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Evaluating the Barriers to Physical Activity During Pregnancy: A Sequential Explanatory Mixed-Methods Study

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Abstract

Background: Despite strong evidence supporting the maternal and fetal benefits of physical activity during pregnancy, many pregnant women fail to achieve the recommended levels of activity for various reasons. Previous studies have largely examined barriers to physical activity from a quantitative perspective, with limited

attention to deeper social, interpersonal, intrapersonal, and environmental factors. Therefore, this study aimed to identify and explain barriers to physical activity among Iranian pregnant women using a sequential explanatory mixed-methods approach.

Methods: This explanatory mixed-methods study was conducted in two sequential phases: quantitative, followed by qualitative. In the quantitative phase, 351 pregnant women aged 18-45 years who met the inclusion criteria were recruited using convenience sampling. Data collection tools included a socio-demographic and obstetric questionnaire and the Pregnancy Physical Activity Perceived Barriers Scale (BPAPS). Data were analyzed using descriptive statistics and univariate and multivariate linear regression in SPSS v.23. In the qualitative phase, women with high barrier scores (BPAPS ≥ 97) were purposively invited for semi-structured interviews. Data saturation was reached after 10 interviews. Qualitative data were analyzed using conventional content analysis. Finally, quantitative and qualitative data were integrated in the interpretation of the study results.

Results: A total of 351 pregnant women were included in the analysis. The mean age of participants was 29.06 ± 5.99 years, and the mean total barrier score was 78.07 ± 16.25. The mean standardized scores for subscales were: environmental barriers 43.67 ± 17.80, pregnancy-related intrapersonal barriers 43.16 ± 16.40, non-pregnancy-related intrapersonal barriers 41.68 ± 18.80, and interpersonal barriers 38.74 ± 17.93.

Multivariate regression analysis indicated that older age, lower education, unemployment, and lack of pre-pregnancy physical activity were significantly associated with higher barriers to physical activity ($P < 0.05$). In the qualitative phase, one overarching theme, “Multidimensional Barriers to Physical Activity During Pregnancy,” and four main categories were identified: intrapersonal barriers, knowledge and communication gaps, socio-cultural limitations, and structural/environmental barriers. The most frequently reported categories from women’s lived experiences were related to intrapersonal barriers and knowledge/communication gaps.

Conclusions: In the quantitative phase, environmental barriers had the highest mean score among the subscales. In the qualitative phase, intrapersonal barriers and knowledge/communication gaps emerged as key themes in women's lived experiences. This difference is not a contradiction but reflects the complementary nature of the two methods: quantitative data capture population-level frequency, while qualitative data provide deeper insight into barriers that are most personally impactful. Overall, the integrated findings suggest that barriers to physical activity during pregnancy are multidimensional. Based on these findings, we recommend three specific public health policy actions: (1) integrating self-efficacy and self-care training into preconception care programs, (2) establishing free or low-cost, female-only safe exercise spaces for pregnant women, and (3) mandating physical activity counseling during all routine antenatal visits.

Keywords: Exercise, Pregnant Women, Health Knowledge, Mixed-Methods Research, Iran

Text box 1. Contributions to the literature

- Highlights multidimensional barriers to physical activity during pregnancy, integrating both quantitative and qualitative perspectives.
- Provides novel insights into intrapersonal and knowledge/communication barriers that are often overlooked in previous studies.
- Demonstrates the influence of socio-demographic factors (age, education, employment, pre-pregnancy activity) on perceived barriers.
- Offers evidence to guide the design of culturally appropriate, multilayered interventions promoting maternal physical activity.
- Strengthens the understanding of environmental and social

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discomforts and psychological complications, including depressive symptoms (4, 5). Fetal benefits are less extensively studied, but emerging evidence suggests improved placental function, higher neonatal Apgar scores (6), and enhanced infant motor and social development(7). Despite this evidence, most previous studies have examined barriers to physical activity using only quantitative or qualitative methods separately. The present study addresses this gap using a sequential explanatory mixed-methods design.

The American College of Obstetricians and Gynecologists (ACOG) recommends that pregnant women without medical or obstetric contraindications engage in regular, moderate-intensity physical activity (i.e., 30 mins/day, 5 days/week). This guidance also emphasizes the need to educate women about the benefits and risks of physical activity and to provide personalized exercise programs (8).

Despite the well-established benefits, physical activity tends to decrease as pregnancy progresses (7). This trend is evident globally. In Iran, one study reported that 52% of women engaged in no physical activity during the first trimester, increasing to 70% by the second trimester (9). International

comparisons reveal variability: a Swedish study of 2,203 pregnant women found only 27% met recommended activity guidelines (10), while an Iranian study reported that only 26.7% engaged in high levels of activity during pregnancy (11). These figures, while not directly comparable due to different measurement tools, consistently indicate low physical activity across diverse populations. What remains unclear is why these low levels persist—a gap this study addresses by exploring barriers from both quantitative and qualitative perspectives. Specifically, the quantitative phase aimed to measure the prevalence of perceived barriers and identify associated sociodemographic and obstetric factors; the qualitative phase aimed to explore the lived experiences of women with high barrier scores; and integration aimed to interpret the quantitative findings in light of women's in-depth narratives.

Pregnant women often adopt a sedentary or low-activity lifestyle for various reasons (12). Intrapersonal barriers (e.g., fear of miscarriage, fatigue, physical discomfort) and interpersonal barriers (e.g., lack of support) are among the most frequently reported factors (13-20).

Social pressure on pregnant women to prioritize family responsibilities further exacerbates these barriers (7, 21). However, most studies examining barriers to physical activity in Iran have been either qualitative or quantitative, and they often did not directly assess the factors influencing physical activity, potentially introducing bias (7). For example, Dolatabadi et al. (2022) investigated barriers to physical activity among a group of Iranian pregnant women, finding that interpersonal barriers were the most

significant while environmental barriers were the least. Nonetheless, the researchers highlighted the need to include rural populations in future studies and to conduct qualitative research to complement quantitative findings and better understand how these barriers influence pregnant women's physical activity (18).

Furthermore, many studies have used researcher-designed tools or general physical activity scales during pregnancy, which limits the applicability of their findings for future interventions aimed at overcoming barriers to physical activity (5, 22, 23). Many studies have used the Pregnancy Physical Activity Questionnaire (PPAQ) to assess physical activity levels, but it has been reported that the PPAQ lacks sufficient structural validity for evaluating total and vigorous activity scores. Unlike the PPAQ, which lacks sufficient structural validity for assessing total and vigorous activity scores (24), and researcher-designed questionnaires that often lack psychometric rigor, the Barriers to Physical Activity in Pregnancy Scale (BPAPS) was specifically developed to measure perceived barriers to physical activity during pregnancy. BPAPS consists of 29 items across four subscales and was validated in an Iranian population with good reliability (Cronbach's alpha = 0.824) and test-retest reliability (ICC = 0.87). While it has been applied in a limited range of populations, its cultural adaptation for Iranian women makes it particularly suitable for the present study (25).

Quantitative research tests existing hypotheses and identifies the prevalence of barriers but is less suited for exploring the how and why of complex social

phenomena. In the context of physical activity during pregnancy, previous quantitative studies (including those using BPAPS) have shown which barriers are most common but cannot explain why women perceive these barriers or how they experience them. Qualitative research provides rich insights into personal perspectives and lived experiences but often has limited generalizability due to small sample sizes. The sequential explanatory mixed-methods design directly addresses both gaps: the quantitative phase provides generalizable prevalence data, and the qualitative phase (selecting women with high barrier scores) explains the lived experiences behind the numbers. Therefore, this design is particularly well-suited for providing a comprehensive understanding of barriers to physical activity among pregnant women (26). Therefore, a mixed-methods design integrating quantitative and qualitative data can provide a more comprehensive, in-depth, and practical understanding of the barriers to physical activity among pregnant women.

Several unique factors in Iran justify this focused study: strong family involvement discouraging physical activity, limited access to female-only exercise facilities (especially in rural areas), extreme seasonal temperatures (18), and a lack of qualitative research on this topic.

Therefore, given these unique cultural, social, and environmental factors, this study employed a sequential explanatory mixed-methods design, combining the BPAPS questionnaire with semi-structured interviews to assess barriers to physical activity during pregnancy in an Iranian population. The qualitative

phase provided an in-depth understanding of these barriers and the lived experiences of pregnant women. Finally, quantitative findings were interpreted in light of the qualitative data. By directly addressing the gaps identified in previous Iranian studies—specifically the lack of qualitative depth and integrated evidence on barriers—these findings can inform antenatal care policy in Iran through three actionable pathways: incorporating physical activity counseling into routine prenatal visits, designing culturally appropriate educational programs for families, and advocating for female-friendly exercise facilities in both urban and rural areas.

Methods

Study Setting, Participant, and Design

This sequential explanatory mixed-methods study was conducted among pregnant women attending antenatal clinics affiliated with Babol University of Medical Sciences, Iran. Quantitative data were collected between May 2022 and August 2024. Convenience sampling was chosen for feasibility and ease of access to eligible participants attending the clinics. However, this method may introduce selection bias, as women who attend these clinics may differ from those who do not. This limitation is addressed in the limitations section. The study employed a quantitative approach to identify barriers to physical activity during pregnancy using the Barriers to Physical Activity in Pregnancy Scale (BPAPS). This was followed by in-depth, semi-structured

interviews aimed at further explaining the barriers experienced by pregnant women. Finally, the quantitative findings were interpreted in the context of the qualitative data to provide a comprehensive understanding of the barriers.

Quantitative stage & instruments

In the quantitative phase of the study, the maximum sample size was calculated based on a previous study (18) using the mean ± standard deviation of the total physical activity barriers score (88.55 ± 19.28), a 95% confidence level. The margin of error of 1.5 was selected based on the 29-145 range of the BPAPS scale, allowing precise estimation of the mean score. The 10% dropout adjustment follows standard epidemiological practice to account for incomplete questionnaires. For multivariate linear regression, we assumed a maximum of 10 predictor variables, requiring a minimum of 100-150 participants (10-15 participants per predictor). Our sample of 351 exceeds this requirement. The study protocol has been published in Client-Centered Nursing Care (27).

Participants for the quantitative phase were recruited using convenience sampling based on eligibility criteria. Eligible and consenting women completed the study questionnaires after being informed of the research objectives. Inclusion criteria were: age 18-45 years, gestational age 10-37 weeks, absence of medical conditions restricting or prohibiting physical activity during pregnancy, ability to read and write, no disability, and no

severe symptoms such as excessive shortness of breath, severe chest pain, dizziness or fainting unrelieved by rest, as well as no signs of preterm labor (e.g., regular painful contractions, continuous vaginal fluid loss, or vaginal bleeding). Eligibility was determined by a trained midwife through a brief interview with each participant. 'No disability' referred to the absence of any physical or cognitive impairment limiting physical activity. 'Severe symptoms' were defined as excessive shortness of breath at rest, severe chest pain, dizziness or fainting unrelieved by rest, regular painful contractions, continuous vaginal fluid loss, or vaginal bleeding.

Two questionnaires, the demographic-obstetric questionnaire and BPAPS, were completed by the pregnant women. The demographic-obstetric questionnaire collected information such as age, socioeconomic status, obstetric and delivery history, anthropometric characteristics, and contact details for potential invitation to the qualitative phase. The BPAPS assessed perceived barriers to physical activity during pregnancy.

The BPAPS was developed by Amiri-Farahani et al. (2021) and consists of 29 items across four subscales: pregnancy-related intrapersonal barriers, non-pregnancy-related intrapersonal barriers, interpersonal barriers, and environmental barriers. Items are scored on a 5-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. The total BPAPS score ranges from 29 to 145, with higher scores indicating greater perceived barriers to physical activity. The 29-item scale demonstrated high reliability, with a Cronbach’s alpha of 0.824 and an intraclass correlation coefficient (ICC) of 0.87 for test-retest reliability. Cronbach’s alpha

values for the overall scale and its subscales were 0.82, 0.81, 0.73, 0.73, and 0.72, respectively. Construct validity was confirmed using known-groups validation and exploratory factor analysis (25). The BPAPS was originally developed and validated in an Iranian population; therefore, no additional translation or cultural adaptation was required. Questionnaires were completed in a quiet setting at the prenatal care clinic, with each questionnaire taking approximately 15 minutes to complete.

For missing data, participants who failed to answer more than 10% of items (28) were excluded from the analysis. For participants with ≤10% missing items, no imputation was performed, and the analysis used available complete data (listwise deletion).

Statistical analysis

Participants' sociodemographic, obstetric, and physical activity barrier variables were summarized using descriptive statistics, reporting means and standard deviations for continuous variables, and frequencies and percentages for categorical variables. For the BPAPS subscales, higher scores were interpreted as indicating greater barriers. To compare subscales, each subscale score was converted to a standardized score out of 100. This was calculated by subtracting the minimum possible score for the subscale from the observed score, dividing by the range of possible scores, and multiplying by 100.

Univariate and multivariate linear regression analyses were used to predict barriers to physical activity. Assumptions for linear regression were checked as follows: linearity assessed using residual plots, normality of residuals and homogeneity of variance (homoscedasticity), using Q-Q plots, and multicollinearity using variance

inflation factor (VIF), with a threshold of <5 indicating no significant multicollinearity. Multivariate analysis controlled for potential confounding variables. The multivariate model included the following potential confounders: maternal and spouse age, education, employment status, Number of Children, Residence (Village/City), Preparation Class for Childbirth, BMI, GA, and pre-pregnancy physical activity. Both standardized and unstandardized regression coefficients, along with their 95% confidence intervals (CI), were reported as effect size measures. All tests were two-sided, and analyses were performed using SPSS version 23 with a significance level of $P<0.05$.

Qualitative stage

Participants for the qualitative phase were selected from women who had taken part in the quantitative phase. Preliminary quantitative findings guided the development of qualitative questions, participant selection, and data collection, reflecting an emerging sequential explanatory mixed-methods approach (29). Based on the quantitative findings and team discussions, the focus of the qualitative phase was defined, enabling deeper and more trustworthy insights into the phenomenon. Women whose BPAPS scores were at least two-thirds of the total scale score (BPAPS ≥97) were purposively invited. This cutoff was chosen to select women with high perceived barriers for in-depth exploration. Data saturation was achieved after 10 interviews, defined as the point at which no new codes or themes emerged from three consecutive interviews (no new codes after interview 8; two additional

interviews confirmed saturation). Maximum variation in age, education, and residence was achieved as shown in Table 2.

Following the invitation, interview times and locations were arranged according to participants' preferences and convenience. Individual, face-to-face interviews were conducted either at the clinic or at participants' homes. All participants provided informed consent for audio recording to facilitate accurate transcription. Semi-structured interviews were conducted in Persian, using culturally appropriate language and local dialects. Participants were encouraged to freely describe their experiences through open-ended questions related to barriers to physical activity during pregnancy. The interview duration ranged from 20 to 50 minutes, depending on the participants' expressiveness and willingness to continue the discussion, with all interviews completed in a single session. Data saturation was achieved after 10 interviews.

The interview guide questions explored women's knowledge and awareness of physical activity during pregnancy, experiences of physical activity before and during pregnancy, the influence of family members and spouses on activity or rest, and sources of pregnancy-related information. During interviews, probing questions such as "Could you explain more?", "What do you mean by that?", "Why?", and "How?" were used to deepen understanding. The interview guide included open-ended questions about knowledge of physical activity during pregnancy, experiences before and during pregnancy, family influences, and information sources. Example

questions included: 'What do you know about physical activity during pregnancy?' and 'What barriers have you experienced? The interview guide was piloted with two pregnant women who met the inclusion criteria but were not included in the final sample. Based on pilot testing, minor wording adjustments were made for clarity.

Data analysis was conducted concurrently with data collection. Audio recordings were transcribed verbatim. Coding was performed manually using Microsoft Word and Excel. Two coders (F.B. and R.F.) independently coded the first three interviews. Disagreements were resolved through discussion and consensus with a third author (H.A.N.). For the remaining interviews, the two coders discussed any new codes. Words and phrases were treated as units of analysis. Codes from each interview were continuously compared with previous interviews to identify similarities and differences. Categories were repeatedly reviewed, compared, merged, or refined throughout the analytic process. Ultimately, the research team reached consensus on the codes, subcategories, categories, and themes. The analysis was inductive (conventional content analysis), meaning codes emerged directly from the data rather than from pre-existing categories such as BPAPS subscales. The overlap between qualitative categories and quantitative subscales reflects convergence of findings, not deductive coding. Researchers ensured openness to new themes by avoiding predefined coding frameworks and discussing emergent codes in team meetings.

Trustworthiness was ensured using Enworo's (2023) criteria: credibility, dependability, confirmability, and transferability (30). Specific strategies included member checking (three participants reviewed their interview summaries), prolonged engagement (four months of fieldwork), peer debriefing (two external researchers reviewed the coding process), investigator triangulation (multiple coders), audit trails, reflexivity, and thick description of the study context.

Results

Quantitative results

In the quantitative phase, 358 pregnant women completed the questionnaires. Seven questionnaires were excluded due to incomplete data, and data from 351 participants were included in the final analysis. Missing data were handled using listwise deletion. Excluded participants (n=7) did not differ significantly from included participants (n=351) in age (p=0.34) or gestational age (p=0.51). The mean ± standard deviation age of participants was 29.06 ± 5.99 years, and 74.4% of women (n = 261) were in the second half of pregnancy. Participants' demographic and obstetric characteristics are presented in Table 1.

The mean total score for barriers to physical activity was 78.07 ± 16.25, with scores ranging from 29 to 142. To allow comparison across subscales, scores were standardized to a 0-100 scale, with higher scores indicating greater

barriers to physical activity. The result was multiplied by 100 to express the standardized score as a percentage, making it easier to interpret and compare across subscales. The mean ± standard deviation standardized scores were 43.16 ± 16.40 for pregnancy-related intrapersonal barriers, 41.68 ± 18.80 for non-pregnancy-related intrapersonal barriers, 38.74 ± 17.93 for interpersonal barriers, and 43.67 ± 17.80 for environmental barriers. The mean scores for environmental barriers (43.67) and interpersonal barriers (38.74) showed a relatively small absolute difference, with overlapping standard deviations. The 95% confidence intervals for these subscales were [41.81–45.53] for environmental barriers and [36.86–40.62] for interpersonal barriers.

The most frequently reported barriers were pain-related limitations to physical activity (e.g., back pain, pelvic pain, or headaches) among pregnancy-related intrapersonal barriers (M= 3.09, SD= 1.14); perceiving physical activity as physically demanding among non-pregnancy-related intrapersonal barriers (M= 3.06, SD= 1.12); insufficient information about physical activity during pregnancy among interpersonal barriers (M= 2.80, SD= 1.08); and limited access to physical activity facilities due to long distances from home among environmental barriers (M= 3.05, SD= 1.17).

Key regression assumptions, including the linearity of the relationship between independent and dependent variables, normality of residuals, and homogeneity of variance (homoscedasticity), were examined using residual plots and Q-Q plots. The findings supported the satisfactory fulfillment of

these assumptions. Multicollinearity was assessed by calculating the VIF for all predictor variables. All VIF values were below the threshold of 5, indicating no significant multicollinearity among the predictors and supporting the overall validity of the regression model. Multivariable regression analysis identified maternal age, educational level, employment status, and pre-pregnancy physical activity as significant predictors of perceived barriers to physical activity ($p < 0.05$). Specifically, younger women, those with higher educational attainment, employed participants, and women who were physically active prior to pregnancy reported significantly lower barrier scores. The full multivariate linear regression results, including all coefficients, confidence intervals, and model fit statistics, are presented in Supplementary File 1. In summary, older age (B= 0. 91, 95% CI: 0.43 To 1.38, p< 0.001), lower education (B= -4.39, 95% CI: -8.73 To -0.5, p = 0.047), unemployment (B= -9.54, 95% CI: -16.37 To -2.71, p= 0.006), and lack of pre-pregnancy physical activity (B = -7.34, 95% CI: -11.43 To -3.25, p < 0.001) were significantly associated with higher barrier scores. The model explained 0.16% of the variance (R square = 0.19 and adjusted R square = 0.16).

Table 1. Demographic and Obstetric Characteristics of Pregnant Women (n: 351)

Variables	Items	Number (%)
Women's age	< 35 years ≥ 35 years	279 (79.5) 72 (20.5)
Women's education	Less than high school High school diploma University education	86 (24.5) 148 (42.2) 117 (33.3)

Women's job	Unemployed Employed	316 (90.0) 35 (10.0)
residence	Rural Urban	186 (53.0) 165 (47.0)
Gestational Age	Trimester1 Trimester2 Trimester3	31 (8.8) 121 (34.5) 199 (56.7)
Body Mass Index	≤ 24.9 25-29.9 ≥ 30	151 (43.0) 117 (33.3) 78 (22.2)
Number of children	One child at most Two children At least three children	253 (72.1) 73 (20.8) 25 (7.1)
Preparation class for childbirth*	No Yes	211 (78.7) 57 (21.3)
Pre-pregnancy physical activity	No Yes	247 (70.4) 104 (29.6)

*Childbirth preparation classes are conducted after the 20th week of pregnancy. Therefore, 83 women who were less than 20 weeks pregnant were excluded from this specific analysis.

Qualitative results

In the qualitative phase, 10 pregnant women aged 18 to 39 years were interviewed. Participants demonstrated diversity in educational level (ranging from below high school to university education) and place of residence. The demographic–obstetric characteristics of women in the qualitative phase are presented in Table 2. Following data analysis and coding, one overarching theme, "Multidimensional barriers to physical activity during pregnancy," along with four categories and eleven subcategories, was identified (Table 3).

Table 2. Demographic and obstetric information of qualitative phase participants

Participant	Age	BPAPS Score	Education	Residence	Job	Pre-Pregnancy

						Physical Activity
1(code323)	18	109	High school diploma or below	Urban	Unemployed	No
2(code18)	32	112	University Education	Rural	Unemployed	No
3(code81)	27	114	High school diploma or below	Rural	Unemployed	No
4(code43)	30	126	University Education	Urban	Unemployed	Yes
5(code194)	39	112	High school diploma or below	Rural	Unemployed	No
6(code262)	34	103	University Education	Urban	Unemployed	Yes
7(code311)	38	101	University Education	Urban	Unemployed	No
8(code236)	19	142	High school diploma or below	Urban	Unemployed	No
9(code348)	25	98	University Education	Urban	Unemployed	No
10(code157)	29	138	University Education	Rural	Unemployed	No

Table 3. Subcategories, categories, and themes extracted from the qualitative phase

Codes	Subcategories	categories	Theme
Pregnancy headache Feeling tired, sleepy, and lethargic Back pain Leg pain Feeling physically weak A large, heavy belly Nausea	Physical barriers	**Pregnancy-related intrapersonal barriers**	
Fear of harming the fetus Lack of motivation Impassion Lack of interest in exercise Fear of miscarriage Fear of premature birth	Psychological-individual barriers		
Lack of exercise before pregnancy Not having a walking habit Not following a diet Not having an exercise program in life Being inactive before pregnancy	lifestyle factors		

Understanding daily activities at home as physical activity is sufficient Lack of awareness of the benefits of physical activity during pregnancy Lack of sufficient information about how to be physically active during pregnancy	limited knowledge and awareness	**Knowledge and Communication Gaps**	Multidimensional Barriers to Physical Activity during Pregnancy
Obtaining information about physical activity during pregnancy on Google Gaining information from television Gaining information from the experiences of pregnant women Gaining information from people around them Gaining information from social media	Inadequate or unreliable information sources		
Lack of advice from the doctor/midwife about physical activity Lack of knowledge about the method, type and method of exercise during pregnancy	Weak/poor communication with healthcare providers.		
Prohibition of physical activity by family and friends Fear of miscarriage and harm to the fetus by family and friends Encouragement of inactivity by family and friends during pregnancy Lack of support from family and friends	Interpersonal barriers	**Socio-Cultural Barriers**	
Spouse's lack of cooperation in housework Spouse's prohibition Spouse's fear of miscarriage	lack of spousal support		
Responsibility for doing housework Responsibility for children	Maternal responsibilities		
Hot weather Cold weather Lack of access to women-only parks Difficult physical activity for pregnant women in parks Unsuitability of the home for physical activity The gym is far from the residence Lack of parks around the residence	Environmental barriers	**Structural and Environmental Barriers**	

High cost of sports clubs Taxi fare	Economic barriers		

Pregnancy-related intrapersonal barriers

This category comprised three subcategories: physical barriers, psychological-individual barriers, and lifestyle factors. Among physical barriers, sleepiness, back pain, leg pain, and the increasing size and weight of the abdomen as pregnancy progressed were reported more frequently than other barriers. Participants stated that prolonged sleeping during pregnancy was a major obstacle to engaging in physical activity. In addition, back pain and abdominal enlargement in later pregnancy contributed to the avoidance of physical activity. As one participant noted, “Towards the end of pregnancy, my back pain became worse, and that made walking difficult for me” (Participant 9).

Among psychological-individual barriers, fear of miscarriage and fear of harming the fetus during physical activity were most expressed. One woman explained, “Up to five or six months, because the fetus is not fully formed and there is a risk of miscarriage, you shouldn’t be physically active” (Participant 9). Another participant stated, “I felt my body was weak, and physical activity could harm both me and my baby” (Participant 8).

A pre-existing sedentary lifestyle and absence of regular physical activity prior to pregnancy were identified as major lifestyle-related barrier, leading women to avoid physical activity during pregnancy. As one participant

expressed, “I’ve never really been into exercise at all” (Participant 5, 39 years old).

Knowledge and Communication Gaps

This category encompassed three subcategories: limited knowledge and awareness, inadequate or unreliable information sources, and weak/poor communication with healthcare providers. Most participants reported limited understanding of safe and beneficial physical activity during pregnancy. Some considered routine household chores an adequate substitute for exercise, stating, “I didn’t exercise because housework counts as exercise” and “I didn’t even know I should exercise during pregnancy” (Participant 3).

Within the subcategory of weak provider communication, the most reported issue was the lack of guidance from doctors or midwives regarding physical activity. Many participants noted that they received no advice during prenatal visits, leading them to overlook or undervalue exercise

In the absence of formal education during prenatal visits, women often relied on informal sources such as internet searches, social media, or advice from friends and relatives. Despite easy access, these sources were not always accurate or reliable: “I followed several midwifery pages on Instagram that provided information about physical activity” (Participant 9, 25 years old); “If I needed information, I would ask friends who had given birth before me” (Participant 5, 39 years old).

Socio-Cultural Barriers

This category included three subcategories: interpersonal barriers, lack of spousal support, and maternal responsibilities. Participants indicated that the reactions and expectations of family and others often hindered their engagement in physical activity. Family restrictions, concerns about miscarriage or fetal harm, and advice to limit movement led many women to avoid exercise. One participant stated, “My family, especially my mother and sister, said I shouldn’t be active during pregnancy and that I should rest” (Participant 8).

Spousal support emerged as another key factor. Participants reported that their partners did not share household responsibilities, leaving them with most of their time and energy consumed by childcare and household chores. One woman explained, “I wanted to go for a walk, but I had to cook for my child and tidy the house” (Participant 4). Consequently, even when motivated, women’s household and family responsibilities frequently hindered their participation in physical activity.

Structural and Environmental Barriers

This category included two subcategories: environmental barriers and economic barriers, reflecting external conditions and structural limitations. Participants identified weather conditions as a significant obstacle to physical activity, corroborating the quantitative findings, which showed environmental barriers, particularly weather, as the highest-rated among the four subscales. Excessive heat on some days caused fatigue and a sense of

weakness, while cold weather reduced women's willingness to engage in outdoor physical activity.

Limited infrastructure, such as a lack of parks or exercise facilities tailored for pregnant women and insufficient dedicated public spaces, along with long distances to accessible gyms or parks, further restricted opportunities for safe physical activity. "Women's parks or green spaces suitable for walking during pregnancy are ideal, but there is no such place near our home" (Participant 9). "In the summer, I felt very tired and weak due to the heat, and in cold weather, I preferred to stay indoors" (Participant 8).

Although most participants emphasized environmental barriers, one also cited economic factors, noting that private gyms charge high fees, making the cost of attending exercise classes a deterrent to physical activity.

Integration of findings

Integration of quantitative and qualitative findings was performed using narrative synthesis. While environmental barriers had the highest mean score in the quantitative phase, qualitative data revealed that intrapersonal barriers and knowledge/communication gaps were particularly impactful in women's lived experiences. These findings are complementary: qualitative themes helped explain why environmental barriers, despite their high prevalence, were not the most salient in women's narratives. This difference is not contradictory but reflects the complementary nature of the two methods: quantitative data capture population-level frequency, whereas

qualitative data capture depth of lived experience. Thus, environmental barriers are more prevalent, but intrapersonal barriers are more salient when present.

Discussion

In this section, we first summarize the key quantitative and qualitative findings, then interpret them in relation to previous literature, and finally discuss implications for practice and policy.

The present study employed a sequential explanatory mixed-methods design to evaluate barriers to physical activity during pregnancy. In the quantitative phase, environmental barriers, followed by pregnancy-related intrapersonal barriers, emerged as the most prominent obstacles to physical activity. A previous study also identified environmental factors, such as extreme hot or cold weather, as key barriers during pregnancy (31). Similarly, research in Nigeria reported that environmental factors, including unfavorable weather, air pollution, limited access to suitable transportation, and a lack of appropriate exercise facilities, were among the most significant barriers to physical activity for pregnant women (32). In line with prior studies, pregnancy-related intrapersonal barriers, such as low energy, pain, and swelling, were also frequently reported as major obstacles (18, 31). In contrast, Dolatabadi et al. (2022) found that environmental barriers were the least significant factor affecting physical activity among pregnant women (18).

Although the quantitative findings highlighted the prominent role of environmental barriers, followed by pregnancy-related intrapersonal barriers, the literature shows inconsistent evidence regarding the most significant obstacles to physical activity during pregnancy. This discrepancy may reflect cultural, social, and structural differences across populations, seasonal variations during data collection, or differences in pregnant women's awareness and attitudes toward physical activity. For example, Davenport et al. (2018) reported that intrapersonal factors, such as fear of harming the fetus, excessive fatigue, nausea, and pregnancy-related physical changes, had a greater impact on reduced physical activity than environmental factors (33). While Dolatabadi et al. (2022) found that environmental barriers were the least significant among Iranian pregnant women, our study identified environmental barriers as the most prevalent. This difference may be explained by several factors. First, Dolatabadi's study was conducted in a different geographic region of Iran with milder climate. Second, their sample included more urban participants with better access to facilities. Third, seasonal variation in data collection may have influenced perceptions of weather as a barrier. Our study included both urban and rural participants across all seasons over 28 months, capturing more variation in environmental conditions.

Participants in the qualitative phase described their experiences during pregnancy, which encompassed individual and physical challenges, lack of knowledge, socio-cultural conflicts, and environmental constraints. Overall,

the qualitative findings supported the general pattern observed in the quantitative phase, highlighting that pregnant woman face multidimensional barriers to physical activity. Analysis of their experiences revealed one overarching theme, “Multidimensional Barriers to Physical Activity during Pregnancy,” comprising four categories: intrapersonal barriers, knowledge and communication gaps, socio-cultural limitations, and structural and environmental barriers. Most of the extracted codes were related to intrapersonal barriers and knowledge and communication gaps, while environmental barriers were mentioned less frequently. However, differences in the prevalence of certain dimensions between the quantitative and qualitative phases should not be interpreted as contradictory; rather, they reflect differences in data collection methods and the specific focus of each phase.

Intrapersonal Barriers

In the qualitative phase, intrapersonal barriers emerged as a primary category, consistent with the quantitative findings, and included three subcategories: physical, psychological–individual, and lifestyle barriers.

The subcategory of physical barriers encompassed various forms of physical discomfort experienced during pregnancy. Consistent with previous studies, intrapersonal barriers including physical discomfort (back pain, fatigue, leg pain), fear of harming the fetus, and lack of pre-pregnancy activity habits were frequently reported by participants (32, 34, 35). Overall, physical

discomfort and pain represent a prevalent and globally recognized barrier to physical activity in pregnancy.

Within the psychological–individual subcategory, common codes included fear of harming the fetus, fear of miscarriage, lack of interest, and low motivation for physical activity. Fear of potential harm to the fetus may be related to limited knowledge and lack of access to information on safe physical activity during pregnancy (36). Similarly, participants in a qualitative study by Kianfard et al. (2022) reported a lack of interest in engaging in physical activity due to concerns about causing irreversible harm to their baby (37). Concerns about the type and safety of physical activity, and fear of injury to oneself or the fetus, are well-documented key barriers (34). In the present study, these fears were particularly pronounced among women with a history of miscarriage or those who had heard of miscarriage or preterm birth from others. This fear appears to be reinforced by the protective attitudes of family members (38). Ahmadi and Amiri-Farahani (2021) similarly reported that most women consistently expressed fear of harming their unborn child through physical activity (39).

Most participants in both the quantitative and qualitative phases reported not having a regular physical activity routine before pregnancy, with lack of pre-pregnancy activity emerging as a key barrier to maintaining exercise during pregnancy. Other studies have also reported that, even before pregnancy, women did not consistently engage in healthy behaviors, such as balanced nutrition, regular physical activity, or walking (18, 40). These findings

highlight the importance for health policymakers to develop programs that encourage an active lifestyle among women of reproductive age, even before pregnancy. Incorporating physical activity education into preconception care and improving access to safe, accessible exercise spaces can help establish healthy habits prior to pregnancy and sustain them during pregnancy (40). Moreover, implementing incentive-based policies and fostering social support can play a key role in reducing barriers and promoting women's engagement in physical activity

Knowledge and Communication Gaps

Another key category identified in the qualitative analysis was knowledge and communication gaps, highlighting insufficient, unreliable, or inaccessible information sources. Many women had a limited understanding of safe and beneficial physical activity during pregnancy, often perceiving routine daily tasks or household chores as sufficient exercise. Participants frequently relied on unreliable sources, including social media, experiences of recently delivered mothers, friends, and acquaintances, which contributed to confusion and uncertainty. This reliance was largely attributed to a lack of guidance from doctors or midwives during prenatal visits, making weak provider communication a critical subcategory. Notably, the lack of access to adequate information about physical activity, which emerged as the most commonly reported interpersonal barrier in the quantitative phase, aligned with these qualitative findings. The convergence of quantitative and

qualitative results highlights the pivotal role of knowledge and communication barriers in limiting physical activity among pregnant women. This finding has a clear implication for healthcare providers: offering brief, accurate counseling on physical activity during routine antenatal visits could reduce women's reliance on unreliable sources and correct common misconceptions.

These findings align with previous studies (18, 41). For instance, a 2017 review found that women often viewed routine daily activities, including household chores, as adequate physical activity and highlighted the lack of guidance and counseling from healthcare professionals (42). In contrast, some studies identified healthcare providers as the primary source of information (43, 44), while others reported that women relied on websites, television, and family (45-47). Nonetheless, most studies highlighted a persistent lack of guidance from healthcare providers (38, 48-50). Prior research has also identified barriers faced by providers in delivering effective counseling, such as limited knowledge, time constraints, and insufficient resources (36). Therefore, enhancing healthcare providers' capacity and support may improve the provision of guidance on physical activity during pregnancy.

Social and Cultural Barriers

The qualitative analysis identified social and cultural barriers as key factors limiting physical activity during pregnancy. Interpersonal barriers included

family and social attitudes, such as concerns about miscarriage, discouragement from exercise, and promotion of inactivity. Spousal support was also limited; partners often restricted physical activity, expressed fears of harm to the mother or fetus, and did not assist with household chores, leaving women with insufficient time, energy, and safety to engage in exercise. Maternal responsibilities further constrained opportunities for physical activity. One participant stated, “If I find free time, I just sleep because I’m too exhausted.” These combined pressures contribute to low physical activity levels among pregnant women.

The reliance on informal information sources in this study reflects the Iranian cultural context, where family networks and social relationships play a central role in health decisions. Pregnant women often receive advice from mothers, mothers-in-law, and friends who have experienced pregnancy. While these sources are trusted, they may perpetuate outdated or incorrect beliefs (e.g., that physical activity causes miscarriage). Additionally, gender norms in Iran limit women's access to information outside the home, making social media a convenient but often unreliable alternative. Interventions should leverage family networks as channels for accurate information while addressing misconceptions within these networks.

These findings are consistent with previous studies. Similarly, Harrison et al. (2018) reported that lack of family support is a potential barrier to physical activity during pregnancy (34). Prior research has also identified restrictions

imposed by family or social networks as a significant obstacle to engaging in physical activity during pregnancy (18, 37). Kianfard et al. (2022) found that some pregnant women considered the lack of spousal support a major barrier to maintaining physical activity (37). Additionally, studies have shown that pregnant women, especially those with children, face limited opportunities for leisure-time physical activity due to family responsibilities and childcare (42, 51). Other research has indicated that social support from spouses and family members is a predictor of women's participation in physical activity during pregnancy (34, 52). The lack of spousal support reported by participants reflects broader gender dynamics in Iranian families. Traditional gender roles assign domestic responsibilities (cooking, cleaning, childcare) primarily to women, leaving them with limited time and energy for physical activity. Even when women were motivated to exercise, they reported being unable to do so because of household duties. Additionally, some husbands actively prohibited physical activity due to fears of miscarriage or fetal harm. Addressing these barriers requires interventions targeting couples, not just pregnant women. Therefore, educational interventions targeting families and couples may help correct misconceptions and enhance both emotional and practical spousal support, ultimately promoting greater engagement in physical activity among pregnant women.

Structural and Environmental Barriers

Structural and environmental barriers encompassed external factors, such as physical conditions, urban infrastructure, and economic constraints, that influence women's participation in physical activity during pregnancy. Participants experienced these barriers to differing degrees. Within the subcategory of environmental barriers, women most frequently cited adverse weather conditions, such as extreme heat or cold, which limited opportunities for outdoor physical activity. Within the subcategory of environmental barriers, women most commonly reported adverse weather conditions, such as extreme heat or cold, which restricted opportunities for outdoor physical activity. Economic barriers were also prominent, as the costs of participating in exercise programs or accessing suitable facilities posed significant challenges for pregnant women. Consistent with previous studies, lack of appropriate facilities, air pollution, and absence of safe spaces were identified as major barriers to physical activity during pregnancy (14, 18, 53). Additionally, the limited availability of programs specifically designed for pregnant women during leisure time highlights the need for policymakers to promote low-cost activities, such as walking, and to enhance access to safe and affordable exercise spaces, thereby supporting healthy physical activity throughout pregnancy (42).

Individual Determinants of Physical Activity Barriers During Pregnancy

In the quantitative phase of the present study, the relationship between individual characteristics and barriers to physical activity was examined. Maternal age was positively associated with reported barriers, indicating that older women reported more obstacles. In contrast, educational level and employment status were inversely related to barriers, with women who had higher education and those who were employed experiencing fewer barriers to physical activity.

Previous studies on these associations have shown inconsistent results. Some reported a positive relationship between age and physical activity barriers (5), while others found an inverse relationship (41), and some observed no significant association (18). Regarding employment, one study indicated that unemployment was linked to lower adherence to recommendations from the American College of Obstetricians and Gynecologists (ACOG) and the American College of Sports Medicine (ACSM) (54), whereas a 2020 systematic review reported that unemployed women engaged in more physical activity during pregnancy than employed women (41). This heterogeneity may be explained by differences in job type, work environment, working hours, social roles, and the level of family support across different communities.

Regarding educational level, some previous studies reported findings consistent with the present study (10, 41), which could be attributed to higher awareness, better access to information sources, and stronger self-care skills

among more educated women. However, Haakstad et al. (2009) found no association between education level and physical activity in the third trimester (55).

Given these inconsistencies, it appears that individual factors such as education and employment are influential only when considered within an appropriate socio-cultural context and alongside family and environmental support. Differences in measurement tools for physical activity barriers, demographic characteristics of the participants, definitions of employment (full-time/part-time/informal), and the types of physical activity assessed may also account for the discrepancies in findings. Therefore, the interpretation of these variables should take into account the cultural, economic, and healthcare system context of each population.

Interpretation of Results

The apparent difference between quantitative and qualitative findings regarding environmental versus intrapersonal barriers reflects the complementary nature of the two methods. Quantitative data were derived from a larger sample (n=351) and captured population-level frequency, where environmental barriers (e.g., weather, lack of facilities) were reported most consistently. However, qualitative participants were purposively selected from those with the highest barrier scores (BPAPS ≥97), and open-ended interviews allowed them to elaborate on barriers that were most emotionally disruptive, such as fear of miscarriage and lack of motivation.

Thus, environmental barriers are more prevalent at the population level, but intrapersonal barriers are more salient in women's lived experiences. These findings are complementary, not contradictory.

Strengths and limitations

This study employed a sequential explanatory mixed-methods design, which enhanced the accuracy and depth of the findings in identifying barriers to physical activity. Conducting the quantitative phase allowed for the identification of general patterns of barriers, while the subsequent qualitative phase provided a deeper understanding and explanation of these findings, enabling a multilayered and realistic comprehension of the issue. Another strength of the study was the purposeful selection of participants for the qualitative phase; selecting individuals with higher barrier scores from the quantitative phase ensured rich data and increased the likelihood of capturing a diverse range of barriers. Additionally, the use of semi-structured interviews, meticulous coding, repeated code reviews, and application of Enworo’s (2023) criteria to ensure data validity and trustworthiness strengthened the quality of the qualitative phase. Despite its strengths, this study has several limitations. First, small subgroup sample sizes—especially regarding employment status—led to wide confidence intervals, so those findings should be interpreted cautiously. Larger, more diverse samples are needed for more precise estimates. Second, convenience sampling and the limited geographic and cultural scope (only Babol University-affiliated

clinics) reduce generalizability to broader populations of pregnant women in Iran or elsewhere. Third, self-reported data may have introduced social desirability or recall bias. Fourth, in the qualitative phase, although data saturation was reached after ten interviews, some uncommon barriers might have been missed. Fifth, variability in interview settings (clinic vs. home) could have affected participants' responses. Sixth, the cross-sectional design of the quantitative phase prevents causal inferences. Finally, the BPAPS scale, though validated, may not capture all culturally specific barriers relevant to Iranian pregnant women.

Future research is recommended to adopt multicenter designs with larger and more diverse samples and to examine changes in barriers across different trimesters of pregnancy. Developing multidimensional interventions that consider diverse cultural, social, and economic contexts may significantly help reduce barriers to physical activity and promote an active lifestyle among pregnant women.

Conclusions

While environmental barriers were identified as the most frequently reported barrier in the quantitative phase, the qualitative findings highlighted intrapersonal barriers and knowledge/communication gaps as particularly salient in women's detailed narratives. This difference reflects the complementary nature of the mixed-methods approach, rather than a discrepancy: quantitative data, derived from a larger sample, emphasize

population-level trends, whereas qualitative data provide in-depth insights into aspects of women's experiences that may not appear prominent at the population level.

Overall, integrating quantitative and qualitative approaches suggests that barriers to physical activity during pregnancy are multilayered, with environmental, intrapersonal, economic, and communication factors potentially interacting to shape women's behaviors. From a public health policy perspective, our findings support three actionable recommendations: (a) incorporating physical activity self-efficacy training into preconception and prenatal care; (b) improving infrastructure by establishing accessible, female-only exercise facilities; and (c) requiring healthcare providers to offer standardized physical activity counseling during each antenatal visit, supported by adequate training and resources.

List of abbreviations

PPAQ: Pregnancy Physical Activity Questionnaire

BPAPS: Barriers to Physical Activity during Pregnancy Scale

ACOG: American College of Obstetricians and Gynecologists

ICC: Intraclass Correlation Coefficient

CI: Confidence Intervals

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Babol University of Medical Sciences (Approval Code: IR.MUBABOL.HRI.REC.1401.238). The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. All participants in both the quantitative and qualitative phases were informed about the purpose of the study, assured of confidentiality, and provided written informed consent prior to participation. Participation was voluntary, and respondents could withdraw at any time without consequence.

Consent for publication

Not applicable.

Availability of data and materials

Study datasets are accessible from the corresponding author on reasonable request.

Competing interests

The authors declared no conflict of interest.

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Authors' contributions

Conceptualization and study design: F.B, R.F & L.AF, Quantitative data collection: RF & SN, Quantitative Analysis: HA.N, R.F & F.B, Qualitive data collection and analysis: F.B & R.F, Method integration and interpretation of finding: F.B, R.F & HA.N, Drafting the original manuscript: F.B, R.F & A.O, Critical revision, editing of the manuscript and Final approval of the submitted version: All authors.

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