics of the participants

Variable	Category	N	Percentage (%)
Gender	Male	151	40.8
	Female	219	59.2
Age	18 – 22	123	33.2
	23 – 26	190	51.4
	27 – 30	57	15.4
Residence	Hostel	144	38.9
	Off-campus	226	61.1
Course level	Year 1	92	24.9
	Year 2	91	24.6
	Year 3	78	21.1
	Year 4	81	21.9
	Year 5 and above	28	7.6

Table 2. Physical activity levels with participants' demographic characteristics (n=370)

Variables	Physical activity levels			X	df	p-value
	Low PA (n = 115) F(%)	Moderate PA (n = 34) F(%)	High PA (n =211) F(%)			
Overall	115(31.1%)	234(63.2)	21(5.7%)			
Gender						
Male	47(31.1)	140(63.9)	10(6.6)	.443	2	.801
Female	68(31.1)	86(59.7)	11(5.0)			
Location						
Hostel	48(33.3)	86(59.7)	10(6.9)	1.516	2	.469
Off-campus	67(29.6)	148(65.5)	11(4.9)			
Age						
18-22	35(28.5)	81(65.9)	7(5.7)	.928	4	.921
23-26	61(32)	119(62.6)	10(5.3)			
27-30	19(33.3)	34(59.6)	4(7.0)			
Course level						
Year 1	29(31.5)	58(63.0)	5(5.4)			.941
Year 2	29(31.9)	57(62.6)	5(5.5)			
Year 3	19(24.4)	54(69.2)	5(6.4)			
Year 4	29(35.8)	47(58.0)	5(6.2)			
Year 5	9(32.1)	18(64.3)	1(3.6)			

Note. Low PA= <600 MET-minute/week; Moderate PA= >600 to < 3,000 MET-minute/week; High PA= e" 3,000 MET-minute/week; X = chi-square; df= degree of freedom; F=frequency; % = percent

median values of 9 (Table 4). In the overall constraints, only gender revealed significant difference, males (Md = 30, n=151) and females (Md =32, n =219), U = 13535.50, Z = -2.978, p = .003, r = -0.16. The Spearman correlation analysis for determining relationship between TPAL with Levels of PA and TPAL and categories of constraints' are presented in Table 6. Significant positive correlation exist between TPA and LPA (r = .76, p = .000), MPA (r= .65, p = .000), and HPA (r-.56, p = .000). However, negative non-significant correlation exist with T constraint (r = -.05), Tcstruct (-.07, p = .178), Tintra (r = -.09, p = .096) and positive with Tinter (r .02, p = .661).

DISCUSSION

The purpose of the study was to assess PA levels and how categories of constraints where associated with PAL, as well as how PA constraints differ based on demographic variables. The study revealed that majority of the students had moderate PAL, a reasonable proportion more than before COVID-19 had low PAL; while insignificant percentage attained high PAL. No significant difference on PAL was observed across demographic variables, but there was a gradual drop in high PA level and increase in percentage of low PAL when compared with previous studies prior to COVID-19 pandemic in Nigeria. This result supports previous study

(Theis *et al.*, 2021) that lockdown resulted in reduced PAL and manifestation of negative physical, psychological and social health. However, moderate PAL stimulate cellular immunity (Pedersen *et al.*, 2000 and Da Silveira *et al.*, 2020), thus may provide the needed protection to the body against COVID-19 infection. On the other hand, protracted lockdown may lead to further drop in individuals' PAL to low PAL which may be detrimental to health. Although, results (Table 2) indicated no significant difference on gender probably because equal percentage of males and females were inactive (low PAL), and more of the males achieved moderate and high PAL. This is in line with Adeloye *et al.* (2021) and WHO (2021) findings. Students resident in off-campus seem to be more physically active than those in the hostels as revealed by the percentage of low, moderate and high PAL (Table 2). This could be attributed to PA behaviour of trekking considerable distance to lectures cultivated in school before COVID-19 Pandemic which probably made them to engage more in PA at home.

In terms of constraints, gender appears to be the only significant variable affected by intrapersonal, interpersonal and structural constraints. The result is not surprising as literature evidence on gender differences in constraints to PA abound (Crawford and Godbey, 1987 and Ocal, 2014). These differences could be attributed to the different ways males and females are affected by these categories of

Table 3. Result of Mann-Whitney and Kruskal-Wallis Test on physical activity levels of participants by demographic variables (n=370)

| Variable | N | Total PA score (MET-min/week | | U, H(X²) | df | Z | p-value | R |
		Mean Rank	Median, n =370					
Gender								
Male	151	196.40	1215.00, n= 370	U(29657.00)		-1.628	.103	-0.09
Female	219	178.98	1062.00					
Residence								
Hostel	144	187.64	1165.00, n = 370	U(15964.00)		-.307	.759	-0.02
Off-campus	226	184.14	1116.00					
Age								
18-22	123	195.49	1182.00	H(X²) = 1.859	2		.395	
23-26	190	178.66	1056.00					
27-30	57	186.75	1022.00					
Course level								
Year 1	92	200.78	1302.00	H(X²)= 6.124	4		.190	
Year 2	91	174.20	1036.00					
Year 3	78	199.58	1292.00					
Year 4	81	169.79	929.00					
Year 5	28	178.1	1069.00					

Note. U = Mann-Whitney U test; H(x²) = Kruskal-Wallis test, df = degree of freedom

Table 4. Result of Mann-whitney and Kruskal-wallis test on participants physical activity constraints by demographic variables

Variables	N	Intrapersonal Constraints				Interpersonal Constraints				Structural Constraints			
		Mean Rank	Median	U, ZH, (df), P-value	R	Mean Rank	Median	U, Z, H, (df, n), P-value	R	Mean Rank	Median	U, Z, H, (df), P-value	r
Gender													
Male	151	204.41	11.00	U(13678.500, 370)= -2.856, .004	-.20	164.96	11.00	U(13433.00, 370) = -3.110, .002	.16	151.76	8.00	U(11439.500, 370) =- 5.089, .000	-0.36
Female	219	172.46	10.00			199.66	12.00			208.76	9.00		
Residence													
Hostel	144	181.85	10.00	U(15746.000, 370),-.530, .596	-.13	191.43	12.00	U(15418.000, 370) = -.863,.388		186.67	9.00	U(16103.500, 370) = -.170 .865	
Off-campus	226	187.83	11.00			181.72	12.00			184.75	9.00		
Age													
18-22	123	187.29	11.00	H(2,370) = 1.175, .556		181.66	12.00	H(2, 370)= .248, .883		193.35	9.00	H²(2,370)= 3.070,.215	
23-26	190	188.52	10.00			187.18	12.00			186.89	9.00		
27-30	57	171.59	10.00			188.18	12.00			163.93	8.00		
Academic level													
Year 1	92	193.70	11.00	H(4, 370) = 5.421, .247		178.22	12.00	H(4,370) =2.276,.685		211.96	9.00	H(4,370)= 16.320,.003	
Year 2	91	200.09	11.00			193.51	12.00			177.46	9.00		
Year 3	78	165.01	10.00			195.04	12.00			189.47	9.00		
Year4	81	180.25	10.00			180.37	12.00			182.40	9.00		
Year5	28	183.43	10.00			171.64	11.00			122.61	8.00		
Grand Constraint													
Gender													
Male	151	165.64	30.00	U=13535.50, 370, -2.978, .003	-0.16								
Female	219	199.19	32.00										
Residence													
Hostel	144	189.45	32.00	U= 15703.00,370, -.570, .569	-0.03								
Off-campus	226	182.98	31.00										
Age													
18-22	123	190.01	32.00	H(2, 370) =2.145, .342									
23-26	190	188.25	31.00										
27-30	57	166.59	30.00										

Table 4. *Continued ...*

Variables		Intrapersonal Constraints				Interpersonal Constraints				Structural Constraints			
	N	Mean Rank	Median	U, ZH, (df), P-value	R	Mean Rank	Median	U, Z, H, (df, n), P-value	R	Mean Rank	Median	U, Z, H, (df), P-value	r
Academic level													
Year1	92	204.39	32.00	H(4, 370) =			.						
Year2	91	191.92	32.00	9.307, .054									
Year3	78	178.87	31.00										
Year4	81	179.58	31.00										
Year5	28	138.16	29.00										

Note. Intrac = Interpersonal constraint; interc = interpersonal constraint;structc = structural constraint; U= Mann-Whitney U test; H(x²)= Kruskal-Wallis test, df degree of freedom; r = effect size

constraints. Also, the result showed that males experience intrapersonal constraint more than females as indicated by a higher mean rank (Table 5). This result was not expected, though Crawford and Godbey (1987) reported that intrapersonal constraint is the most influential among the three categories of constraints, as an individual capable of overcoming it can as well navigate through other constraints to participate in PA. However, it was expected that females should experience intrapersonal constraint more than males in view of socio-cultural issues on sex stereotype, which restricts female gender access to opportunities, placed them in subservient position to males with belief that they should focus on domestics (Crawford *et al.*, 1991; Godbay *et al.*, 2010 and Selvaratnam *et al.*, 2021). The result also reveals that females experience interpersonal, structural and overall constraints more than males. These findings align with previous studies (Craig and Brown, 2016 and Stankowski *et al.*, 2017) but contrasted with (Selvaratnam *et al.*, 2021). Females' experience of interpersonal constraint more than males supports Kim *et al.* (2020) that individuals who prefer participating alone experience interpersonal constraints especially during COVID-19 pandemic that physical contact was disapprove. Females are not often very outgoing like the males, thus may not have much inclination to partners in PA to avoid COVID-19 infection. The significant difference existing between academic levels could have resulted from lack of time due to academic pressure. Since constraints are factors that prevent individuals from participating in PA (Jackson, 2000), such factors could be summated depending on priority such a person attaches to staying active (Crawford *et al.*, 1991).

Environmental Implications

COVID-19 movement restriction subjected individuals to series of positive and negative environmental issues. The closure of public places, schools and fitness centres forced people to remain in the comfort of their homes which increased tendency for sedentary behaviour. The lockdown decongested automobile traffic which constrained people from engaging in routine PA prior to the pandemic in Metropolitan cities such that usual busy roads became lonely and favourable for leisure PA (Lawanson *et al.*, 2020). With the lockdown scenario, people could safely embark on individual PA encouraged by COVID-19 preventive health

measures, such as walk, jogging and cycling without fear of being knocked down by automobiles. This opportunity was countered by many factors.

In Nigeria several environmental challenges such as poor road network, lack or absence of pedestrian lane for safe walk and cycling, poor awareness of the health benefits of regular PA which compels some people to feel their socio-economic status is being evaluated when they choose to walk the smallest distance instead of moving in their cars (Adeloye *et al.*, 2021). More so, people on daily bases are confronted with unsafe open spaces for walk, jog, cycle, run and other physical activities (WHO, 2021) because the environment has been bedeviled with increased rates of insecurity

emanating from high rate of insurgence, kidnapping, killings and all manner of criminality in the recent time in Nigeria. This situation contravenes WHO advocacy for safe environment that will support recreational physical activity such as walking, cycling and others. A number of online PA options were advocated, such as carrying heavy loads, stair walking, jogging on the spot, yoga and other but several environmental barriers constitute a cog in actualization of these PA (Nienhuis and Lesser, 2020). This is partly as a result of increased rate of urbanization, where most low income homes and communities have limited spaces for PA (Lawanson *et al.*, 2020). This is because buildings are congested, most compounds lack open space play,

Table 5. Mann-whitney and Kruskal-wallis test on participants overall physical activity constraints by demographic variables

Overall constraint	N	Mean Rank	Median	U, H, (df)	Z	P	R
Gender							
Male	151	165.64	30.00	U=13535.50	-2.978	.003	-0.16
Female	219	199.19	32.00				
Residence							
Hostel	144	189.45	32.00	U= 15703.00	-.570	.563	-0.03
Off-campus	226	182.98	31.00				
Age							
18 -22	123	190.01	32.00	H(x^2)=2.145		.342	
23 -26	190	188.25	31.00				
27-30	57	166.59	30.00				
Course Level							
Year 1	92	204.39	32	H(x^2)=9.307		.054	
Year 2	91	191.92	32				
Year 3	78	178.87	31				
Year 4	81	179.58	31				
Year 5	28	138.16	29				

Note. Overall constraint = intrapersonal + interpersonal+ structural constraints; U= Mann-Whitney U test; H(x^2)= Kruskal-Wallis test, df =degree of freedom; r = effect size

Table 6. Spearman correlation analysis on study variables and sub-dimensions'

Variable	1	2	3	4	5	6	7	8
IPAQ-SF/LS TPA MET-min/wk	-							
IPAQ-SF/LS LPA[a]	.76**	-						
IPAQ-SF/LS MPAb[b]	.65**	49**	-					
IPAQ-SF/LS HPA[c]	.56**	.09	.10	-				
Tconstraints	-.05	-.06	.07	-.03	-			
Tcstruct	-.07	-.08	-.09	.06	.74**	-		
Tintra	-.09	-.08	-.08	-.00	.74**	.34**	-	
Tinter	.02	.03	.00	-.00	.56**	.17**	.16**	-

Note. PA = physical activity; MET = metabolic equivalent task; TPA = total PA MET-min/week; IPAQ-SF/LF = International physical activity questionnaire-Short form/leisure form;LP = low physical activity; MPA = moderate physical activity; VPA = high physical activity; IPAQ-SF/LF LPA[a] = <600MET-min/week; IPAQ-SF/LF MPA[b]= > 600 to 3000 MET-min/week; IPAQ-SF/LF HPA[c] = e''#3,000MET-min/week; Const = constrain; Tconst = total constraint; Tcsstrut = tota structural constraint; Tcintra = total intra personal constraint; Tcinter = total interpersonal constraints

there are insufficient space in most homes as some families house more than eight inmates in a two or three bed room apartment which is not conducive for on the spot physical activities or online routine PA. The COID-19 preventive health measures deteriorated PAL of active and inactive undergraduate students and the built environment helped to perpetrate inactive lifestyle. This indicates the need to devise health promoting measures to increase PA among undergraduate students during future pandemic.

CONCLUSION

The health importance of regular PA during COVID-19 pandemic cannot be overemphasized as it has been validated to improve physical, psychological and social health. Maintaining health appropriate physical activity level (PAL) help to boost immune system and protect the body against arrays of negative health problems associated with COVID-19 pandemic. This study is the first in Nigeria to assess undergraduate students' PA levels and associated constraints using IPAQ-SF/LF and modified COVID-19 leisure question by Kim *et al.* (2020). The findings of this study contribute to body of existing literature on constraints to PA participation especially during COVID-19 pandemic and the environmental implications. There is need for collaboration and concerted efforts by government and university administration to provide and promote safe environment that supports physical activity in all communities including university community and increase opportunities for students to be active on daily bases for optimal well-being.

Limitations

This study is limited to undergraduate students' population in University of Nigeria, Nsukka. The assessment of PA level was based on IPAQ-SF/LF scores, a self-reported instrument, thus is subject to under/over reporting by respondents. A more objective measure of PA with accelerometer or pedometers was not carried out in this study as result of cost of such equipment. Further studies are needed with objective PA measures and interventions to overcome constraints and promote PA awareness among students.

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