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Assessing physical activity levels and associated factors among pregnant women in Hanoi, Vietnam: a facility-based cross-sectional study

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Abstract

Background: Physical activity (PA) during pregnancy offers substantial health benefits for both mothers and fetuses. However, many pregnant women do not meet recommended activity levels. This study aimed to evaluate PA levels and associated factors among pregnant women in Hanoi, Vietnam.

Methods: A cross-sectional study was conducted among 234 pregnant women attending prenatal check-ups at Hanoi Obstetrics and Gynecology Hospital from January to May 2024. Data on demographics, clinical history, and pregnancy-related activities were collected using the Pregnancy Physical Activity Questionnaire. PA levels were classified based on the 2020 WHO guidelines recommending at least 150 minutes of moderate- to vigorous-intensity activity (≥3 METs) per week. Logistic regression was used to identify associated factors.

Results: Only 20.9% of participants met WHO PA guidelines. Most PA was light intensity (33.3%) and primarily housework-related (69.7%). Only 22.2% engaged in exercise during pregnancy, with slow walking being the most common activity. Adequate PA was significantly associated with maternal age 25–34 years (odds ratio [OR]=0.33, 95% confidence intervals [CI]: 0.12–0.93), age ≥35 years (OR=0.16, 95% CI: 0.04–0.63), pre-pregnancy exercise habits of 1–4 times/week (OR=3.03, 95% CI: 1.21–7.62) or ≥5 times/week (OR=3.59, 95% CI: 1.05–12.24), and proximity to fitness facilities (OR=2.51, 95% CI: 1.07–5.89).

Conclusions: Most pregnant women in this study did not meet recommended PA levels. Promoting regular exercise before pregnancy, especially among older women, and improving access to fitness facilities may help enhance PA during pregnancy.

Keywords: exercise habits; maternal health; pregnant people; pregnancy physical activity questionnaire (PPAQ - author-defined)

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1. INTRODUCTION

Physical activity (PA) was defined by the World Health Organization as any movement produced by skeletal muscles that involves energy expenditure. This includes all forms of movement, whether during recreational activities, active commuting, occupational tasks, and household responsibilities [1]. Maintaining PA during pregnancy is not only an essential component of a healthy lifestyle but also provides subtantial benefits for both maternal and fetal health. Regular PA reduces the risk of pregnancy-related complications and contributes to fetal development, with long-term positive effects on child's health when mothers adhere to recommended PA guidelines during pregnancy [2–6]. Several studies have demonstrated the positive health outcomes associated with increased PA during pregnancy. These benefits include a reduced risk of preterm births [5] and cesarean delivery [6], improved cardiovascular function [7], maintenance and enhancement of fitness levels, and alleviation of depression symptoms, comtributing to overall mental well-being [8,9]. In November 2020, the World Health Organization published new global guidelines on PA and sedentary behavior, which, for the first time, included specific recommendations for pregnant women [10]. Accordingly, the WHO recommends that pregnant women engage in at least 150 minutes of moderate-intensity PA per week while to minimize sedentary behavior [10]. However, many expectant mothers tend to decrease their PA levels during pregnancy rather than maintaining or increasing them [2,11,12]. The prevalence of physical inactivity - defined as failing to meet the minimum recommended levels – ranges from 64.5% to 91.5%, with the highest rates observed in the third trimester [12,13].

A study conducted among 299 pregnant women attending antenatal care at public and private health facilities in Mekelle, Ethiopia, found that 79.3% (237 participants) were classified as sedentary based on the adapted PPAQ. Women aged 26–35 years, those with no formal education, and those not employed outside the home were at higher risk of being sedentary [14]. Similarly, a study conducted in by Kasoha et al., involving 218 pregnant women from 11 outpatient clinics, reported a significant decline in PA during pregnancy, particularly in strenuous activities, while moderate activities remained unchanged [15]. Similarly, a cross-sectional study of 1,636 pregnant women at a tertiary hospital in Shanghai reported a 47.5% prevalence of physical inactivity. Walking was the most common PA: however, only 2.8% of participants met the recommended 150 minutes of moderate-intensity PA per week. Factors negatively associated with physical inactivity included higher personal income, regular exercise before pregnancy, being in second or third trimesters, and experiencing symptoms such as nausea or vomiting [16]. In Malaysia, the prevalence of physical inactivity among pregnant women was 38.3%, with household tasks being the most commonly performed activity, despite only 24.8% of participants being housewives or unemployed. Vigorous activity was nearly absent. Factors associated with inactivity included being primigravida, having lower education levels, and a higher body mass index (BMI) [17]. In Vietnam, adherence to the PA guidelines set by the American College of Obstetricians and Gynecologists among pregnance women ranges from 20.9% to 37.1% [18–20]. PA level during pregnancy are influenced by a combination of personal, family-social, and environmental factors. However, most existing studies primarily focus on personal factors with limited research examining the role of family-social and environmental influences. Furthermore, studies that do explore these aspects relying solely on qualitative surveys, lacking quantitative assessments [21].

Understanding the importance of PA during pregnancy is essential to provide pregnant women with appropriate knowledge and guidance to help them maintain a healthy lifestyle and optimize maternal and fetal health. However, data on the PA status of pregnant women and associated factors in Vietnam remain limited. Hanoi Obstetrics and Gynecology Hospital is one of the largest obstetrics and gynecology hospitals in Hanoi city and the northern region. On average, this hospital receives over a million pregnant women for prenatal check-ups each year, and this number continues to rise. However, no specific study have examined the PA and related factors among pregnant women attending this hospital, thus information on PA levels is necessary to improve the prenatal care program at the hospital. There-

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fore, this study aimed to assess the PA levels and associated factors among pregnant women receiving antenatal care at Hanoi Obstetrics & Gynecology Hospital.

2. MATERIALS AND METHODS

2.1. Study design

To estimate the prevalence of PA during pregnancy and provide baseline data for future research, we conducted a cross-sectional descriptive study at Hanoi Obstetrics and Gynecology Hospital from January to May 2024. The study participants were pregnant women at any gestational stage attending prenatal check-ups during the study period.

Hanoi Obstetrics and Gynecology Hospital is a premier institution in obstetrics and gynecology in Hanoi and one of the top six leading specialized facilities in Vietnam. It serves as a tertiary referral hospital under the Ministry of Health. Annually, the hospital manages over 40,000 deliveries, performs more than 20,000 obstetric and gynecological surgeries, and conducts hundreds of thousands of procedures and nearly one million outpatient visits, including many complex and rare cases successfully treated.

2.1.1. Inclusion criteria

- Pregnant women in any of the three trimesters attending prenatal check-ups at the maternity clinics of Hanoi Obstetrics and Gynecology Hospital, who were able to participate in interviews, including listening and speaking.
- Pregnant women who provided informed consent after receiving a detailed explanation of the study.

2.1.2. Exclusion criteria

- Pregnant women experiencing medical or obstetric complications, as well as serious psychological conditions that could impact the accuracy of data or information.
- Pregnant women who had previously participated in interviews for this study.

2.2. Sample size and sampling

Sample size: The formula to calculate sample size for descriptive studies:

$$n = Z^2_{1-\frac{\alpha}{2}} \frac{p(1-p)}{d^2}$$

Which:

n: minimum sample size.

α: level of statistical significance.

$Z_{(1-\alpha/2)}$: critical value (with α=0.05, $Z_{(1-\alpha/2)}$=1.96, which corresponds to a statistical power of 80%)

p=0.173 (Proportion of pregnant women meeting PA guidelines from a previous study) [22].

d=0.05 (maximum allowable margin of error).

Substituting into the formula, the minimum sample size was calculated as n=220 individuals.

Sampling method: Convenience sampling. All pregnant women attending prenatal check-ups at Hanoi Obstetrics and Gynecology Hospital who met the selection criteria and did not fall under any exclusion criteria were invited to participate in this study until the required minimum sample size was achieved. Ultimately, four participants were excluded due to incomplete exercise-related data, and another six were removed due to discomfort while completing the questionnaires, resulting in a total of 234 valid response forms were included for analysis.

2.3. Data collection tools and measures

The study used a structured questionnaire consisting of four parts, including personal characteristics, family-social factors, environmental factors and activities during pregnancy. Among these, the PA characteristics was evaluated by Pregnancy Physical Activity Questionnaire (PPAQ), developed by Chasan-Taber et al. [23]. This is a semi-quantitative questionnaire consisting of 32 items: household/caregiving activities [13], occupational activities [5], exercise/sports activities [8], transportation activities [3], and three open-ended questions to capture additional activities. The PPAQ assessed the frequency, duration, and energy expenditure of activities, allowing analysis by type, intensity, or total energy expenditure. In 2008, Ota et al. translated the PPAQ into Vietnamese and validated it for use among Vietnamese pregnant women. The translation followed a rigorous forward and backward

translation process, reviewed by researchers from Vietnam, the USA, and Japan to ensure cultural adaptation. For the analysis of reliability, the intra-class correlation coefficient (ICC) value was 0.88 (95% confidence intervals [CI] 0.83–0.94) for total activity, 0.94 for sedentary, 0.88 for light, 0.90 for moderate, and 0.87 for vigorous activities. The Bland and Altman analysis showed that the first and second PPAQ total scores did not significantly differ from zero, and mostly fell within the range of 0±1.96 SD. Construct validity was supported by a Pearson correlation coefficient of 0.29 (p=0.02). The Vietnamese PPAQ was deemed reliable and culturally acceptable, reflecting concepts consistency with the original English version [24].

The questionnaire was designed and administered on Google Forms. After designing the survey on Google Forms, a pre-test was conducted with 11 pregnant women (representing 5% of the minimum sample size) from comparable healthcare settings who were not part of the main study. This test aimed to refine the questionnaire to the survey before administration, incorportaing feedback received from participants to enhance clarity and relevance. Based on participant feedback, no significant modifications were needed as the respondents reported no difficulty understanding or answering the questions.The finalized questionnaire was exported as a link and a QR code, which was sent directly to pregnant women attending Hanoi Obstetrics Hospital at specific times: when waiting for their examination, awaiting test results, or after completing their prenatal check-up. For each activity, participants were asked to choose the category that best reflected the time spent on that activity daily or weekly during their current trimester. Upon recruitment, the women were informed about the study's objectives and procedures. After receiving a clear introduction and providing informed consent via online consnt form, participants completed the questionnaires in approximately 15 minutes in a quiet area of the clinic. The PPAQ assesses both the frequency and duration of various activities, assigning an intensity value to each one. To ensure privacy during data collection via QR codes and Google Forms, all responses were submitted anonymously, with no personal identifiers collected. Additionally, access to the survey data was restricted to authorized research team members only, and all data were stored securely in password-protected files.

This study adhered to the Consensus-Based Checklist for Reporting of Survey Studies (CROSS) to ensure comprehensive and transparent reporting [25]. The CROSS checklist was followed during the development, conduct, and reporting of this survey study.

PPAQ assesses PA by measuring both the frequency (number of times per week) and duration (hours or minutes per session) of various activities. The average time (in hours) spent on each activity was categorized into intervals: 0, 0.25, 0.75, 1.5, 2.5, and 3.0 hours per week. The total PA level was calculated as the sum of (duration×intensity) for each reported activity. Activity intensity was measured in metabolic equivalent task (MET) values and quantified according to The 2011 Compendium of Physical Activities [26]. Activities were classified by intensity levels: sedentary (<1.5 MET), light-intensity (1.5–2.9 MET), moderate-intensity (3.0–6.0 MET), and vigorous-intensity (>6.0 MET). Additionally, activities were grouped by type, including occupational tasks, domestic chores (e.g., caregiving), and sports or exercise. Pregnant women were considered to have enough PA according to WHO recommendations if they engaged in at least 150 minutes per week (2.5 hours/week) of moderate-intensity activity or at least 75 minutes per week (1.25 hours/week) of vigorous-intensity activity, equivalent to activities of at least 3 METs, spread throughout the week.

2.4. Statistical analysis

The data were downloaded from Google Sheets, cleaned, coded, and managed using SPSS software package (version 25.0; IBM, Armonk, NY, USA). Categorical variables (belonging to the categories of individual, family-social, and environmental factors) were presented as frequencies and percentages (%). For quantitative variables (energy expenditure in MET-minutes/week), mean and standard deviation were used according to categorize data based on the intensity and type of activity. Logistic regression models were utilized to evaluate the relationship between PA and various individual, family-social, and environmental factors. The steps used to identify these factors were as follows. First, we used back-

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ward elimination to remove variables with a p-value>0.25. Second, considering educational level, marital status, occupational status, pre-pregnancy BMI, symptoms of discomfort, history of miscarriage/abortions, and advice from a medical professional to be clinically relevant or related to the level of PA in previous studies, we included these seven variables into the model [22,27,28]. To assess multicollinearity the Variance Inflation Factors (VIFs) for each independent variable was calculated before including them in the logistic regression model. A VIF threshold of 5 was used to detect potential multicollinearity. Variables with high VIFs (greater than 5), such as a history of premature birth and exercise during pregnancy, were excluded to reduce multicollinearity, ensuring the stability and accuracy of regression estimates. Finally, maternal age, educational level, marital status, occupational status, stage of pregnancy, parity, symptoms of discomfort, pre-pregnancy BMI, regular exercise before pregnancy, history of miscarriage/abortions, exercise advice from a medical professional, and proximity to a fitness center near the place of residence were entered as independent variables into the logistic regression model. The odds ratio (OR) along with a 95% CI was used to measure the association. A p-value of less than 0.05 and a 95% CI that did not include 1 were considered significant criteria for reporting associations.

2.5. Ethical consideration

This study was carried out in 2024 following the approval of ethical clearance from the Council of Ethics in Biomedical Research of Hanoi Obstetrics & Gynecology Hospital (decision numbered 161/QĐ-PS and 428/CN-PS). Participants in the study were explained about the purpose, benefits, disadvantages, and how to conduct the study. The research was conducted only when the research participant agreed. The information was encrypted and presented in digital form, confidential information. The research process did not affect the health of pregnant women and the fetus.

3. RESULTS

This study aimed to assess PA levels and identify factors associated with PA among pregnant women. The following sections present the distribution of PA, its specific characteristics, and the key factors influencing PA levels in this population.

3.1. Characteristics of research participants

This study included 234 pregnant women. The majority of participants (70.5%) lived in the urban area, with smaller proportions residing in suburban (15.8%) and other provinces (10.7%). Regarding the obstetric and health characteristics, most of the participants reported good health before pregnancy, with only 14.5% indicating certain health issues such as gastritis, sinusitis, or low blood pressure. etc., while 180 (76.9%) experienced some symptoms of discomfort, including nausea, vomiting, fatigue, and back pain.

The other characteristics of the pregnant participants are detailed in Tables 1 and 2.

Among the participants, 55.6% reported receiving advice on PA from a healthcare professional. Prior to pregnancy, nearly half (47.0%) did not engage in regular exercise, and during pregnancy, 51.7% discontinued their exercise routines. Slow walking was the most common form of activity (73.1%), while yoga and prenatal classes were less frequent-

Table 1. Socio-demographic characteristics of pregnant women attending antenatal care at Hanoi Obstetrics & Gynecology Hospital (n=234)

Variables	Frequency	
	n	%
Age group (years)		
18–24	38	16.2
25–34	147	62.8
≥35	49	21.0
Level of education		
Non-formal education	16	6.8
Primary and secondary school (1–9 grades)	16	6.8
High school (10–12 grades)	37	15.9
College/university and above level	165	70.5
Marital status		
Married/Living with partner	223	95.3
Not married	11	4.7
Occupational status		
Mental work	136	58.1
Manual work	31	13.2
Other	67	28.7

Table 2. Obstetric and health characteristics of pregnant women attending antenatal care at Hanoi Obstetrics & Gynecology Hospital (n=234)

Variables	Frequency	
	n	%
Stage of pregnancy		
First trimester (≤13 weeks)	29	12.4
Second trimester (13–27 weeks)	58	24.8
Third trimester (≥28 weeks)	147	62.8
Parity		
0 child	70	29.9
≥1 child	164	70.1
History of premature birth		
No	219	93.6
Yes	15	6.4
History of miscarriage/abortion		
No	187	79.9
Yes	47	20.1
Symptoms of discomfort		
No	54	23.1
Yes	180	76.9
Pre-gravid BMI		
Underweight: <18.5 kg/m^2	47	20.1
Normal: 18.5–24.99 kg/m^2	170	72.7
Overweight: 25–29.99 kg/m^2	16	6.8
Obesity: ≥30 kg/m^2	1	0.4

BMI, body mass index.

Table 3. Physical activity characteristics of pregnant women attending antenatal care at Hanoi Obstetrics & Gynecology Hospital (n=234)

Variables	Frequency	
	n	%
Exercise advise from a medical professional		
No	104	44.4
Yes	130	55.6
Sources of information about exercise[1)]		
Books and newspapers	81	40.5
Friends or relatives	140	59.8
Multi-media	100	50.0
Medical/health institutions	114	48.7
Public announcement	15	7.5
A habit of exercise before pregnancy		
No exercise	110	47.0
Less than once a week	43	18.4
1–4 times/week	64	27.3
≥5 times/week	17	7.3
A habit of exercise while pregnant		
I continued doing exercises	52	22.2
I stopped the exercises	121	51.7
I continued to exercise but slowed down	61	26.1
Fitness central nearby the living place		
No	70	29.9
Yes	164	70.1
Preferred mode of exercise[1)]		
Walking slowly	171	73.1
Walking quickly	7	3.0
Yoga	36	2.6
Prenatal exercise class	15	6.4
Running	3	1.3
Cycle	9	3.8
Other	43	18.3

[1)] Could choose more than one.

ly reported (Table 3).

3.2. Prevalence of physical activities by type and level

Table 4 shows the distribution of physical activities among participants. Household and caregiving activities accounted for the highest energy expenditure (69.7%), while sports/exercise contributed the least (2.8%). In terms of intensity, light activities were most common (33.3%), followed by moderate (31.8%) and sedentary activities (31.5%). Only 20.9% of participants met the WHO-recommended levels of PA.

According to the multivariate analysis results in Table 5, the factors significantly associated with adequate WHO PA included age group, frequency of exercise before pregnancy, and having proximity to a fitness facility. Specifically, pregnant women aged 25–34 were 67% less likely to engage in sufficient PA compared to those aged 18–24 (OR=0.33; 95% CI: 0.12–0.93; p<0.05). Similarly, women aged 35 and older had an 84% lower likelihood of meeting the WHO-recommended PA levels compared to the 18–24 age group (OR=0.16; 95% CI: 0.04–0.63; p<0.05). In contrast, pregnant women who exercised between 1–4 times per week were 3.03 times more likely to meet the WHO recommendations compared to those who did not exercise (OR=3.03; 95% CI: 1.21–7.62; p<0.05), and those who exercised at least 5 times per week were 3.59 times more likely to meet the guidelines (OR=3.59; 95% CI: 1.05–12.24; p<0.05). Furthermore, pregnant women living in proximity to a gym were 2.51 times

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Table 4. Prevalence of physical activities of pregnant women by type and level (n=234)

Physical activity (MET h/week)		%
By type of activity		
Household/caregiving	116.14	69.7
Commute	14.48	8.7
Sports/exercise	4.59	2.8
Occupational	31.34	18.8
Total physical activity	166.55	100
By activity intensity		
Sedentary	52.44	31.5
Light	55.38	33.3
Moderate	53.03	31.8
Vigorous	5.70	3.4
Meet the guideline, n (%)	49	20.9

Factors related to PA status among research participants.
MET, metabolic equivalent task.

more likely to meet the WHO recommendations compared to those without such access (OR=2.51; 95% CI: 1.07–5.89; $p<0.05$).

In summary, the prevalence of PA among pregnant women meeting WHO guidelines was 20.9%. Key predictors of sufficient PA levels included maternal age, pre-pregnancy exercise habits, and distance from home to exercise facilities. These findings emphasized the main factors influencing PA in this population and align with the study's aim of assessing PA levels and their associated factors.

4. DISCUSSION

PA during pregnancy provides significant health benefits for both mothers and their fetuses. However, current PA levels among pregnant women remain well below international recommendations, and the factors influencing exercise practices during pregnancy are not well understood. This study aimed to address part of this gap by using a self-developed questionnaire, incorporating questions adapted from the PPAQ. Among 234 pregnant women attending antenatal care at Hanoi Obstetrics and Gynecology Hospital, the proportion of those who engaged in sufficient PA according to the 2020 WHO Guidelines on PA and Sedentary behaviour was notably low. Factors associated with adequate PA levels included maternal age, pre-pregnancy exercise frequency, and recommendations from healthcare providers.

The majority of participants in this study were aged 25–34 (62.8%) years, with the smallest group being those aged 18–24 (16.2%) years. These findings align with previous studies conducted in Ho Chi Minh City, where the 26–35 age group represented 57.6%–60.7% of participants [18,22]. This can be explained by the fact that women aged 25–34 are generally more physiologically mature, psychologically prepared, and likely to have more stable economic conditions, making them more ready for pregnancy. The smaller proportion of women in the 18–24 age group reflects the trend of delayed marriage and childbirth, with increasing numbers of women having their first child in the 25–29 age range, as seen in Vietnam's 2019 Population and Housing Census [29]. In terms of PA, 53.0% of pregnant women reported exercising in the three months prior to pregnancy, which is higher than the 35.1% reported in a 2020 study at Hung Vuong Hospital [22] but lower than the 71.7% in Copenhagen [30]. Between 2019 and 2020, social distancing measures implemented during the COVID-19 pandemic restricted mobility and significantly limited opportunities for PA. In contrast, the higher rate observed in Copenhagen may be attributed to the participants' higher educational level of participants and Denmark's generally more active lifestyle, where many pregnant women regularly engage in PA and frequent use of bicycles for transportation [30].

Our findings indicate that household and caregiving activities constitute the majority of in PA among pregnant women, accounting for 69.7% of total PA. This proportion is notably higher than that reported in previous studies, including one conducted at Hung Vuong Hospital (54.8%) [22], and another study in Brazil (48.6%) [13]. In terms of PA intensity, there was minimal variation, with light-intensity (33.2%) and moderate-intensity activities (31.8%) being the most common, while vigorous activity was the least frequent (3.4%). This trend may be attributed to sedentary behaviours, such as prolonged use of computers, smartphones, and TV. Similarly, studies in China have found that pregnant women often refrained from engaging in vigorous activity due to concerns about miscarriage and the belief that pregnancy requires more increased rest [31,32].

Table 5. Bivariate and multivariate analysis of factors associated with physical activity status among pregnant women attending antenatal care at Hanoi Obstetrics & Gynecology Hospital (n=234)

Variables	Bivariate analysis		Multivariate analysis	
	p-value	OR (95% CI)	p-value	OR (95% CI)
Age group				
18–24		(ref)		(ref)
25–34	0.18	0.58 (0.26–1.28)	0.03	0.33 (0.12–0.93)
≥35	0.03	0.30 (0.10–0.90)	0.009	0.16 (0.04–0.63)
Level of education				
Non-formal education		(ref)		(ref)
Primary and secondary school (1–9 grades)	0.21	3.19 (0.52–19.64)	0.20	3.77 (0.50–28.59)
High school (10–12 grades)	0.57	1.63 (0.30–8.90)	0.65	1.56 (0.24–10.25)
College/university and above level	0.42	1.89 (0.41–8.69)	0.84	1.21 (0.18–8.04)
Marital status				
Not married		(ref)		(ref)
Married/living with partner	0.34	2.74 (0.34–21.96)	0.21	4.21 (0.45–39.60)
Occupational (employment) status				
Mental work		(ref)		(ref)
Manual work	0.88	1.08 (0.42–2.75)	0.77	0.80 (0.19–3.41)
Other	0.75	0.89 (0.43–1.85)	0.31	0.53 (0.16–1.78)
Stage of pregnancy				
First trimester (≤13 weeks)		(ref)		(ref)
Second trimester (14–27)	0.24	2.26 (0.58–8.75)	0.52	1.62 (0.38–7.03)
Third trimester (≥28 weeks)	0.13	2.61 (0.74–9.15)	0.21	2.35 (0.61–9.02)
Parity				
≥1 child		(ref)		(ref)
0 child	0.06	0.54 (0.28–1.04)	0.61	0.81 (0.37–1.79)
Symptoms of discomfort				
No		(ref)		(ref)
Yes	0.31	0.69 (0.34–1.41)	0.56	0.77 (0.32–1.87)
A habit of exercise before pregnancy				
No exercise		(ref)		(ref)
Less than once a week	0.27	1.68 (0.67–4.18)	0.25	1.87 (0.64–5.47)
1–4 times/week	0.01	2.67 (1.25–5.74)	0.01	3.03 (1.21–7.62)
≥5 times/week	0.03	3.46 (1.11–10.74)	0.04	3.59 (1.05–12.24)
Pre-gravid BMI				
Underweight: <18.5 kg/m^2		(ref)		(ref)
Normal: 18.5–24.99 kg/m^2	0.27	1.65 (0.68–3.98)	0.10	2.33 (0.85–6.39)
Overweight: 25–29.99 kg/m^2	0.72	1.32 (0.30–5.85)	0.35	2.17 (0.43–10.98)
Obesity: ≥30 kg/m^2	1.000	-	1.000	-
History of miscarriage/abortion				
No		(ref)		(ref)
Yes	0.52	0.87 (0.39–1.95)	0.89	1.07 (0.41–2.82)
Exercise advice from a medical professional				
No		(ref)		(ref)
Yes	0.52	0.79 (0.42–1.49)	0.08	0.51 (0.24–1.09)
Fitness central nearby the living place				
No		(ref)		(ref)
Yes	0.1	1.87 (0.88–4.00)	0.03	2.51 (1.07–5.89)

CI, confidence interval; OR, odds ratio; BMI, body mass index.

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The World Health Organization advises that pregnant women participate in a minimum of 150 minutes of moderate-intensity PA weekly or at least 75 minutes of vigorous-intensity PA. Our study found that only 20.9% of participants met the WHO's PA guidelines. This proportion is significantly lower than the 43.8% reported among adults aged 25 to 64 in Ho Chi Minh City who met the recommendation of engaging in at least 30 minutes of moderate-intensity PA on five or more days per week [33]. This discrepancy may be attributed to the tendency of many pregnant women to reduce their activity levels and prioritize rest. Other studies in Vietnam show varying proportions of pregnant women meeting the WHO PA recommendations, ranging from 17.3% to 53.8% [18,19,22]. Compared to these, our study found a relatively lower prevalence, which may be attributed to differences in participant. In our study, 48.3% of pregnant women exercised during pregnancy, with the majority (73.1%) choosing slow walking, an activity with an energy expenditure of 3.2 MET-hours [26], classified as moderate-intensity exercise. To meet the WHO recommendation, pregnant women would need to engage in slow walking for at least 30 minutes on most days of the week. However, we found that only 3.8% of pregnant women exercised five or more times per week, which aligns with the relatively low proportion of adequate PA observed in our study.

The proportion of pregnant women meeting the WHO PA recommendations was 20.9%, meaning that 79.1% of the 234 participants did not achieve the recommended level of PA during pregnancy. When compared to studies from other regions and countries, our finding of 79.1% noncompliance with WHO PA recommendations is significantly higher than the prevalence of physical inactivity reported in Malaysia, which was 38.3% [17]. The difference may be explained by the Malaysian study focusing on women aged 18–40 in their first trimester (≤13 weeks of gestation) with singleton pregnancies, which may exhibit different patterns of PA patterns compared to the broader range of gestational ages included in our study. Additionally, Malaysian women may be more accustomed to maintaining an active lifestyle even before pregnancy, with only 28.2% of women aged 16 and older classified as physically inactive [34], compared to 30.9% in Vietnam [35]. In Ethiopia, a low-income country, the prevalence of physical inactivity was even lower at 21.9% [36]. In contrast, the rate of insufficient PA reported among pregnant women in Shanghai, China, was as high as 97.2% [16]. These findings align with global data indicating that physical inactivity rates are nearly twice as high in high-income countries compared to low-income countries [37].

The multivariate analysis from our study identified several factors significantly associated with adequate physical activity in accordance with WHO guidelines. These factors include age group, exercise frequency before pregnancy, and accessibility to a fitness facility. Specifically, pregnant women aged 25–34 were 67% less likely to meet WHO-recommended PA levels compared to those aged 18–24 (OR=0.33; 95% CI: 0.12–0.93; $p<0.05$). This result suggests that while the 25–34 age group remains physically active, they are less likely than their younger counterparts to achieve the recommended activity levels. This reduction in activity might be attributed to increased work-level or family obligations typically associated with this age group, as noted by Hesketh et al., which restricts available time for exercise [38]. Furthermore, women aged 35 and older were significantly less likely to engage in adequate PA, with only 16% meeting the recommendation (OR=0.16; 95% CI: 0.04–0.63) compared to the 18–24 age group. This is consistent with existing literature, which highlights a more pronounced decline in PA among older pregnant women, possibly due to greater physiological challenges or pregnancy-related complications [39]. This finding aligns with results from the U.S. National Health and Nutrition Examination Survey, which indicated that individuals in the younger age group of 16–25 years were less likely to be classified as having sedentary PA [40]. Additionally, in a prospective cohort study involving British women, younger participants were less likely to reduce their PA levels during pregnancy [41].

Our results indicate that pregnant women who participated in PA 1 to 4 times a week were 3.03 times more likely to adhere to the WHO's PA recommendations compared to those who did not engage in exercise prior to pregnancy (OR=3.03; 95% CI: 1.21–7.62). Moreover, those who exercised 5 times or more per week had an even higher likelihood (OR=3.59;

95% CI: 1.05–12.24). This suggests a strong correlation between pre-pregnancy and adherence to PA guidelines during pregnancy. These results align with earlier studies, including those conducted by Gaston & Cramp, which found that regular PA prior to pregnancy is a strong predictor of continued activity during pregnancy [15]. Similarly, a study by Evenson et al. also reported that women who were more physically active before pregnancy were significantly more likely to maintain adequate levels of PA throughout pregnancy [42]. These authors highlighted the importance of pre-pregnancy exercise routines, noting that women with established pre-pregnancy exercise habits tended to view PA as an integral part of their lifestyle, making it easier to continue during pregnancy. Furthermore, they suggested that women with consistent exercise habits were more confident in adapting their activity routines to the changing demands of pregnancy, which may explain the higher likelihood of adherence observed in both their study and ours. Our results further support the conclusions of Hailemariam et al., who identified pre-pregnancy exercise as a significant determinant influencing PA levels during pregnancy [14]. They emphasized that pregnant women who were active before conception tended to have improved health outcomes and fewer pregnancy complications, reinforcing the benefits of consistent PA across life stages. Similar results were also found in other studies conducted in Vietnam [18,19]. However, in these studies, the variable of exercise before pregnancy was only assessed as either “yes” or “no,” which did not allow for an evaluation of how different exercise frequency levels impacted adequate PA according to WHO recommendations. This is also a new aspect introduced in our research.

The proximity to fitness centers was found to significantly influence PA levels among pregnant women. Those residing near a gym were 2.51 times more likely to meet theWHO recommended physical activity levels compared to those living further away (OR=2.51; 95% CI: 1.07–5.89; $p<0.05$). This finding emphasizes the role of environmental factors in encouraging PA during pregnancy. Previous studies have similarly reported that individuals living in neighborhoods with more PA facilities tend to spend more time on physical activities, including vigorous-intensity exercise [43]. For example, researchers in China found that proximity to PA facilities increased PA levels and suggested that enhancing access to such facilities could effectively promote PA in the population [44]. Similarly, a study in Sweden observed that longer distances from home to paid indoor or outdoor PA facilities were associated with lower exercise frequency [45]. These trends have also been confirmed in various other studies [46] . However, this research is, to the best of our knowledge, the first to examine the relationship between proximity to fitness centers and PA levels specifically among pregnant women. Gyms and fitness centers offer accessible spaces, structured opportunities for exercise, and professional guidance, including specialized prenatal exercise programs, which likely encourage participation and help women remain active during pregnancy. Thus, further observational and experimental research is needed to validate these findings and explore their broader implications. If corroborated, initiatives to develop physical exercise programs and prioritize the establishment of fitness centers in residential areas could play a vital role in promoting healthy behaviors, particularly among pregnant women.

This study is one of the few studies that have examined PA status of Vietnamese pregnant women. However, it still has some limitations. Firstly, the research focused solely on pregnant women who were receiving antenatal care at the Hanoi Obstetrics and Gynecology Hospital, which may not sufficiently represent pregnant women in the northern region of Vietnam or in Vietnam as a whole. Secondly, assessing PA through self-reported questionnaires may not intriduce recall bias, as estimating PA by asking pregnant women to recall their average weekly activity time can be prone to inaccuracies. Besides, the study employed convenience sampling, which, while practical for recruitment, may introduce selection bias and limit the diversity of the sample. As a result, the findings may not fully represent the broader population of pregnant women in Vietnam, particularly those who do not attend antenatal care at large urban hospitals. Finally, the cross-sectional nature of this stidy limited the ability to establish causal relationship of the identified related factors.

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5. CONCLUSION

This study revealed that the level of PA among pregnant women was insufficient compared to global standards. Factors associated with meeting WHO-recommended PA levels included maternal age, proximity to fitness centers, and pre-pregnancy exercise frequency. Prioritizing the establishment of fitness centers in residential areas, improving access to exercise facilities more accessible, integrating exercise guidance into prenatal care, and promoting affordable prenatal fitness programs and community-based initiatives, such as walking groups or outdoor classes, are practical steps to increase PA participation among pregnant women.

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Conflict of interest

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Availability of data and material

Upon reasonable request, the datasets of this study can be available from the corresponding author.

Ethics approval

This research was conducted in 2024 after obtaining ethical clearance from the Council of Ethics in Biomedical Research of Hanoi Obstetrics & Gynecology Hospital (decision numbered 161/QĐ-PS and 428/CN-PS). The research was conducted only when the research participant agreed and its process did not affect the health of pregnant women and the fetus.

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