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Physical activity during pregnancy and its association with sociodemographic characteristics: a cross-sectional study

A prática de atividade física durante a gestação e sua associação com características sociodemográficas: um estudo transversal

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ABSTRACT

Introduction: Pregnancy is a period of intense physical, emotional, and social changes that require adaptations to ensure maternal and fetal well-being. In this context, physical activity (PA) can contribute to preventing gestational complications and promoting the health of the pregnant woman and her baby. However, adherence to adequate levels of PA during pregnancy remains low. Objective: To evaluate the practice of PA among pregnant women receiving care in the public health network of Curitiba, Paraná, Brazil. Methods: This is a cross-sectional study, linked to the Maternal and Child Health Cohort of Curitiba, with the participation of 195 pregnant women aged 16 years or older. Sociodemographic, clinical, and PA-related information were collected and analyzed by descriptive and inferential statistics, using the Chi-square test and Poisson regression with a robust estimator. Results: There was a high prevalence of physical inactivity: 80.5% of pregnant women did not reach 150 minutes of moderate PA per week and 89.2% did not perform vigorous activities for at least 10 continuous minutes. Despite this, 77.4% reported walking for at least 10 minutes per day. Sedentary time predominatly ranged between 4 and 6 hours per day. Consultation with a Physical Education professional was a factor positively associated with greater practice of moderate PA. Conclusion: There is a need to expand access to professional guidance and develop interdisciplinary strategies to promote safe PA during pregnancy, aiming at better maternal and child outcomes.

Keywords: Pregnancy; Physical exercise; Public health; Health promotion.

RESUMO

Introdução: A gestação representa um período de intensas mudanças físicas, emocionais e sociais, que requerem adaptações para garantir o bem-estar materno e fetal. Nesse contexto, a prática de atividade física (AF) pode contribuir para a prevenção de complicações gestacionais e para a promoção da saúde da gestante e do bebê. No entanto, a adesão a níveis adequados de AF durante a gestação permanece baixa. Objetivo: Avaliar a prática de AF entre gestantes atendidas na rede pública de saúde de Curitiba, Paraná, Brasil, bem como sua associação com fatores sociodemográficos e clínicos relacionados ao acompanhamento pré-natal. Métodos: Trata-se de um estudo transversal, vinculado à Coorte de Saúde Materno-Infantil de Curitiba, com participação de 195 gestantes com idade igual ou superior a 16 anos. Foram coletadas informações sociodemográficas, clínicas e relacionadas à prática de AF, analisadas por estatística descritiva e inferencial, utilizando teste Qui-quadrado e regressão de Poisson com estimador robusto. Resultados: Há elevada prevalência de inatividade física: 80,5% das gestantes não atingiram os 150 minutos semanais de AF moderada e 89,2% não realizaram atividades vigorosas por ao menos 10 minutos contínuos. Apesar disso, 77,4% relataram caminhar por pelo menos 10 minutos diários. O tempo sedentário predominou entre 4 a 6 horas diárias. A consulta com profissional de Educação Física foi um fator associado positivamente à maior prática de AF moderada. Conclusão: Há necessidade de ampliar o acesso à orientação profissional e desenvolver estratégias interdisciplinares para promoção da AF segura durante a gestação, visando melhores resultados materno-infantis.

Palavras-chave: *Gravidez; Exercício físico; Saúde pública; Promoção da saúde.*

Introduction

Pregnancy is a milestone in family life, especially for women, who experience bodily transformations and necessary adaptations to meet the demands of a new being who depends on them. This period involves numerous physical and emotional changes, including weight gain, hormonal fluctuations, and postural adaptations, which may result in discomfort, such as low back pain, affecting women's health[1]. The gestational period requires special attention from health professionals to en-

sure pregnant women's quality of life and well-being[2,3].

However, these changes do not characterize pregnancy as a pathological condition. Although necessary, such alterations often generate psychological conflicts, including fear, distress, anxiety, doubts, uncertainty, low self-esteem, and depression[3]. In this context, the practice of exercise may help prevent musculoskeletal pain, improve mental health, and promote a smoother childbirth, provided that physical activity (PA) is adapted to the pregnant woman's condition[3,4].

Engaging in PA during pregnancy provides numerous benefits, such as the prevention of conditions including preeclampsia, complications during childbirth and in the newborn, gestational hypertension, and diabetes. In addition, PA contributes to controlling gestational weight gain, maintaining cardiorespiratory fitness, relieving stress, facilitating postpartum recovery, and promoting successful breastfeeding[5,6]. The World Health Organization recommends aerobic, muscle-strengthening, and stretching exercises, with intensity adjusted according to the pregnant woman's routine and the progression of pregnancy, while avoiding activities that pose a risk of falls and fetal trauma[7]. These guidelines suggest that pregnant women engage in at least 150 minutes of moderate-intensity aerobic PA per week[7].

Among the types of PA recommended for pregnant women are light walking, cycling, stretching sessions, yoga, and light water-based exercises (such as swimming and water aerobics), which provide low impact and reduce joint stress due to buoyancy[8,9]. Breathing exercises are also important, as they promote body awareness and facilitate gas exchange, aiding relaxation and labor[4]. Flexibility exercises help balance the abdominal, pelvic floor, and lower back muscles and are commonly used to maintain proper posture during pregnancy[8].

Studies have shown that PA during pregnancy is associated with factors such as younger age, higher educational level, planned pregnancy, and guidance received during prenatal care[10]. Recommendations for PA provided by health professionals have also been shown to significantly increase pregnant women's adherence to exercise[11].

Several public initiatives, such as the Curitiba Mother Network (*Rede Mãe Curitibana*), exemplify programs aimed at ensuring comprehensive care for pregnant women by promoting educational practices on the importance of PA[12]. This network encourages the inclusion of PA as part of prenatal care, integrating it into multiprofessional follow-up[13]. Monitoring by interdisciplinary teams, comprising physicians, nurses, nutritionists, physical education professionals, and psychologists, has proven essential to expanding access to qualified information, encouraging adherence to healthy practices, and addressing the physical, emotional, and social needs of pregnant women[14].

Worldwide, programs such as Centering Pregnancy in the United States demonstrate the benefits of this model by promoting group meetings that combine medical consultations with health education, strengthening social support and improving perinatal outcomes[15,16]. Another example is Finland's *Maternity Package*, which encourages prenatal follow-up by offering support and guidance from the early stages of pregnancy. Although in other countries these policies are not specifically related to PA, their implementation aims to improve pregnant women's quality of life, especially in communities with limited access to information, reinforcing the importance of coordinated, multidisciplinary health care[15].

Despite the well-documented benefits of PA during pregnancy, many studies indicate that a large proportion of pregnant women do not achieve the recommended levels of PA, often due to a lack of adequate guidance[16,17]. In the municipality of Curitiba, leisure-time PA among women (equivalent to at least 150 minutes per week) increased over the historical series up to 2021, reaching 32.6%[18]. In contrast, the indicator of insufficient PA increased in 2021, reaching 54.1%[18].

Therefore, it is essential for health services to expand access to education on this topic and to encourage safe and effective practices for pregnant women. Accordingly, the aim of this study was to assess PA practices among pregnant women receiving care in the public health system of Curitiba, Paraná, Brazil, and to analyze their association with sociodemographic, clinical, and prenatal care–related factors.

Methods

This cross-sectional study is embedded in the Curitiba Maternal and Child Health Cohort, Paraná, Brazil (COOSMIC), which follows pregnant women and their children throughout the first 1,000 days of life in Brazil. The cohort aims to explore complex causal networks by identifying inequities and vulnerabilities among mothers and children assisted by the municipal public health service network. This study is the result of a partnership between the Pontifical Catholic University of Paraná and the Curitiba Municipal Health De-

partment. In its prospective phase, the cohort included 1,200 pregnant women and their children, who were followed up until two years of age.

Ethical considerations

The research protocol of the COOSMIC study was approved by the Research Ethics Committee of the Pontifical Catholic University of Paraná under approval number 6.498.474. It was also approved by the Ethics Committee of the Curitiba Municipal Health Department under approval number 6.588.994.

Data collection

Data were collected through face-to-face interviews and, during the COVID-19 pandemic, were adapted to online interviews, all conducted by previously trained interviewers. The variables and data collection items were integrated with the International Physical Activity Questionnaire[19]. Information was recorded using electronic devices and processed on the Qualtrics platform, in accordance with the study protocol previously published[19].

Sample

Pregnant women aged 16 years or older who were followed at the *Mãe Curitibana* Health Unit participated in the study, either by receiving prenatal care at this service or by being referred by the network of Health Units of the municipality of Curitiba for complementary examinations.

The analyzed subsample was selected by convenience and included all pregnant women enrolled in the COOSMIC study up to April 2021 who provided complete responses for the dependent and independent variables considered in this investigation, totaling 195 participants. Pregnant women who took part in the pilot study were excluded from the final sample due to modifications made to the data collection instruments after this initial phase[20].

Eligibility criteria

Pregnant women aged 16 years or older who were receiving care at the *Mãe Curitibana* Health Unit were included in the study. Pregnant women presenting psychological disorders that could interfere with or prevent adequate comprehension and communication with the research team were excluded[20].

This exclusion criterion was based on two complementary procedures: (1) the researcher's observation, identifying behavioral signs incompatible with appropriate participation in the study, and (2) participants' self-report of previously diagnosed psychological conditions that could compromise their understanding or interaction during the research procedures.

Data analysis

Data related to the sociodemographic characteristics of the pregnant women, access to consultations with a physical education professional, and the practice of PA during pregnancy were analyzed. Data analysis was conducted using descriptive and analytical statistical methods[20].

The dependent variables were: walking for at least 10 continuous minutes at home, at work, as a means of transportation to go from one place to another, for leisure, for pleasure, or as a form of exercise (no/yes); engagement in moderate-intensity PA for at least 10 continuous minutes (no/yes); accumulation of at least 150 minutes of moderate-intensity PA per week (no/yes); engagement in vigorous-intensity PA for at least 10 continuous minutes (no/yes); time spent sitting per weekday (<3 hours, 4–6 hours, 7–9 hours, and ≥10 hours); and time spent sitting per weekend day (<3 hours, 4–6 hours, 7–9 hours, and ≥10 hours)[20].

Thus, the independent variables considered in this study included: maternal age (16–19 years; 20–34 years; 35 years or older); self-reported race/ethnicity (white, Black, mixed-race, Asian, or Indigenous); marital status (single, separated/divorced, married or living with a partner, or widowed); educational level (completed elementary education or less, incomplete high school, completed high school, or higher education); monthly household income (equal to or less than one minimum wage, one to three minimum wages, three to five minimum wages, or more than five minimum wages, using 2019 as the reference year); receipt of social welfare benefits (no or yes); household density per sleeping room (adequate—up to two persons per bedroom, or inadequate—three or more persons per bedroom); gestational risk stratification (high, intermediate-high, intermediate-medium, or habitual); trimester of pregnancy (first, second, or third trimester); and care provided by a Physical Education professional (no or yes)[20].

To minimize potential sources of bias, the questionnaire was previously validated and adapted for the target population, ensuring clarity and relevance of the questions. Interviewers were adequately trained to avoid inconsistent interpretations and reduce the influence of subjectivity during data collection. In addition,

participants' anonymity was guaranteed to encourage honest responses, and inclusion and exclusion criteria were rigorously defined to ensure sample homogeneity.

In this study, data were measured on nominal and ordinal scales; therefore, nonparametric statistical tests were applied, specifically the Chi-square test. Nonparametric tests are appropriate because they do not require assumptions of normality or homogeneity of variances. All analyses were performed using only complete responses provided by the pregnant women[20].

All statistical analyses were carried out using IBM SPSS Statistics® software, version 25.0.

Results

Table 1 describes the socioeconomic and demographic characteristics of the study population. Most pregnant women were aged between 20 and 34 years (69.7%), self-identified as White (60.8%), were married or living with a partner (70.8%), and had completed higher education (44.6%). Regarding monthly household income, the most prevalent category was one to three minimum wages (42.1%), using 2019 as the reference year. In addition, the majority of participants reported not receiving any financial benefits from social programs (74.9%) and not living in households with family overcrowding (94.4%).

Table 2 presents information related to gestational health, such as gestational trimester and risk classification, as well as data regarding PA practice among the pregnant women. Most participants were in the second (39%) or third trimester of pregnancy (39%), and usual gestational risk was the most frequent classification (52.3%). Care provided by a physical education professional during pregnancy was uncommon, reported by only 4.1% of the participants.

Regarding engagement in moderate-intensity physical activities, such as light cycling, swimming, dancing, light aerobic exercise, recreational volleyball, carrying light loads, and performing household tasks inside the home, in the yard, or in the garden (e.g., sweeping, vacuuming, or gardening), as well as any activity that induces mild sweating or a moderate increase in breathing or heart rate, 57.9% of the pregnant women reported not performing these activities for continuous periods of at least 10 minutes. Furthermore, most participants did not reach the recommended accumulation of 150 minutes of moderate-intensity PA per week (80.5%), as shown in Table 2.

With regard to engagement in vigorous-intensity physical activities, such as running, aerobic exercise, playing soccer or basketball, cycling at a fast pace, performing heavy household tasks at home, in the yard, or in the garden, carrying heavy loads, or any activity that leads to intense sweating and a marked increase in breathing or heart rate, 89.2% of the pregnant women reported not performing these activities for continuous

Table 1 – Sociodemographic characteristics of the study population

Variable	Absolute frequency (n)	Relative frequency (%)
Age group		
16 – 19 years	17	8.7
20 – 34 years	136	69.7
35 years or older	42	21.5
Self-reported race/ethnicity		
White	118	60.5
Black	22	11.3
Brown (mixed race)	48	24.6
Asian	3	1.5
Indigenous	2	1.0
Does not know/prefers not to inform	2	1.0
Marital status		
Single	52	26.7
Separated/Divorced	4	2.1
Married or living with a partner	138	70.8
Widowed	0	0.0
Does not know/prefers not to inform	1	0.5
Educational level		
Completed elementary school or less	22	11.3
Incomplete high school	25	12.8
Completed high school	60	30.8
Higher education	87	44.6
Does not know/prefers not to inform	1	0.5
Total or approximate household income		
Equal to or less than 1 minimum wage*	4	2.1
From 1 to 3 minimum wages	82	42.1
From 3 to 5 minimum wages	42	21.5
More than 5 minimum wages	40	20.5
Does not know / prefers not to inform	27	13.8
Household crowding**		
Adequate	184	94.4
Inadequate	9	4.6
Does not know / prefers not to inform	2	1.0
Receipt of social benefits		
Yes	48	24.6
No	146	74.9

Source: COOSMIC data (2019-2021). *Reference value for the minimum wage (2019): BRL 998.00. **Household crowding: Defined according to the number of people per room used for sleeping. Up to three people per bedroom is considered adequate; three or more people per bedroom is considered inadequate.

Table 2 – Characteristics of the study population

Variable	Absolute frequency (n)	Relative frequency (%)
Gestational trimester		
First trimester 0 – 13	42	21.5
Second trimester 14 – 26	76	39.0
Third trimester 27 – 41	76	39.0
Does not know/prefers not to inform	1	0.5
Gestational risk		
High risk	45	23.1
Intermediate–High	9	4.6
Intermediate–Moderate	15	7.7
Usual (low risk)	102	52.3
Does not have the prenatal card	23	11.8
Does not know/prefers not to inform	1	0.5
Care by a Physical Education professional		
Yes	8	4.1
No	186	95.4
Does not know/prefers not to inform	1	0.5
Walking for at least 10 continuous minutes		
Yes	151	77.4
No	44	22.6
Moderate-intensity physical activity for at least 10 continuous minutes		
Yes	82	42.1
No	113	57.9
Accumulation of 150 minutes of moderate-intensity physical activity per week		
Yes	38	19.5
No	157	80.5
Vigorous physical activity for at least 10 continuous minutes		
Yes	21	10.8
No	174	89.2
Time spent sitting per weekday		
<3 hours	59	30.3
4-6 hours	64	32.8
7-9 hours	28	14.4
≥10 hours	44	22.6
Time spent sitting per weekend day		
<3 hours	56	28.7
4-6 hours	73	37.4
7-9 hours	25	12.8
≥10 hours	41	21.0

Source: COOSMIC data (2019-2021)

periods of at least 10 minutes, as shown in Table 2.

Sedentary behavior was assessed by evaluating the total time pregnant women spent sitting at work, at home, at school or college, and during leisure time, such as watching television or reading. Most participants reported sitting for 4–6 hours per weekday (32.8%). A similar pattern was observed on weekends (37.4%). More than 20% of pregnant women reported spending more than 10 hours per day sitting, both on weekdays and on weekends (Table 2).

The results obtained from the Chi-square test analysis are presented in Tables 3 and 4. Variables statistically associated ($p < 0.05$) with the dependent variable "walking for at least 10 continuous minutes" were age group, educational level, gestational trimester, gestational risk classification, and care provided by a physical education professional. Variables associated with the dependent variable "accumulation of 150 minutes of moderate-intensity PA per week" were race/ethnicity, gestational trimester, and care provided by a physical education professional. Variables associated with the dependent variable "engagement in vigorous-intensity PA for at least 10 continuous minutes" were race/ethnicity, gestational risk classification, and care provided by a physical education professional. Age group was associated with the dependent variable "time spent sit-ting per weekday," while age group, marital status, and care provided by a physical education professional were associated with "time spent sitting per weekend day."

Discussion

The present study aimed to assess PA practices among pregnant women receiving care in the public health system of Curitiba, Paraná, Brazil. The findings indicate that although walking is part of the routine of most pregnant women, whether at home, at work, as a means of transportation, or for leisure, the practice of moderate- and vigorous-intensity PA was limited. A large proportion of participants did not engage in moderate-intensity activities for sufficient duration nor achieved the minimum weekly recommendation for this intensity level. Vigorous-intensity exercise was even less frequent, suggesting a predominance of sedentary behaviors with respect to higher-intensity physical efforts.

Among the pregnant women participating in this study, the highest prevalence of physical activity was observed for light-intensity activities, particularly walking performed for at least 10 continuous minutes, whether at home, at work, as a means of transportation, or for leisure, enjoyment, or exercise. This practice was reported by 77.4% of the participants. Similar findings were reported in a study conducted in Pelotas with 4,471 pregnant women, in which walking accounted for 77.5% of the PA performed, and only 10.4% of women reported

Table 3 – Analysis of physical activity and sedentary time and their correlations with gestational variables and care by a Physical Education professional

Variables	Walking for at least 10 continuous minutes			Engaging in moderate-intensity physical activity for at least 10 continuous minutes			Accumulation of 150 minutes of moderate-intensity physical activity per week			Engaging in vigorous-intensity physical activity for at least 10 continuous minutes		
	No n (%)	Yes n (%)	p*	No n (%)	Yes n (%)	p*	No n (%)	Yes n (%)	p*	No n (%)	Yes n (%)	p*
Age group												
16 a 19 years	3 (6.8)	14 (9.3)		14 (12.4)	3 (3.7)		15 (9.6)	2 (5.3)		17 (9.8)	0 (0.0)	
20 a 34 years	31 (70.5)	105 (69.5)	0.871	77 (68.1)	59 (72.0)	0.091	111 (70.7)	25 (65.8)	0.376	119 (68.4)	17 (81.0)	0.280
35 years or older	10 (22.7)	32 (21.2)		22 (19.5)	20 (24.4)		31 (19.7)	11 (28.9)		38 (21.8)	4 (19.0)	
Marital status												
Single	9 (20.5)	43 (28.7)		32 (28.6)	20 (24.4)		45 (28.8)	7 (18.4)		46 (26.6)	6 (28.6)	
Separated/Divorced	2 (4.5)	2 (1.3)	0.262	2 (1.8)	2 (2.4)	0.783	3 (1.9)	1 (2.6)	0.423	4 (2.3)	0 (0.0)	0.774
Married or living with a partner	33 (75.0)	105 (70.0)		78 (69.6)	60 (73.2)		108 (69.2)	30 (78.9)		123 (71.1)	15 (71.4)	
Gestational trimester												
1º Trimester (0-13 weeks)	11 (25.0)	31 (20.7)		28 (25.0)	14 (17.1)		40 (25.6)	2 (5.3)		37 (21.4)	5 (23.8)	
2º Trimester (14-26 Weeks)	16 (36.4)	60 (40.0)	0.813	37 (33.0)	39 (47.6)	0.108	59 (37.8)	17 (44.7)	0.022	67 (38.7)	9 (42.9)	0.845
3º Trimester (27-41 Weeks)	17 (38.6)	59 (39.3)		47 (42.0)	29 (35.4)		57 (36.5)	19 (50.0)		69 (39.9)	7 (33.3)	
Gestational risk												
High risk	16 (36.4)	29 (19.3)		32 (28.6)	13 (15.9)		37 (23.7)	8 (21.1)		42 (24.3)	3 (14.3)	
Intermediate–High	1 (2.3)	8 (5.3)		6 (5.4)	3 (3.7)		8 (5.1)	1 (2.6)		8 (4.6)	1 (4.8)	
Intermediate–Moderate	5 (11.4)	10 (6.7)		10 (8.9)	5 (6.1)		11 (7.1)	4 (10.5)		15 (8.7)	0 (0.0)	
Usual (low risk)	21 (47.7)	81 (54.0)	0.032	51 (45.5)	51 (62.2)	0.159	80 (51.3)	22 (57.9)	0.761	86 (49.7)	16 (76.2)	0.190
Does not have the prenatal card	1 (2.3)	22 (14.7)		13 (11.6)	10 (12.2)		20 (12.8)	3 (7.9)		22 (12.7)	1 (4.8)	
Care by a PE professional												
No	41 (93.2)	145 (96.7)	0.307	110 (98.2)	76 (92.7)	0.056	153 (98.1)	33 (86.8)	0.002	167 (96.5)	19 (90.5)	0.188
Yes	3 (6.8)	5 (3.3)		2 (1.8)	6 (7.3)		3 (1.9)	5 (13.2)		6 (3.5)	2 (9.5)	

Source: COOSMIC data (2019-2021)
*Results of the Chi-Square Test between Dependent and Independent Variables. PE = Physical Education.

engaging in PA at the beginning of pregnancy[21].

Regarding moderate-intensity PA performed for at least 10 continuous minutes, most pregnant women (57.9%) reported not engaging in such activities. In addition, 80.5% did not accumulate 150 minutes of moderate-intensity PA per week. Comparable results were observed in a cross-sectional study of pregnant women attending Primary Health Care Units in Botucatu, São Paulo, where only 10.2% met the recommendation of 150 weekly minutes of moderate-to-vigorous PA during leisure time[22]. Furthermore, the World Health Organization Guidelines on Physical Activity and Sedentary Behaviour and the Brazilian Physical Activity Guidelines recommend that pregnant women engage in at least 150 minutes of moderate-intensity aerobic PA per week[7,23].

Another relevant finding was that most participants (89.2%) did not engage in vigorous-intensity PA, such as running, aerobic exercise, playing soccer, fast cycling, playing basketball, performing heavy household chores, carrying heavy loads, or any activity that causes heavy sweating or a marked increase in breathing or heart rate, for at least 10 continuous minutes. According to the Brazilian Physical Activity Guidelines, pregnant women who were physically active before pregnancy and prefer vigorous activities should perform at least 75 minutes per week, as such activities may be continued during pregnancy and postpartum when appropriately indicated[7]. A systematic review and meta-analysis found that vigorous-intensity exercise during the third trimester appears to be safe for low-risk pregnant women and may be associated with a lower risk of preterm birth[24].

Table 4 – Analysis of Time spent sitting and their correlations with gestational variables and care by a Physical Education professional

Variables	Time spent sitting per weekday (hours)					Time spent sitting per weekend day (hours)				
	<3 n (%)	4-6 n (%)	7-9 n (%)	≥10 n (%)	p*	<3 n (%)	4-6 n (%)	7-9 n (%)	≥10 n (%)	p*
Age group										
16 a 19 years	1 (1.7)	5 (7.8)	5 (17.9)	6 (13.6)		1 (1.8)	7 (9.6)	4 (16.0)	5 (12.2)	
20 a 34 years	44 (74.6)	42 (65.6)	17 (60.7)	33 (75.0)	0.084	43 (76.8)	46 (63.0)	15 (60.0)	32 (78.0)	0.097
35 years or older	14 (23.7)	17 (26.6)	6 (21.4)	5 (11.4)		12 (21.4)	20 (27.4)	6 (24.0)	4 (9.8)	
Marital status										
Single	14 (24.1)	13 (20.3)	8 (28.6)	17 (38.6)		12 (21.8)	15 (20.5)	7 (28.0)	18 (43.9)	
Separated/Divorced	2 (3.4)	1 (1.6)	0 (0.0)	1 (2.3)	0.418	1 (1.8)	1 (1.4)	1 (4.0)	1 (2.4)	0.161
Married or living with a partner	42 (72.4)	50 (78.1)	20 (71.4)	26 (59.1)		42 (76.4)	57 (78.1)	17 (68.0)	22 (53.7)	
Gestational trimester										
1º Trimester (0-13 weeks)	9 (15.3)	18 (28.6)	8 (28.6)	7 (15.9)		13 (23.2)	18 (25.0)	3 (12.0)	8 (19.5)	
2º Trimester (14-26 Weeks)	24 (40.7)	20 (31.7)	13 (46.4)	19 (43.2)	0.311	18 (32.1)	27 (37.5)	14 (56.0)	17 (41.5)	0.540
3º Trimester (27-41 Weeks)	26 (44.1)	25 (39.7)	7 (25.0)	18 (40.9)		25 (44.6)	27 (37.5)	8 (32.0)	16 (39.0)	
Gestational risk										
High risk	17 (28.8)	14 (22.2)	3 (10.7)	11 (25.0)		16 (28.6)	16 (22.2)	3 (12.0)	10 (24.4)	
Intermediate–High	1 (1.7)	7 (11.1)	0 (0.0)	1 (2.3)		2 (3.6)	3 (4.2)	3 (12.0)	3 (7.3)	
Intermediate–Moderate	6 (10.2)	4 (6.3)	2 (7.1)	3 (6.8)	0.266	6 (10.7)	3 (4.2)	3 (12.0)	3 (7.3)	0.682
Usual (low risk)	28 (47.5)	31 (49.2)	20 (71.4)	23 (52.3)		25 (44.6)	42 (58.3)	13 (52.0)	22 (53.7)	
Does not have the prenatal card	7 (11.9)	7 (11.1)	3 (10.7)	6 (13.6)		7 (12.5)	8 (11.1)	3 (12.0)	5 (12.2)	
Care by a PE professional										
No	56 (96.6)	62 (96.9)	26 (92.9)	42 (95.5)	0.827	55 (100.0)	70 (95.9	20 (80.0)	41 (100.0)	0.000
Yes	2 (3.4)	2 (3.1)	2 (7.1)	2 (4.5)		0 (0.0)	3 (4.1)	5 (20.0)	0 (0.0)	

Source: COOSMIC data (2019-2021)
*Results of the Chi-Square Test between Dependent and Independent Variables. PE = Physical Education.

More than 20% of the pregnant women in this sample reported spending more than 10 hours per day sitting, both on weekdays and weekends, indicating a high level of sedentary behavior. This finding is consistent with results from a cross-sectional study conducted with pregnant women attending primary health care units in Ribeirão Preto, São Paulo, in which 57% of the 799 participants were classified as sedentary[25]. Similar results were reported in another study that identified a high prevalence of insufficiently active pregnant women (77.7%)[22]. More recent evidence indicates that 52.6% of pregnant women are sedentary, with an even higher prevalence when considering leisure-time PA, which was not performed by 98.9% of participants[26].

A cohort study observed that PA levels during pregnancy decreased as gestational age advanced, with inactivity increasing from 98.3% at the 24th gestational week to 100% at the 32nd week, possibly due to biological, physiological, and/or cultural factors[27]. Weight gain and changes in the center of gravity may contribute to reduced willingness to engage in PA toward the end of pregnancy.

In contrast to these findings, the present study observed an association between the accumulation of 150 minutes of moderate-intensity PA per week and gestational trimester, with a lower prevalence of moderate-intensity PA among women in the first trimester compared with those in the third trimester.

Another relevant finding was the low frequency of care provided by a physical education professional, reported by only 4.1% of pregnant women. This limited coverage restricts the ability to more precisely evaluate the impact of such specialized follow-up on PA practice during pregnancy. Nevertheless, the prevalence of accumulating 150 minutes of moderate-intensity PA per week was higher among women who received care from a physical education professional compared with those who did not. These findings suggest a potential positive effect of specialized guidance; however, given the small number of women receiving this care, the results should be interpreted with caution, and studies with greater representation of this service are needed to confirm this association.

Evidence from supervised interventions in preg-

nant women reinforces the importance of the physical education professional's role in maternal health during pregnancy. Studies have demonstrated benefits such as improved control of gestational weight gain, enhanced physical well-being, and better quality of life. Qualified supervision increases the effectiveness of interventions by reducing excessive weight gain and promoting positive effects on symptoms and health perceptions[28-30].

In this study, no association between PA practice and socioeconomic factors was identified in the multivariate analysis. This finding may be explained by the relative socioeconomic homogeneity of the sample, which limits the variability required to detect differences between groups, as well as by the potential leveling effect of the COVID-19 pandemic on PA behaviors. In contrast, a cross-sectional study conducted in Vitória da Conquista, Bahia, found that higher income (greater than two minimum wages) and higher educational level were associated with higher PA levels among pregnant women, with lower PA observed when these variables were less favorable[24].

It is also important to highlight the pandemic context in which this study was conducted. Several studies have shown that the COVID-19 pandemic significantly reduced PA levels in the general population. A scoping review reported a consistent decline in PA and an increase in sedentary behavior during lockdown periods[31]. Among pregnant women, a prospective study in the United States identified a reduction in total PA and an increase in sitting time after the onset of restrictions in 2020[32]. In general, studies report that pregnant women reduced exercise due to fear of virus exposure and the closure of parks, gyms, and social spaces[32]. These findings suggest that the pandemic context may have directly influenced the results of the present study, contributing to lower PA levels and increased sedentary behavior among the assessed pregnant women, even though PA and exercise were considered essential for maintaining health during the pandemic[33].

This study has some limitations that may have influenced PA levels among the participants. Data collection occurred during the COVID-19 pandemic, a period marked by quarantine measures, mobility restrictions, and increased time spent at home. These conditions may have substantially reduced opportunities for structured or guided PA, particularly in outdoor or group settings, while favoring increased sedentary behavior.

Additionally, the convenience sampling strategy may have introduced selection bias, as participants represented only pregnant women attending the health unit during the data collection period, potentially excluding women with lower prenatal care adherence. Thus, the observed patterns may reflect an exceptional context or a specific profile of accessible participants, limiting the generalizability of the findings to other populations. Information bias should also be considered, as PA data were self-reported and may be subject to recall bias or social desirability bias. Furthermore, as a cross-sectional study, it was not possible to establish temporality or evaluate changes over the course of pregnancy, limiting causal inferences.

Potential uncontrolled confounding should also be acknowledged. Variables such as prior PA history, social support, individual barriers, and environmental characteristics were not included in the analysis and may have influenced the results. Moreover, generalizability is limited because the sample was drawn from a single public health unit and collected during a pandemic context, reflecting a specific reality that may not represent other populations or regions.

Future studies, ideally prospective and using probabilistic sampling, are needed to clarify the magnitude of these biases and to strengthen the generalizability of the findings. Additionally, further research should compare these patterns in non-restrictive (post-pandemic) scenarios to better understand the extent of these effects.

In conclusion, the results demonstrated a high prevalence of pregnant women who did not engage in PA during pregnancy, particularly with respect to moderate- and vigorous-intensity activities. Women who received care from a physical education professional showed a higher prevalence of moderate-intensity PA, reinforcing the potential positive impact of this type of follow-up. Nevertheless, access to this professional remains limited, indicating the need to expand the availability of this service within public prenatal care.

In this context, strengthening interprofessional collaboration is essential to promote educational and health promotion actions that reduce barriers and encourage PA practice among pregnant women. The findings of this study may also be applicable to other populations served by public health systems, particularly in regions with similar socioeconomic characteristics, providing support for policies aimed at expanding access to physical education professionals and promoting the systematic incorporation of PA into prenatal care.

Conflict of interest

The authors declare no conflicts of interest.

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Author contributions

Fagundes IS: Conceptualization; Methodology; Software development, implementation, and testing; Data and experiment validation; Data analysis; Investigation; Resources; Data curation; Project administration; Funding acquisition; Writing – original draft; Approval of the final manuscript. Ivnuk LP: Conceptualization; Methodology; Software development, implementation, and testing; Investigation; Project administration; Data presentation design; Writing – original draft; Writing – review and editing; Approval of the final manuscript. Pereira CH: Conceptualization; Methodology; Data analysis; Investigation; Project administration; Data presentation design; Writing – original draft; Writing – review and editing; Approval of the final manuscript. Orsi JSR e Werneck RI: Supervision; Project administration; Writing – review and editing; Approval of the final manuscript. Schmitt ES: Software development, implementation, and testing; Data and experiment validation; Data analysis; Investigation; Writing – original draft; Approval of the final manuscript. Zermiani TC: Supervision; Writing – original draft; Writing – review and editing; Approval of the final manuscript.

Statement on the use of artificial intelligence tools in the manuscript preparation

The authors used ChatGPT artificial intelligence tools to assist in the translation process of the manuscript.

Data availability statement

The data underlying the findings of this study are contained within the manuscript.

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Reviewers' assessment

The reviews of this article were originally conducted in Portuguese. This version has been translated using ChatGPT and subsequently reviewed by the Chief Editors.

Reviewer A

Anonymous

Dear Authors,

I congratulate you on the preparation of the manuscript, which aims to analyze, through a cross-sectional study, the level of physical activity of pregnant women assisted in the public health system of Curitiba, Paraná, Brazil.

- I would like to highlight the following points for improvement:

Pandemic Context

- Data were collected during the COVID-19 pandemic, which may have significantly affected the physical activity patterns of pregnant women. This limits the demographic representativeness of the study. A comparison with post-pandemic data would be necessary to strengthen this aspect.

Depth of Analysis

- The amount of information collected and the conclusions presented seem more appropriate for a conference abstract than for a scientific article. At times, the discussion becomes vague. It would be important to deepen the analysis, especially regarding the impacts of the presence of a Physical Education professional on pregnant women's health. Issues such as symptom improvement, body weight control, and quality of life could be explored to reinforce the scientific relevance of the study.

Scientific Relevance and Language

- The article requires substantial modifications to strengthen its scientific relevance and reduce pandemic-related bias. In addition, the use of more formal language throughout the text is recommended.

Final decision

- Mandatory revisions

Reviewer B

Chimenny Auluã Lascas Cardoso Moraes
University of São Paulo, Ribeirão Preto, São Paulo, Brazil

Specific considerations and suggestions.

Introduction (lines 35–55)

- The background is adequate, but it lacks the identification of specific gaps in the local literature. Justifying more precisely the focus on the public health system of Curitiba could strengthen the originality of the study. It is suggested to include updated local epidemiological data (post-2021) for contextualization.

Study Objective

- Although it is clear in the abstract and introduction, it is recommended to emphasize it more strongly at the end of the introduction, reinforcing the focus on associated sociodemographic factors.

Study Design (lines 70–115)

- The description is adequate, but convenience sampling (line 85) should be discussed in terms of selection bias. The exclusion criterion related to psychiatric disorders (lines 90–95) requires further detail regarding the assessment method.

Data Collection Instruments

- The instruments were mentioned, but it would be important to detail the adaptation and validation of the questionnaire for the specific population (line 105).

Statistical Analysis (lines 120–135)

- The methods are appropriate; however, there is no mention of how missing data were handled, which may be relevant in this type of study.

Presentation of Results (lines 140–215)

- It is suggested to present sample characteristics, physical activity levels, and statistical associations in greater detail, using tables that highlight significant p-values.

Discussion and Limitations

- The low frequency of care provided by Physical Education professionals (4.1%) limits the impact analysis.
- The limitation related to the pandemic (line 270) is

valid but could be expanded by discussing behavioral biases resulting from confinement.
- The lack of association with socioeconomic factors (line 260) deserves further exploration.
- The limitations (lines 280–290) could be expanded to include risks of selection bias, information bias due to self-report, and the absence of prospective analysis.
- Potential uncontrolled confounding biases and limitations in the generalizability of the results were not discussed.

Conclusion and Applicability

- The conclusion is consistent, but it is recommended to emphasize the importance of expanding access to Physical Education and health professionals in prenatal care. It is also suggested to discuss the applicability of the results to other populations, especially within public health systems in other regions, strengthening the practical and policy impact of the study.

Technical Review

- Check consistency in the use of units of measurement and technical terms.
- Standardize nomenclature and abbreviations (e.g., use of "PA" for physical activity).
- Update older references (2004, 2007, 2009, 2013, 2019), replacing them with more recent systematic reviews and meta-analyses, if possible.

Final decision

- Mandatory revisions