## RESEARCH

**Reproductive Health** 



# Barriers, attitudes and perceptions to physical activity among pregnant women in Ibadan, Nigeria and the associated factors: a mixed method study

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## Abstract

**Background** Physical activity has several health benefits during pregnancy. However, it remains low among pregnant women because of various barriers. This study assessed the attitude, perception, barriers to physical activity during pregnancy and the associated factors.

**Method** We conducted a cross-sectional study using a sequential explanatory mixed method among 465 pregnant women attending antenatal care from four healthcare facilities in Ibadan, Nigeria. Data was collected using a pre-tested interviewer-administered questionnaire, and we conducted four focus group discussions. Using the Barriers to Physical Activity during Pregnancy Scale questionnaire, we assessed the barriers based on the socioecological theory. The explanatory variables included sociodemographic characteristics, obstetric factors, past obstetric history and physical activity-related issues. Data were analysed using univariate and bivariate methods (independent T-tests and ANOVA), and multiple linear regression was at 5% significance. We applied thematic content analysis to qualitative data.

**Results** The mean age of the participants was  $29.22 \pm 5.01$  years. The mean  $\pm$  SD of the total physical activity barrier score (PABS) was  $85.35 \pm 22.82$ . The PABS for the subscales were intrapersonal barriers ( $34.46 \pm 8.79$ ), non-pregnancy intrapersonal barriers ( $14.47 \pm 5.67$ ), and interpersonal barriers ( $11.67 \pm 4.25$ ), environmental, political and organisational barriers ( $24.766 \pm 8.82$ ). The significant relationships between the total score of physical activity barriers and religion (p < 0.030), education (p < 0.000), complaints in pregnancy (p < 0.043), antenatal admission in the hospital (p < 0.004), physical activity advice (p < 0.018), pre-pregnancy physical activity (p < 0.000). Factors associated with physical activity barrier score were maternal education: adjusted  $\beta$ : – 15.26, 95% CI: – 27.83; – 2.69; p = 0.017, antenatal admission adjusted  $\beta$ : 12.20, 95% CI 3.74; 20.67, p = 0.005 pre-pregnancy physical activity: adjusted  $\beta$ : – 12.27, 95% CI – 1.6.5; – 7.99, p = 0.001. Significant themes that emerged in the perception of pregnant women towards physical activity are understanding physical activity, personal experience of physical activity, barriers experienced by pregnant women, the role of support, perceived benefits, and information from health care workers.

**Conclusion** Our study showed that pregnant women attending antenatal clinics in Ibadan, Nigeria, face various barriers to physical activity during pregnancy. Using the socioecological framework, the most commonly reported barriers by our respondents were intrapersonal and environmental barriers. Sociodemographic characteristics,

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pre-pregnancy physical activity, and antenatal admission were significant factors associated with the total barrier scores of respondents. Healthcare professionals should be trained in promoting physical activity during pregnancy. Tailored interventions are necessary to promote physical activity among pregnant women in Nigeria, including the training of health workers.

Keywords Physical activity, Attitudes, Barriers, Factors, Pregnancy, Nigeria

## Background

Physical inactivity is the fourth most significant risk factor for premature mortality [1]. Physical inactivity affects 1.4 billion adults, 27.5% of the world's adult population, including pregnant women [2]. Physical activity has several health benefits, including improving cardiovascular fitness and controlling, blood pressure, blood sugar, mood, and sleep quality [3, 4]. Sub-Saharan Africa is also experiencing increased physical inactivity due to the ongoing epidemiologic and nutritional transitions against globalisation, westernisation, and urbanisation [5]. These changes have led to an epidemic of non-communicable diseases, such as cardiovascular disease, obesity, and stroke, which occur in more significant numbers in females than males. Hence, the feminisation of non-communicable disease (NCD) risk factors has been reported among women of reproductive age [6-8]

Pregnant women are generally advised to prioritise rest over physical activity due to concerns about potential complications for both the mother and the fetus. These complications result from the aggravation of physiological and anatomical changes occurring during this period [9]. Some other factors associated with reduced physical activity during include miscarriage, fear of complication, preterm delivery, and intrauterine growth restriction. These conditions have been ascribed to the shunting of blood away from the placenta to the muscles [10]. Physical activity during pregnancy has several benefits, including enhancing cardiovascular and respiratory fitness and lowering the risk of maternal obesity, excessive weight gain, gestational diabetes mellitus, and preeclampsia [11, 12]. It also improves the quality of sleep, diminishes levels of anxiety and depression [13] and enhances the overall sense of well-being [14]. Moreover, physical activity also has long-term effects on preventing and controlling NCDs [15].

The World Health Organization (WHO) and other professional bodies such as the American Congress of Obstetricians and Gynecologists (ACOG) and the Royal College of Obstetricians and Gynecologists (RCOG) recommend that pregnant women participate in at least 150 min of moderate-intensity physical activity each week [1]. Despite these guidelines, physical inactivity is high in pregnant women because of fear of complications, lack of information, cultural beliefs, and lower back pains [16]. Findings from a study conducted in Canada by [17] reported that only 24.7% of pregnant women were sufficiently active, as less than one in four Canadian pregnant women met the recommended level of physical activity. Globally, prenatal physical inactivity is a significant public health problem with an increased risk of maternal-foetal complications [18–22].

Pregnancy is an opportunity to begin and sustain a healthy lifestyle and avoid sedentary behaviours because of its benefits for both the mother and fetus. Despite these benefits, pregnant women encounter many barriers to physical activity. As a result of the possible detrimental effects of physical inactivity in pregnancy, researchers have investigated the potential barriers to physical activity in pregnancy under these themes : intrapersonal, interpersonal, environmental, organisational, and political factors [23]. Intrapersonal barriers include fatigue, lack of energy, fear and concern regarding safety [24], and muscular discomfort [25]. Interpersonal barriers include lack of knowledge about exercise safety, lack of time, problems and lack of social support from husbands and families, conflicting advice from friends and neighbours, and lack of physician advice [26]. Among the environmental, organisational, and political barriers were financial constraints, living in an unsafe neighbourhood, lack of suitable transportation options, insufficient recreational facilities, high costs, lack of specific programs for pregnant women, cold and hot weather conditions, and air pollution, along with distance to facilities [16, 27].

In Nigeria, there is a lack of evidence on the barriers of pregnancy physical activity and the associated factors. A study in Benin, Nigeria, reported that only 22% of their pregnant study population exercised as recommended by WHO and reported lack of time, fatigue and feelings of embarrassment as the barriers to physical activity [28]. Adeniyi et al. [29] also reported that none of their respondents attained the recommended level of physical activity by WHO, a minimum of 150 min of moderate-intensity physical activity per week. Almost a decade later, in the same study setting, the Ibadan Pregnancy Cohort study (IbPCS)-a multicenter cohort study among pregnant women in Ibadan [30] showed that none of the pregnant women met the WHO recommended level of physical activity, and the average time spent on moderate-intensity physical activity in the study was

26.5 min per week. These studies assessed physical activity in pregnancy using the Pregnancy Physical Activity Questionnaire (PPAQ).

In summary, the current evidence suggests that Nigerian women do not derive sufficient benefits from physical activity during pregnancy, as physical activity has not been emphasised in maternal health services. However, studies investigating barriers are needed in Nigeria. Our current study improves upon a recent study that examined barriers to pregnancy physical activity with a small sample size [31]. Hence, our current study assessed the barriers, attitudes, perceptions and associated factors of pregnancy physical activity in Ibadan, Nigeria, using a mixed method and standardised tool.

## Methods

## Study design, setting, population and sample size estimation

A cross-sectional study was conducted among pregnant women attending antenatal clinics at four health facilities in Ibadan, using a sequential explanatory mixed method of data collection (quantitative and qualitative) from 20th February to 26th March 2024. The facilities were Adeoyo Maternity Teaching Hospital, Jericho Specialist Hospital, Agbowo Primary Health Center, and Ojoo Primary Health Center. Study participants were proportionately allocated to the selected health facilities based on the monthly delivery rates: Adeoyo Maternity Teaching Hospital (250 women), Jericho Specialist Hospital (150 women), Agbowo Primary Health Center (100 women), and Ojoo Primary Health Center (100 women). Antenatal clinic attendees at the selected healthcare facilities who met the eligibility criteria, including pregnant women at any trimester of pregnancy, aged  $\geq 18$  years, and gave their informed consent to participate, were recruited into the study serially until the sample size was reached. The sample size formula for single proportion was used: where n sample size, Z = 95% confidence level, 1.96, d = level of precision (0.5), p = prevalent (50%) physical inactivity in Nigeria [32] and 10% non-response. The minimum sample size calculation was 424 pregnant women. Thirty pregnant women were selected across the four health facilities to participate in the qualitative phase. Pretested interviewer-administered questionnaires were used for data collection, developed from the literature [33]. Barriers to Physical Activity during Pregnancy Scale (BPAPS) was used to measure the barriers associated with pregnancy physical activity (dependent variable) [34]. The explanatory variables assessed were sociodemographic characteristics, obstetric factors, past obstetric history and physical activity-related issues, as shown in the conceptual framework in Fig. 1.

#### Qualitative data

Focus group discussions were conducted among groups of pregnant women at each facility after providing a detailed explanation of the study's purpose. Interviews were conducted using an interview guide and audio recording equipment, with informed consent granted by the participants. The interviews were conducted in English or Yoruba, based on the groups' preferences. Topics covered during the interviews included understanding of physical activity, types of physical activities engaged in, personal experiences with physical activity during pregnancy, changes from pre-pregnancy physical activity, barriers to physical activity they have experienced, frequency of physical activity, role of support/ information, perceived benefits, source of information, information from health care workers. Four FGDs were conducted with one session per health facility, comprising 6-12 pregnant women. Each interview lasted about 15 and 20 min until we reached saturation.

## Measures

## Outcome variable

Barriers to physical activity score using the socioecological framework (interpersonal, intrapersonal, community, environmental barriers). The BPAPS designed by Amiri-Farahani and colleagues [34] was used to quantitatively identify the barriers to physical activity during pregnancy. It includes 29 items structured under four factors: pregnancy-related intrapersonal barriers, nonpregnancy-related intrapersonal barriers, interpersonal barriers, and environmental barriers. Responses to the BPAPS are scored on a Likert 5-point scale as follows: 5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and 1=strongly disagree. The total score of BPAPS ranges from 10 to 145, with a higher score indicating more significant barriers to physical activity during pregnancy. BPAPS is a validated and reliable tool with high internal consistency and stability-Cronbach alpha coefficient of 0.824 and a test-retest reliability score of 0.87. Cronbach's alpha coefficients of the total scale and subscales of pregnancy-related intrapersonal, non-pregnancy, interpersonal, and environmental barriers were 0.82, 0.81, 0.73, 0.73 and 0.72, respectively [34]. Among our study population were their Cronbach's alpha coefficients of the total scale and subscales 0.91, 0.92, 0.90, 0.95, and 0.96, respectively.

#### Independent variables

Sociodemographic characteristics included indicators such as age of respondent (<24, 25–29, 30-34, >35), marital status (single and married), type of family (monogamous and polygamous), ethnicity (Yoruba and



Fig. 1 Conceptual framework of barriers against physical activity among pregnant women

Non-Yoruba), religion (Christian and Muslim), level of education (primary, secondary and tertiary), occupation (employed and unemployed) and average monthly income (<20,000-39,999, 40,000-79,999,  $80,000-99,000, \ge 100,000$ ). In addition, we also examined the obstetric characteristics and past obstetric history of respondents' gravidity, parity, gestational age, planned pregnancy, and antenatal admission, complaints in the current pregnancy, previous C/S, previous miscarriage, previous stillbirth, pre-pregnancy physical activity, and physical activity advice. We also assessed the

attitudes of pregnant women towards physical activity and sources of information on physical activity during pregnancy.

## **Ethical consideration**

We obtained ethical approval from the Oyo State Ethics Review Committee Ministry of Health Oyo State Ibadan, Nigeria. (NHREC/OYOSHRIEC/10/11/22). All respondents were informed about the study and procedures involved and gave verbal and written consent forms.

#### Statistical analyses

Data were analysed using SPSS V.26 (SPSS). Categorical and continuous data were summarised using percentages and mean (±standard deviation). The sources of pregnancy physical activity information were presented using a bar chart. The BPAPS subscale scores were presented as means and standard deviations, with higher values indicating higher barriers. We tested the associations between independent variables and total barrier score using the independent T-test and ANOVA and reported the means ± SD and p values. Multiple linear regressions were conducted for variables statistically significant on bivariate analysis (religion, maternal education, complaints in current pregnancy, antenatal admission, physical activity advice, and pre-pregnancy physical activity. We reported the adjusted  $\beta$  coefficient, 95% CI and p-values. All statistical analyses were carried out at a twosided p<0.05. Thematic content analysis was conducted for the qualitative study to identify recurring themes and sub-themes aligned with the study's main objectives. We triangulated the quantitative and qualitative results.

## Results

## Background characteristics of pregnant women in Ibadan, Nigeria

The sociodemographic characteristics of the pregnant women in Ibadan, Nigeria, are described in Table 1. The mean age of the participants was 29.22 + 5.01 years. The majority of the respondents were married (96.8%) and in monogamous relationships (84.9%), had at least secondary education (97.5), earned less than < 100,000 Naira (92.5%), Yoruba ethnic group (89.5%), employed (73.1%).

## Attitude towards pregnancy physical activity.

The attitude towards pregnancy physical activity is shown in Table 2, which comprised the attitude towards the safety, the conduct and benefits of physical activity. While a significant proportion stated that PA was safe, a smaller proportion had concerns about the safety: 103 (22.2%) agreed that physical activity caused pregnancy complications, including abortion 106 (22.8%), and was harmful 77 (16.5%). Regarding carrying out physical activity, the majority agreed that physical activity improves labour and delivery (86.9%), women who had never exercised could start during pregnancy (83.2%), and regular exercise thrice weekly is preferable to no exercise at all (81.5%). Concerning the benefits of pregnancy physical activity, a majority reported that it improves general health (93.7%), enhances sleep (86.0%), and improves mood (84.1%). The participant's primary sources of information on physical activity were

Page	5 of	14
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Table 1	Background	characteristics	of pregnant	women in
Ibadan, N	Vigeria			

Variables	Frequency (465)	Percentage (%)
Age group (years)		
≤24	87	18.7
25–29	150	32.3
30-34	159	34.2
≥35	69	14.8
Mean age	29±5.01	
Marital status		
Single	15	3.2
Married	450	96.8
Types of family		
Monogamous	395	84.9
Polygamous	70	15.1
Ethnicity		
Yoruba	416	89.5
Igbo	23	4.9
Hausa	12	2.6
Others*	14	3.0
Religion		
Christianity	239	51.4
Islam	226	48.6
Education		
No formal education	4	0.9
Primary	8	1.7
Secondary	196	42.2
Tertiary	257	55.3
Occupation		
Employed	102	22.0
Self-employed	339	73.1
Unemployed	24	5.2
Monthly income		
< 20,000	75	16.1
20,000-39,999	140	30.1
40,000–79,999	199	42.8
80,000–99,000	16	3.4
> 100,000	35	7.5

\*Ibibio, Igala, Tiv, Urhobo, Edo

Antenatal education (81.7%), others were healthcare professionals (45.8%), family (44.1%), friends (35.5%), and media (32.5%) (Fig. 2).

## Physical activity barrier scores by subscales

The physical activity barrier scores by subscales are shown in Table 3. The mean  $\pm$  SD of the total physical activity barrier score (PABS) was  $85.35 \pm 22.82$ . The PABS for the subscales were as follows: intrapersonal barriers ( $34.46 \pm 8.79$ ), non-pregnancy intrapersonal barriers ( $14.47 \pm 5.67$ ), and interpersonal barriers ( $11.67 \pm 4.25$ ),

### Table 2 Attitude towards the safety, conducts and benefits of physical activity

Variables		Responses					
	SA n (%)	A n (%)	UD n (%)	D n (%)	SD n (%)		
Attitude towards safety of physical activity							
Physical activity during pregnancy is not safe for the mother or fetus	24 (5.2)	79 (17.0)	18 (3.9)	238 (51.2)	106 (22.8)		
Physical activity during pregnancy leads to abortion or miscarriage, preterm birth, and intrauterine growth retardation	25 (5.4)	81 (17.4)	31 (6.7)	228 (49.0)	100 (21.5)		
Engaging in regular physical activity during pregnancy is harmful	15 (3.2)	62 (13.3)	32 (6.9)	264 (56.8)	92 (19.8)		
Physical activity during pregnancy increases body temperature	17 (3.7)	58 (12.5)	50 (10.8)	256 (55.1)	84 (18.1)		
Attitude towards carrying out physical activity							
Physical activity improves a woman's labour and delivery	139 (29.9)	265 (57.0)	13 (2.8)	36 (7.7)	12 (2.6)		
Avoid long periods of standing in one place without moving while pregnant	132 (28.4)	282 (60.6)	18 (3.9)	23 (4.9)	10 (2.2)		
Women who have never exercised can begin an exercise program during pregnancy	102 (21.9)	285 (61.3)	40 (8.6)	32 (6.9)	6 (1.3)		
Engaging in physical activity during pregnancy improves the health of the baby	131 (28.2)	292 (62.8)	23 (4.9)	15 (3.2)	4 (0.9)		
Regular exercise at least three times per week is better than activity done irregularly or less often during pregnancy	115 (24.7)	264 (56.8)	29 (6.2)	51 (11.0)	6 (1.3)		
Attitude towards the benefits of physical activity							
Physical activity decreases infant weight	52 (11.2)	118 (25.4)	59 (12.7)	193 (41.5)	43 (9.2)		
Engaging in physical activity decreases joint pain	73 (15.7)	275 (59.1)	37 (8.0)	66 (14.2)	14 (3.0)		
Physical activity improves your mood	97 (20.9)	294 (63.2)	32 (6.9)	33 (7.1)	9 (1.9)		
Engaging in physical activity decreases back pain	86 (18.5)	268 (57.6)	43 (9.2)	55 (11.8)	13 (2.8)		
Engaging in physical activity decreased pregnancy-induced hypertension	63 (13.5)	186 (40.0)	130 (28.0)	74 (15.9)	12 (2.6)		
Engaging in physical activity decreases the risk of gestational diabetes mellitus	52 (11.2)	182 (39.1)	143 (30.8)	74 (15.9)	14 (3.0)		
Physical activity enhances better sleeping patterns	102 (21.9)	298 (64.1)	29 (6.2)	27 (5.8)	9 (1.9)		
Physical activity improves your general health	141 (30.3)	295 (63.4)	17 (3.7)	8 (1.7)	4 (0.9)		
Physical activity decreases the risk of muscle cramps and oedema in the lower limbs	103 (22.2)	187 (40.2)	116 (24.9)	53 (11.4)	6 (1.3)		
Physical activity improves your self-image	102 (21.9)	295 (63.4)	41 (8.8)	22 (4.7)	5 (1.1)		
Engaging in physical activity decreases complications at birth	97 (20.9)	209 (44.9)	59 (12.7)	89 (19.1)	11 (2.4)		
Women can continue regular exercise during pregnancy	113 (24.3)	292 (62.8)	36 (7.7)	21 (4.5)	3 (0.6)		

environmental, political and organisational barriers (24.766±8.82). Intrapersonal barriers related to pregnancy were the most critical barriers among our study population, which comprised drowsiness ( $3.62\pm1.33$ ), lack of energy and tired ( $3.77\pm1.22$ ), pains ( $3.60\pm1.30$ ), shortness of breath ( $3.56\pm1.29$ ).

## Relationship between individual characteristics and PA barriers

The relationship between individual characteristics of pregnant women and PA barriers is shown in Table 4. There were statistically significant relationships between the total score of physical activity barriers and religion (p < 0.030), education (p < 0.000), complaints in pregnancy (p < 0.043), antenatal admission in the hospital (p < 0.004), physical activity advice (p < 0.018), prepregnancy physical activity (p < 0.000). Specifically, for maternal education: primary ( $104.4 \pm 30.7$ ), secondary ( $88.7 \pm 22.9$ ) and tertiary ( $81.9 \pm 21.6$ ). Complaints in current pregnancy (*yes*—91.3 ± 21.0: *no*—84.6 ± 22.1),

antenatal admission (*yes*—96.3 ± 22.3: *no*—84.5 ± 22.7), physical activity advise (*yes*—84.5 ± 22.5: *no*—93.0 ± 24.3), pre-pregnancy physical activity (*yes*—80.9 ± 22.6: *no*—94.2 ± 20.7). The patterns of prenatal physical activity are shown in Fig. 3. Walking was our study participants' predominant prenatal physical activity (88.0%).

## Factors associated with PA barriers among pregnant women.

The factors associated with PA barriers among pregnant women are displayed in Table 5. Respondents with secondary education: adjusted  $\beta$ : – 15.26, 95% CI – 27.83; – 2.69; p=0.017 and tertiary education: adjusted  $\beta$ : 20.06, 95% CI – 32.56; – 7.55; p=0.002 had significantly lower total barrier scores compared with women with primary education. Also, women who had antenatal admission experienced higher total barriers score: adjusted  $\beta$ : 12.20, 95% CI 3.74; 20.67, p=0.005 compared to those who did not have antenatal admission. Respondents who engaged in pre-pregnancy physical activity had significantly



Fig. 2 Sources of pregnancy physical activity information

lower total barrier scores: adjusted  $\beta$ : – 12.27, 95% CI – 1.6.5; – 7.99, p=0.001 compared to those who did not. The output of the qualitative data is presented in Table 6.

## Discussion

Despite the immense benefits provided by physical activity, it has been grossly underutilised by pregnant women due to various barriers encountered and the failure to prioritise physical activity in maternal health services in several countries, including Nigeria. Hence, pregnancy physical activity has remained persistently low in Nigeria as most pregnant women prefer rest over activity. Notably, Adeniyi et al. and Adeoye within the same study setting, reported that none of the pregnant study participants met the WHO recommendation of 150 min of moderate-intensity physical activity per week in Nigeria [29, 30]. Unfortunately, the barriers towards pregnancy physical activity have been sparsely investigated except in a few countries—South Africa [33], Nigeria [31], and Iran [16]. In this current study, we assessed the attitude, perceptions, and barriers against physical activity among pregnant women in Ibadan, Nigeria and the associated factors, using the social-ecological framework, which examined interpersonal, non-pregnancy related intrapersonal, interpersonal, environmental, organisational and political barriers in a mixed method study.

Essentially, our respondents had a positive attitude towards physical activity, as a significant proportion reported that pregnancy physical activity (PPA) is safe and beneficial because it improves sleep and general health, decreases birth complications, and improves mental health. A positive attitude toward PPA has been supported by other studies [35, 36]. Conversely, other researchers described a negative attitude toward PPA [37–39]. This variation may result from participants' level of awareness, education and health literacy, and

Table	e 3 Score of	<sup>=</sup> phy:	sical activity	barriers and	l its su	bscales	(n = 465)
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Subscale	Variables	Mean	SD	Total mean $\pm$ SD	Min	Max
Intrapersonal barriers	I cannot be physically active because of drowsiness	3.62	1.33	34.46±8.79	10.0	50.0
	I cannot be physically active because I lack energy and tiredness	3.77	1.22			
	I cannot be physically active because I do not have physical activity habits	3.09	1.36			
	Although pregnancy is a time for rest, I can still be physically active	3.81	1.163			
	I cannot be physically active because of the heavy feeling of pregnancy (swell- ing and weight)	3.29	1.35			
	I cannot be physically active because of my abdominal size and my appear- ance	3.34	1.38			
	l cannot be physically active because of pain (such as back pain, hip pain, and headache)	3.60	1.30			
	I cannot be physically active because of shortness of breath	3.56	1.29			
	l do not engage in physical activity because of possible pregnancy complica- tions such as miscarriages and premature labour	3.05	1.35			
	I cannot be physically active because of pregnancy gastrointestinal problems (such as nausea, vomiting, and heartburn)	3.32	1.39			
Non-pregnancy	Physical activity is too hard work for me	3.22	1.51	$14.47 \pm 5.67$	5.0	25.0
intrapersonal barriers	l do not engage in physical activity because l lack confidence in my physical ability	2.84	1.41			
	I do not have the patience to do physical activity	2.91	1.38			
	I cannot be physically active because I do not have a regular schedule in life	2.70	1.33			
	Because of family and childbearing responsibilities/activities, I do not have enough time to engage in physical activity	2.78	1.33			
Interpersonal barriers	In our society, it's not customary for pregnant women to engage in physical activity	2.37	1.11	11.67±4.25	5.0	25.0
	I do not engage in physical activity because I do not have access to complete information about physical activity during pregnancy	2.48	1.19			
	l do not engage in physical activity because my friends/ relative forbids me from doing physical activity during pregnancy	2.36	1.16			
	l do not engage in physical activity because the physician/ midwife does not provide advice on how to do physical activity safely during pregnancy	2.15	1.00			
	l can engage in physical activity, but the physician/midwife does not advise on the benefits of physical activity during pregnancy	2.31	1.14			
Environmental barriers	l can be physically active, but air pollution prevents me from doing physical activity outdoors	2.90	1.36	24.76±8.82	9.0	45.0
	I do not engage in physical activity because I do not have access to a suitable vehicle for transportation	2.83	1.32			
	I do not do physical activity because it is difficult in unfavourable weather (too cold/hot)	2.97	1.35			
	l don't engage in physical activity because I am not able to pay for physical activities	2.48	1.18			
	l do not engage in physical activity because there are no specific physical activity programs designed for pregnant women	2.95	1.35			
	I do not engage in physical activity because parks are unsafe and unsuitable for pregnant women to do physical activity	2.50	1.17			
	I do not do physical activity because I lack space at home	2.43	1.16			
	There is too great a distance from my home to facilities designed for physical activity	2.81	1.30			
	There are very few places where I can do physical activity	2.91	1.31			
Total mean				$85.35 \pm 22.82$	29	145

Boldface indicates the descriptive statistics (mean ± SD, minimum and maximum values) of the barrier subscales

differences in social and environmental contexts. Optimistic attitudes to PPA can be improved by access to accurate information and education from healthcare providers, prenatal classes, and increased awareness of the benefits of PPA through social marketing and behavioural change communication. In this study, the

Variables	Ν	$Mean \pm SD$	P value
Age group			
< 35	396	$84.9 \pm 22.5$	0.310
≥35	69	$87.9 \pm 24.7$	
Marital status			
Single	15	90.8±17.3	0.347
Married	450	$85.2 \pm 22.1$	
Types of family			
Monogamous	395	84.6±22.6	0.078
Polygamous	70	89.8±23.8	
Ethnicity			
Yoruba	416	85.6±22.7	0.416
Non- Yoruba's	49	$82.8 \pm 23.5$	
Religion			
Christianity	239	83.1±22.2	0.030*
Islam	226	87.7±23.2	
Occupation			
Employed	441	85.6±22.1	0.402
Unemployed	24	81.5±19.6	
Level of education			
Primary	12	104.4±30.7	0.001*
Secondary	196	88.7±22.9	
Tertiary	257	81.9±21.6	
Income per month			
< 20,000	75	85.6±23.7	0.941
20,000-99,999	355	85.1±22.9	
> 100,000	35	$86.4 \pm 20.9$	
Gestational age			
1st trimester	21	87.8±22.6	0.864
2nd trimester	173	$84.9 \pm 22.9$	
3rd trimester	271	85.4±22.9	
BMI			
Normal weight	23	81.1±19.8	0.402
Overweight	126	83.8±21.4	
Obese	316	$86.3 \pm 23.5$	
Planned pregnancy			
Yes	383	85.1±23.2	0.680
No	82	86.3±21.3	
Gravida			
1	138	$86.0 \pm 22.6$	0.630
2-3	271	85.6±21.9	
<u>&gt;</u> 4	56	82.6±27.3	
Parity			
0	149	86.4±22.5	0.511
1–2	287	85.2±22.2	
≥3	29	81.2±29.6	
Previous stillbirth			
Yes	16	81.6±30.5	0.551
No	310	$85.2 \pm 22.5$	

**Table 4** Relationship between individual characteristics and PA

 barrier among pregnant women in Ibadan, Nigeria

## Table 4 (continued)

Variables	Ν	$Mean\pmSD$	P value
Previous Caesarean	section		
Yes	40	$84.4 \pm 25.9$	0.832
No	287	$85.2 \pm 22.5$	
Previous miscarriag	e		
Yes	70	$86.9 \pm 23.9$	0.456
No	257	$84.6 \pm 22.7$	
Complaints in the c	urrent pregnancy		
Yes	53	$91.3 \pm 21.0$	0.043
No	412	$84.6 \pm 22.1$	
Antenatal admissio	n		
Yes	33	$96.3 \pm 22.3$	0.004
No	432	$84.5 \pm 22.7$	
Physical activity adv	/ice		
Yes	420	$84.5 \pm 22.5$	0.018
No	45	$93.0 \pm 24.3$	
Pre-pregnancy phy	sical activity		
Yes	308	$80.9 \pm 22.6$	< 0.001
No	157	$94.2 \pm 20.7$	

\* Boldface indicates statistically significant associations between independent variables and mean barrier scores

important sources of information on physical activity were antenatal clinic education, health professionals, family, friends, media, television, and radio. Moreover, healthcare professionals should be trained to provide and support PPA, ensure a positive attitude and address fears and misconceptions.

Notably, based on the socioecological framework, we investigated the barriers to PPA using BPAPS and its subscales. We found a high overall barrier score  $(85.35 \pm 22.82)$ . Similar to the barrier score reported among Iranian pregnant women (88.55±19.28) [16]. Specifically, intrapersonal barriers to physical activity  $(34.46 \pm 8.79)$ , including lack of energy and tiredness, drowsiness, pains, and shortness of breath, were the most significant barriers reported by our study participants. The intrapersonal barriers were also supported by our qualitative findings, where participants reported tiredness, body pain (back pain, leg pain), dizziness, morning sickness, and laziness as common barriers. Other studies have also reported high levels of intrapersonal barriers, including-fear of pregnancy complications, the feeling of drowsiness, pains, nausea and vomiting, heaviness, or swelling, and pregnancy is a time to rest [16, 24, 27]. Even though pregnant women have challenges to PPA due to the anatomical and physiological changes that occur during pregnancy-increased lumbar lordosis and gestational weight gain, we found that women could not engage in PA because of perceived misconceptions such



Fig. 3 Patterns of prenatal physical activity in Ibadan, Nigeria

as pregnancy was a time to rest and not for PA [9, 40, 41]. Pregnant women can start their exercise routine tailored to their health and fitness levels [3, 42]. Hence, healthcare

**Table 5**Factors associated with barriers to physical activityamong pregnant women in Ibadan, Nigeria

Independent variables	Adjusted beta coefficients	95.0% C	p value	
Religion				
Christianity	Ref			
Islam	2.3941	- 1.67	6.46	0.247
Level of education				
Primary	Ref			
Secondary	- 15.26	- 27.83	- 2.69	0.017*
Tertiary	- 20.06	- 32.56	- 7.55	0.002*
Complaints in the current	pregnancy			
No	Ref			
Yes	2.45	- 4.37	9.26	0.481
Antenatal admission				
No	Ref			
Yes	12.20	3.74	20.67	0.005*
Physical activity advice				
No	Ref			
Yes	- 3.04	- 9.87	3.80	0.383
Pre-pregnancy physical ac	tivity engaged			
No	Ref			
Yes	- 12.27	- 16.5	- 7.99	<0.001*

\* Boldface indicates statistically significant associations between independent variables and mean differences of the barrier scores

professionals should examine pregnant women to personalise their physical needs and provide tailored programs to make PPA more effective.

The qualitative findings corroborate the intrapersonal reports from our quantitative results, which was the predominant type of barrier experienced by our respondents [43, 44]. Our study participants reported back pain, body pain, weakness, tiredness, vomiting, morning sickness, and fear of safety as the predominant barriers to physical activity. As quoted: "I feel back pain, my leg will be weak, body pain" "Tiredness, back pain, vomiting, spitting" "Body pain" "Morning sickness was a major barrier earlier, now it's mostly fear of safety for me and my baby." Other studies have reported maternal ill health or co-morbid conditions in pregnancy, financial challenges, mood and depression, having wrong advisers and some cultural beliefs as influencing their participation in physical activity [31]. Our respondents also shared some of their experiences with physical activity. As quoted, "Sometimes it seems I want to deliver the baby, because the baby seems to come down and I will have strength", "I used to feel tired, very tired", and "I feel lighter and relaxed with no pain at all? "Physical activity tends to drain me easily and cause dizziness". Consequently, developing tailored pregnancy-specific exercise classes can help increase the level of physical activity among pregnant [45].

We also examined non-pregnancy-related intrapersonal barriers, which included the notion that physical activity is hard work, lack of patience to do physical activity and lack of confidence in my physical ability. In contrast, previous studies reported a lack of a regular

## Table 6 Qualitative data

S/N	Theme	Example quotes
1	Understanding of physical activity	"To be doing work, doing everything, walking" "Exercise is to jump, walk, do so many things." "Physical activity is any body movement that uses energy, like walking, dancing, or doing chores around the house."
2	Types of physical activity engaged in	"When I want to go to market, I won't climb a bike; I can trek going and coming back." "Dancing" "Walking from street to street." "Mostly just walking to places instead of taking transportation. And some little housework."
3	Personal experiences with physical activity during pregnancy	"Sometimes it seems I want to deliver the baby , because the baby seems to come down. I will have strength." "I used to feel tired, very tired." "I feel lighter and relaxed with no pain at all." "Physical activity tends to drain me easily and cause dizziness."
4	Changes from pre-pregnancy activity	"I used to do it now because if I wanted to go somewhere, I wouldn't go by bike. I don't need to climb a bike. I can walk on my leg." "I used to jog, but I can't jog now." "I used to run but can no longer do that." "I used to jog regularly and do full yoga routines before I became pregnant."
5	Barriers to physical activity	"I feel back pain, and my leg will be weak, body pain." "Tiredness, back pain, vomiting, spitting" "Body pain" "Morning sickness was a major barrier earlier. Now it's mostly fear of safety for me and my baby."
6	Frequency of physical activity	"I exercise every two daysif I want to walk, I will go to the market." "I exercise almost every day. I walk for 20 min every day." "Maybe 2–3 times"
7	Role of support/information	"Support motivates me to do it more." "Yes, support from my husband motivates me." "Yes, having some encouragement and guidance helps motivate me."
8	Perceived benefits	."It is very okay because if you reach your birth time, you will find it easy." "Yes, it makes your body flexible." "I feel lighter." "Yes, it can ease constipation and back pain, and they said it prepares for labour."
9	Sources of information	"I used to hear it everywhere, from my friends, people, radio and even when you come to the hospital." "Television, Health care worker" "Social media" "Mainly pregnancy books/websites and tips from my doctor."
10	Information from healthcare workers	"Yes, when we come to the hospital, they tell us to exercise our body." "Yes" "Yes, we do." "Yes, my doctor advised me on appropriate types and levels of exercise."

schedule in life, insufficient time, and a lack of motivation [16, 24]. This variation could be due to differences in the study population/geographical region or societal norms and views. Increasing self-efficacy, providing support and guidance, and promoting a change of mindset towards prioritising physical activity and having workable exercise routines are strategies for addressing these barriers.

The interpersonal barriers, the least of the obstacles  $(11.67 \pm 4.25)$  among our study participants, were lack of partner support and encouragement, lack of advice from health workers on safety and the benefits of physical activity, lack of access to complete information, and societal views. Other studies have reported a lack of knowledge, conflicting advice, prohibition from friends and family to limit participation in physical activity, feelings of exclusion at fitness facilities, and absence of social norms promoting physical activity [16, 26, 33, 46].

Therefore, facilitating social support networks in maternal care, emphasising male involvement, group exercise classes, health communication of maternal lifestyle, especially physical activity partners, providing culture sensitive and specific PA advice involving family members or friends in physical activity programs to promote accountability and encouragement can increase pregnant women engagement in physical activity. The FGD participants also stated that having spousal and family support and access to information can provide massive motivation as quoted: "Support motivates me to do it more", "Yes, support from my husband motivates me", "Yes, having some encouragement and guidance helps motivate me." This aligns with the study by Shum et al. 2022 [44], which found that support systems and informational support influenced women's physical activity behaviour during pregnancy.

The critical environmental factors that prevent pregnant women from maintaining an active lifestyle include weather conditions, air pollution, transportation options, safety concerns, financial constraints, proximity to facilities and lack of adequate facilities for physical activity. Furthermore, participants reported "unfavourable weather (too cold/hot)," "access to a suitable vehicle for transportation," and "no specific physical activity programs designed for pregnant women" as the most significant barriers to engaging in physical activity. Notably, outdoor exercise may be challenging during the rainy season. This finding is consistent with other studies.[16, 27, 43]. Physical, organisational and policy environments (geographical terrain, access to recreational facilities) fostered low physical activity levels among pregnant women in the USA [47]. Therefore, improved access to safe and convenient physical activity facilities or resources (e.g., parks, walking trails, gyms) and policies promoting active transportation (e.g., walkable neighbourhoods and bike lanes) can encourage pregnant women to be more active [33].

We found that the factors associated with the barriers to PPA were maternal education, religion, antenatal admission, pregnancy complaints, a lack of physical activity advice, and prenatal physical activity. However, only maternal education, antenatal admission and prenatal physical activity remained significant after controlling for confounders. High maternal education level, i.e. secondary education (adjusted  $\beta$  coeff.: – 15.26) and tertiary education (adjusted  $\beta$  coeff.: – 20.06), had significantly lower total barrier scores than those with primary education. Other researchers corroborate this [46]. Therefore, interventions focusing on targeted education programs for women with lower educational attainment can further improve their level of awareness. In contrast, there was no statistically significant relationship between education and PPA among Portuguese women [48].

We also found that women who had antenatal admission had an increase in physical activity barrier score (adjusted  $\beta$  coeff.: 12.20). This aligns with other studies, which had reported that women with pregnancy complications or high-risk conditions were more likely to perceive physical activity as risky and face increased barriers [14, 47]. Therefore, precise exercise prescription is needed to tailor physical activity interventions for highrisk pregnancies. Notably, respondents who engaged in pre-pregnancy physical activity had significantly lower total barrier scores (adjusted  $\beta$  coeff.: – 12.27) than those who did not. Previous studies have shown that women who were physically active before pregnancy reported fewer barriers to physical activity during pregnancy [46, 47]. This indicates the importance of physical activity among women of reproductive age as part of pre-conceptual care [23].

Walking was the predominant form of pre-pregnancy physical activity among our study participants. Walking is a low-impact and low-intensity physical activity. It is versatile as it can be adapted to diverse environments and has various health benefits, which include improved posture and balance, cardiovascular fitness, improved sleep and weight management, reduced risk of gestational diabetes and so on [49]. Studies have shown that women who walk regularly during pregnancy may have a lower risk of cesarean delivery and other complications [50].

### **Public health implications**

This research identifies the barriers, attitudes and perceptions of PPA and the associated factors, and it is also an essential contribution to maternal health services, policies, and programmes in Nigeria. It provides substantial evidence for maternal healthcare professionals, public health programmes, and policymakers to promote a healthy maternal lifestyle starting from the antenatal period. Hence, the following recommendations are provided: Perinatal care providers should educate and reassure pregnant women about the benefits and safety of physical activity during pregnancy. They should also provide guidance on proper exercise techniques, ensure compliance and address their concerns. However, maternal health providers may lack the required skills for promoting and implementing PPA; hence, there is a need for further research on the gaps in the health workers' knowledge and competency on PPA for re-orientation and training. It is also crucial to foster collaboration with other healthcare workers, especially physiotherapists, exercise physiologists, health education experts and social workers. Maternal health care providers should be re-oriented and trained on PPA prescription and support through behavioural change communication on physical activity during antenatal visits. Adequate spousal, family and workplace support for pregnant women is also necessary.

#### Strengths and limitations

This study's strength lies in using a mixed method (sequential explanatory method), which has given a better insight into pregnancy physical activity barriers in Nigeria. We used a standardised tool (Barriers to Physical Activity during Pregnancy Scale) to measure the barriers quantitatively based on socioecological theory. The study was conducted in three local government areas (LGAs) across the three tiers of healthcare and primary, secondary, and tertiary healthcare facilities to increase the generalisability of our findings. However, the study still has its limitations. Firstly, the cross-sectional nature of the study precludes causal inferences. It is also difficult to rule out the influence of social desirability bias and recall bias because of the self-reported responses to the questions. Hence, there may have been misclassification bias due to overestimating or underestimating the estimates. However, the qualitative findings corroborated the quantitative aspects. Also, the sample only represents women attending ANC in urban areas; hence, we should carefully extrapolate the findings to the larger community or rural areas.

## Conclusion

Our study showed that pregnant women attending antenatal clinics in Ibadan, Nigeria, face various barriers to physical activity during pregnancy. Using the socioecological framework, the most common barriers reported by our respondents were intrapersonal barriers related to pregnancy (lack of energy and tiredness, dizziness, pains, shortness of breath, vomiting, etc.) scored higher than other barriers. Among the environmental barriers, participants mainly reported access to a suitable vehicle for transportation, unfavourable weather, very few places to do physical activity and air pollution. Sociodemographic characteristics, pre-pregnancy physical activity, and antenatal admission were significant factors associated with the total barrier scores of respondents. Healthcare professionals should be skilled in encouraging awareness and education about the benefits of physical activity during pregnancy. Tailored interventions are necessary to promote physical activity among pregnant women in Nigeria.

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#### Author contributions

FS and IAA designed the study. FS conducted the study under the supervision of IAA. FS and IAA analysed and interpreted the data. FS wrote the initial draft of the manuscript. IAA reviewed and critically revised the manuscript. IAA finalized the manuscript. Both authors read and approved the final manuscript.

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#### Availability of data and materials

The datasets generated and analysed during the current study can be obtained from the corresponding author at a reasonable request.

#### Declarations

#### Ethics approval and consent to participate

We obtained ethical approval from the Oyo State Ethics Review Committee Ministry of Health Oyo State Ibadan, Nigeria. (NHREC/OYOSHRIEC/10/11/22). All respondents were informed about the study and procedures involved and gave verbal and written consent forms. The data was anonymised and stored in a password-protected device accessible to only the researchers.

#### Page 13 of 14

#### Consent for publication

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

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