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Risk of falls, fear of falling, and associated factors during pregnancy: a cross-sectional study

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Abstract

Aim and objectives This research aims to determine women's risk of falls, fear of falling, and associated factors during pregnancy.

Methods This community-based, cross-sectional study was conducted in Türkiye between September 2023 and March 2024 to determine women's risk of falls, fear of falling, and associated factors during pregnancy. A total of 1,382 pregnant women aged 18 years and older were recruited using convenience and snowball sampling methods. In the first stage, pregnant women who met the eligibility criteria were invited to participate in the study from the researcher's personal network. An online survey link was shared with participants, and they were encouraged to forward the survey to other pregnant women in their networks. No restrictions were imposed based on gestational age (weeks). Data were collected using an intake form, the Pregnancy Falls Risk Assessment Scale (PFRAS), and the Modified Falls Efficacy Scale (MFES). Statistical analyses were performed using IBM SPSS Statistics version 25.0. Descriptive statistics, Spearman correlation, multivariable linear regression analyses were performed.

Results A statistically significant, negative, and low level of correlation was determined between PFRAS scores and MFES scores ($r = -0.165$; $p < 0.001$). In addition, a statistically significant, positive, and weak relationship was determined between PFRAS scores and the number of pregnancies ($r = 0.111$; $p < 0.001$), weight gained during pregnancy ($r = 0.242$; $p < 0.001$) and body mass index values ($r = 0.142$; $p < 0.001$); and a statistically significant, negative, and weak relationship was determined between MFES scores and weight gained during pregnancy ($r = -0.113$; $p < 0.001$). In the regression analysis, unintended pregnancy ($\beta = 0.057$, $p < 0.05$) and increased weight gain during pregnancy ($\beta = 0.202$, $p < 0.001$) were associated with higher PFRAS scores, indicating a greater risk of falls. Conversely, the absence of a history of miscarriage or stillbirth ($\beta = -0.083$, $p < 0.05$), the absence of a history of falls ($\beta = -0.085$, $p < 0.05$), and higher MFES scores ($\beta = -0.127$, $p < 0.001$) were associated with lower PFRAS scores. For MFES scores, extended family type ($\beta = -0.065$, $p < 0.05$) and higher PFRAS scores ($\beta = -0.132$, $p < 0.001$) were associated with lower MFES scores, reflecting decreased fall-related self-efficacy. In contrast, treatment-unaided conception ($\beta = 0.056$, $p < 0.05$) was associated with higher MFES scores.

Conclusions Determining and managing fall risks and fear of falling during pregnancy is essential for ensuring maternal safety. Nurses and midwives play a key role in identifying these risks, implementing preventive strategies,

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and raising women's awareness about fall prevention. It is recommended that systematic fall risk assessments be integrated into routine prenatal care to enable timely and individualized interventions, enhance maternal safety, and reduce healthcare burdens associated with fall-related complications.

Trial registration Not applicable.

Keywords Risk of falls, Fear of falling, Pregnancy process

Introduction

Pregnancy induces a variety of changes in the female body, including hormonal shifts, anatomical adaptations, and physiological transformations. Some of the notable physiological changes during pregnancy include substantial weight gain—particularly in the third trimester—greater ligament laxity due to the influence of relaxin, as well as reductions in both neuromuscular control and abdominal muscle strength [1]. These changes may enhance the risk of falls during pregnancy. It was reported that mental changes such as anxiety, depression, fatigue, and difficulty in concentrating in addition to physical changes also increased the risk of falls [2, 3]. Other factors that increase the risk of falls include unwanted pregnancies and increased gestational age (weeks) [4]. However, health-related quality of life is more negative in pregnant women with a history of falls. Therefore, it was found that pregnant women who were psychosomatically affected and had a lower perception of quality of life were more prone to falls [3].

Studies indicated that the frequency of falls during pregnancy varied between 12.7 and 27% [1, 4, 5]. In the study by Drabiščáková and Hederlingová (2022), % 12.7 of pregnant women experienced a fall during pregnancy, whereas Dunning et al. (2003) reported a higher rate of % 26.8 [1, 5]. Falls represent the most frequently reported type of trauma during pregnancy, accounting for approximately 25% of cases [6]. Research conducted in Turkey reveals a much higher rate (54.9%) [7]. Additionally, the incidence of falls during pregnancy is higher than in non-pregnant women of the same age [1, 8]. Falls during pregnancy are the leading cause of minor injuries (e.g. bruises, abrasions, etc.) and the second most common cause of trauma requiring hospitalization immediately after motor vehicle accidents [9]. Traumas sustained during pregnancy have been increasingly recognized as the primary cause of maternal deaths unrelated to obstetric conditions [10].

While falls during pregnancy can lead to contusions, sprains, bone fractures, and many other traumatic complications, it can also lead to obstetric complications such as abortion, premature birth, premature rupture of the membrane, premature separation of the placenta, uterine rupture, stillbirth, or maternal death [11]. Maternal deaths may result from rupture or bleeding of internal organs as a result of head trauma, shock, or a fall [12, 13]. In addition, in case of the hospitalization of a pregnant woman, treatment costs increase, the woman's quality of life decreases, and the woman and her family experience anxiety and fear as a result of the fall [14]. Research stated the association of post-traumatic stress during pregnancy to stress and depression in the postpartum period [15].

A history of falls and the associated risk often lead individuals to limit their voluntary movements due to fear of falling again [16]. When health deteriorates, a person's confidence in safely performing daily activities—known as fall-related self-efficacy—may decline [17]. Moreover, psychological effects linked to falls, such as reduced self-efficacy, have been shown to contribute to repeated falls, balance difficulties, depressive symptoms, restricted daily functioning, decreased physical activity, negative health perceptions, loss of independence, and lowered self-confidence [16, 18].

It is very important to limit falls and related complications that may occur during pregnancy [12]. Identifying pregnant women with a high risk of falls and fear of falling can help, by taking the necessary protective measures, to reduce falls and fear of falling during pregnancy [8]. Falls during pregnancy can lead to a range of serious maternal and fetal outcomes. However, there is a lack of research that evaluates fall risk in pregnant women through an assessment tool specifically designed for pregnancy, while also incorporating measures of fear of falling. In response to this gap, the present study evaluates fall risk scores across different trimesters and explores modifiable factors influencing both fall risk and fear of falling. The results offer valuable insights for clinical practice and public health, supporting targeted prevention, timely interventions, and strategies aimed at enhancing maternal–fetal safety. Accordingly, the main purpose of this study was to assess fall risk, fear of falling, and related factors among pregnant women.

Methods

Study aims and objectives

This study aimed to determine women's risk of falls, fear of falling, and associated factors during pregnancy. The following research questions were addressed:

1. Is there a relationship between women's risk of falls and fear of falling during pregnancy?

2. Is there an association between women's sociodemographic factors and their risk of experiencing falls during pregnancy?
3. Does women's sociodemographic profile correlate with their fear of falling throughout pregnancy?

Setting and participants

This community-based, cross-sectional study was conducted in Türkiye between September 2023 and March 2024. A total of 1,382 pregnant women aged 18 years and older were recruited using convenience and snowball sampling methods. Initially, eligible participants were invited through the researcher's personal network. The online survey link was distributed via individual communication channels such as e-mail, WhatsApp, and other personal messaging platforms. To enhance participant reach, individuals were also encouraged to share the link within their own social networks. This strategy enabled the recruitment of a diverse and geographically dispersed sample of pregnant women. No restrictions were applied regarding gestational age (weeks) at the time of participation. All data collection procedures were conducted online, ensuring broad accessibility and participant convenience. At the beginning of the survey, participants were presented with an informed consent form, and participation in the study was entirely voluntary. In the research, pregnant women who met the inclusion criteria were over the age of 18, literate, able to understand and complete the online questionnaire, and agreed to participate in the study.

A total of 1,496 individuals accessed the online questionnaire. Of these, 114 responses were excluded for the following reasons: 48 participants were under the age of 18, 11 reported not being currently pregnant, and 55 had incomplete or missing responses. After these exclusions, 1,382 complete responses were retained for analysis. Only participants who met all inclusion criteria and completed the entire questionnaire were included. As a result, there were no item-level missing data within the retained records. All incomplete responses were excluded using listwise deletion, and no imputation was performed.

Based on our expectations prior to the study, a sample size calculation was performed assuming a low correlation coefficient ($r = 0.10$). According to the power analysis conducted under this assumption, a sample of 1,043 participants was estimated to provide 90% power at a 95% confidence level. Ultimately, a total of 1,382 volunteers were included in the study. For the correlation analyses, the correlation coefficient obtained between the PFRAS and MFES scores was $r = -0.165$, indicating that the study achieved 99.9% power at a 95% confidence level for this effect size. For the multivariate regression models, which included 13 predictors for PFRAS ($R^2 = 0.105$) and 5 predictors for MFES ($R^2 = 0.044$), approximately 100% power was achieved at a 95% confidence level for both models. As this study is primarily exploratory, these statements are provided for transparency and descriptive purposes, rather than to emphasize post-hoc power.

Data collection tools

Introductory form

The form was designed to collect information about the sociodemographic characteristics of the participants [3, 8, 12]. It contains a total of 16 questions: 6 questions regarding sociodemographic data such as age, education level, employment status, and family type; 5 questions related to pregnancy, including gestational age (weeks), number of pregnancies, and pregnancy intention; and 5 questions concerning factors potentially related to fear of falling and risk of falls during pregnancy, including history of falling during pregnancy, miscarriage, and self-reported height and weight. The researchers used the reported height and weight to calculate Body Mass Index (BMI).

Pregnancy Fall Risk Assessment Scale (PFRAS)

The Pregnant Women's Fall Risk Assessment Scale (PFRAS) was developed by Koç and Hotun Şahin (2022) to evaluate fall risk specifically in pregnant populations. The scale includes a total of 42 items, each scored as "Yes" = 1 and "No" = 0, based on the presence of relevant fall risk factors. Items 34 and 35 are reverse-coded and must be recoded prior to computing the total score—i.e., for these items, "Yes" = 0 and "No" = 1. Following the recoding, the scores from all items are summed to yield the total scale score, which ranges from 0 to 42. Higher scores indicate a greater risk of falling during pregnancy. The original scale reported a Cronbach's alpha of 0.604 [12].

Modified Falls Efficacy Scale (MFES)

The fear of falling was measured using the Modified Falls Efficacy Scale (MFES), which was developed by Hill et al. (1996) by extending the original scale with the addition of four more complex daily activities [19]. The Turkish version of the scale was adapted and validated by Korkmaz et al. (2019), and its reliability and validity have been confirmed in Turkish populations [16]. The Modified Falls Efficacy Scale (MFES) is an expanded form of the original Fall Activity Scale, incorporating items that assess confidence in four distinct outdoor activities. In total, the MFES includes 14 items—10 related to indoor activities and 4 to outdoor ones—designed to evaluate an individual's confidence in completing various daily tasks. Each item is rated on a scale from 0 (no confidence) to 10 (complete confidence), reflecting the participant's fall-related self-efficacy. Higher overall scores indicate greater

self-efficacy in performing everyday activities. The Turkish MFES reported a Cronbach's alpha of 0.97 [16].

Data analysis

All data analyses were performed utilizing SPSS 25.0 (IBM Corp., Armonk, NY). Continuous variables are reported as means with standard deviations and medians alongside interquartile ranges (25th to 75th percentiles). Categorical variables are summarized using frequency counts and percentages. The Spearman Correlation Coefficient was used for relations between continuous variables. We used univariate and multivariable linear regression models to investigate the effects of independent variables on dependent scales. Given the large sample size (n = 1,382), linear regression analyses were conducted to examine the effects of independent variables on the dependent variables. While nonparametric alternatives exist for correlations, no exact nonparametric equivalent for multivariate linear regression is available. The use of linear regression is justified by the central limit theorem, which ensures that with sufficiently large sample sizes, the sampling distribution of the mean approaches normality, supporting the validity of parametric tests. Results from Spearman correlation analyses were consistent with the univariate regression findings, further supporting the robustness of this approach [20].

For both dependent variables (PFRAS total and MFES total), all independent variables were first examined in univariate analyses. A p-value threshold of 0.05 was applied, and all independent variables with $p < 0.05$ were subsequently entered into the multivariate model.

To assess multicollinearity, Variance Inflation Factor (VIF) values were examined for all predictors. Since none of the independent variables had a VIF value greater than 10, no multicollinearity issue was detected, and all variables were retained in the multivariate model [21].

Results

The average age of the pregnant women participating in the study was 27.65 ± 5.3 years and 51.8% were university graduates. An average of 5.99 ± 5.07 kg were gained during pregnancy, and the body mass index was 25.4 ± 4.24 kg/m². Among the participants, 12.2% reported a previous history of miscarriage or stillbirth, 8.5% had experienced a fall prior to the current pregnancy, and 56.4% reported at least one fall during the current pregnancy. Other sociodemographic and pregnancy-related characteristics are presented in Table 1.

Table 2 shows the distribution of the average scores of pregnant women from the Pregnancy Fall Risk Assessment Scale (PFRAS) and Modified Falls Efficacy Scale (MFES). Higher PFRAS scores indicate a greater risk of falling during pregnancy, whereas higher MFES scores indicate greater self-efficacy in performing everyday activities. The average PFRAS total score of the pregnant women was found 9.51 ± 5.13, and the average MFES total score was found 97.73 ± 27.31. The internal consistency analysis showed that the PFRAS demonstrated acceptable reliability (α = 0.75), while the MFES exhibited excellent reliability (α = 0.92). No items were removed from either scale during the analysis.

On examination of Table 3, a statistically significant, negative, and low level of correlation was observed between PFRAS scores and MFES scores (r = -0.165, $p < 0.001$). In addition, a statistically significant, positive, and weak relationship was determined between PFRAS scores and the number of pregnancies ($r = 0.111$; $p < 0.001$), weight gained during pregnancy ($r = 0.242$; $p < 0.001$), and body mass index values ($r = 0.142$; $p < 0.001$). A statistically significant, negative, and weak relationship was observed between MFES scores and weight gain during pregnancy (r = -0.113; $p < 0.001$) (Table 3).

Before presenting the regression results, it should be noted that higher PFRAS scores reflect greater fall risk, whereas higher MFES scores reflect greater self-efficacy. Table 4 examined the factors significantly affecting PFRAS scores; univariate analyses showed that higher education level ($p < 0.001$), being employed ($p < 0.05$), higher monthly income level ($p < 0.05$), treatment-unaided conception ($p < 0.05$), lack of previous history of miscarriage or stillbirth ($p < 0.001$), lack of previous history of falls ($p < 0.001$), and higher MFES scores ($p < 0.001$) were associated with decreased PFRAS scores. In addition, having an extended family type ($p < 0.05$), a higher number of pregnancies ($p < 0.001$), greater gestational age (weeks) ($p < 0.001$), unintended pregnancy ($p < 0.05$), increased weight gain during pregnancy ($p < 0.001$), and higher body mass index ($p < 0.001$) were associated with higher PFRAS scores. In the multivariate model including all these significant factors, unintended pregnancy ($p < 0.05$) and increased weight gain during pregnancy ($p < 0.001$) were associated with higher PFRAS scores, whereas the absence of a history of miscarriage or stillbirth ($p < 0.05$), the absence of a history of falls ($p < 0.05$), and higher MFES scores ($p < 0.001$) were associated with lower PFRAS scores.

On examination of factors associated with MFES scores, univariate analyses indicated that extended family type ($p < 0.05$), higher number of pregnancies ($p < 0.05$), increased weight gain during pregnancy ($p < 0.05$), and higher PFRAS scores ($p < 0.001$) were significantly associated with lower MFES scores. Treatment-unaided conception was significantly associated with higher MFES scores ($p < 0.05$). In the multivariate model including all significant factors, extended family type ($p < 0.05$) and higher PFRAS scores ($p < 0.001$) remained associated with lower MFES scores, while treatment-unaided

Table 1 Distribution of introductory characteristics of pregnant women ($n = 1382$)

		Mean ± SD	Med (IQR)	min - max
Age (years)		27.65 ± 5.3	27 (24–30)	18–57
			n	%
Educational status	Primary School		145	10.5
	High School		465	33.6
	Undergraduate		716	51.8
	Postgraduate		56	4.1
Employment status	Unemployed		906	65.6
	Employed		476	34.4
		Mean ± SD	Med (IQR)	min - max
Working hours per day (if employed, hours)		8.2 ± 1.46	8 (8–8.75)	4–16
			n	%
Family type	Nuclear		1188	86.0
	Extended		194	14.0
Monthly income	Income below expenses		282	20.4
	Income equal to expenses		754	54.6
	Income over expenses		346	25.0
Gestational age (weeks)	0–14		451	32.6
	15–28		520	37.6
	29–42		411	29.7
Intended pregnancy	Intended		1002	72.5
	Unintended		380	27.5
Treatment-aided conception	Yes		95	6.9
	No		1287	93.1
		Mean ± SD	Med (IQR)	min - max
Number of pregnancies		-	1 (1–2)	1–9
Weight gained during pregnancy (kg)		5.99 ± 5.07	5 (2–9)	-16–30
Body mass index (BMI, kg/m^2)		25.4 ± 4.24	24.9 (22.38–27.7)	15.4–50.6
			n	%
History of miscarriage or stillbirth	Yes		169	12.2
	No		1213	87.8
History of falls (before pregnancy)	Yes		117	8.5
	No		1265	91.5
Falls during current pregnancy	Yes		66	56.4
	No		51	43.6

S.D: Standard deviation; Med (IQR): Median (25th and 75th percentiles); min-max: Minimum-maximum values

Table 2 Descriptive statistics and reliability coefficients of the PFRAS and MFES total scores

	Mean ± SD	Med (IQR)	min - max	Cronbach's α
PFRAS total	9.51 ± 5.13	9 (6–13)	0–42	0.75
MFES total	97.73 ± 27.31	100 (79–120)	0–140	0.92

S.D: Standard deviation; Med (IQR): Median (25th and 75th percentiles); min-max: Minimum-maximum values; MFES: Modified Falls Efficacy Scale; PFRAS: Pregnancy Fall Risk Assessment Scale

conception ($p < 0.05$) remained associated with higher MFES scores (Table 4).

Discussion

This study explored the risk of falls, fear of falling, and related factors among pregnant women. Understanding these aspects is crucial, as pregnancy involves multiple physiological and biomechanical changes that may compromise postural stability and increase fall risk [4]. The following discussion interprets our findings in light of these mechanisms and compares them with existing literature.

In our study, the risk of falling and fear of falling during pregnancy were assessed using the PFRAS and MFES scales. The findings indicate that pregnant women generally experience moderate fall risk while maintaining relatively high confidence in performing daily activities.

Anxiety and fears that result from the concern of falling and restrict daily life activities are described as fear of falling. While several studies have assessed fall risk using general instruments, there is limited evidence specifically evaluating fall risk with pregnancy-specific tools, highlighting the need for further research in this area [8, 22, 23]. Our research will contribute to the literature in this aspect. Following the presentation of these findings, the factors affecting fall risk were examined.

Table 3 Correlations between introductory characteristics and total scores of the PFRAS and MFES

Variables		PFRAS total	MFES total
PFRAS total	r	1.000	-0.165*
	p		< 0.001
Age (Years)	r	-0.009	0.018
	p	0.747	0.499
Working hours per day (if employed, hours)	r	0.001	-0.012
	p	0.988	0.790
Number of pregnancies	r	0.111*	-0.019
	p	< 0.001	0.479
Pre-pregnancy weight (kg)	r	0.047	0.006
	p	0.082	0.813
Weight gained during pregnancy (kg)	r	0.242*	-0.113*
	p	< 0.001	< 0.001
Body mass index (BMI, kg/m^2)	r	0.142*	0.012
	p	< 0.001	0.668

*$p < 0.05$ statistically significant correlation; r: Spearman's correlation coefficient

Our study supports the literature results that the lack of previous history of miscarriage, stillbirth, or falls increases the risk of falls. Higher MFES scores were determined to have a significantly decreasing effect on PFRAS scores. Although correlations between PFRAS and MFES scores and several variables were statistically significant, all correlation coefficients were below 0.25, indicating weak associations. Therefore, while these findings reached statistical significance due to the relatively large sample size, their clinical significance may be limited. Nevertheless, the subsequent univariate and multivariate regression analyses provided more robust insight into factors affecting fall risk, highlighting variables with clinically meaningful impact.

Findings indicate that, extended family type, a higher number of pregnancies, greater gestational age (weeks), unintended pregnancy, increased weight gain during pregnancy, and higher body mass index were associated with higher fall risk during pregnancy. Awoleke's research (2019) reported that maternal age, unintended pregnancy, multiparity, and labor time below 40 weeks increase the risk of falls [24]. Given these social and demographic risk factors, multidisciplinary care approaches should include social support assessments. Pregnant women with extended family responsibilities or multiple children may benefit from counseling and assistance to reduce physical strain and fall risk.

Analysis revealed that, as gestational age (weeks) advanced, notable shifts in the center of pressure during the second and third trimesters were associated with increased PFRAS scores. Consistent with our findings, previous research examining dynamic postural stability and fall risk throughout pregnancy reported reduced stability and higher fall risk test results in the third trimester compared to the first and second trimesters [24–26]. Çakmak et al. reported that fall risk test scores increased during the second and third trimesters compared to the first trimester, with the highest scores observed in the third trimester [8, 27]. The increased risk of falls with the progression of pregnancy can be explained by musculoskeletal changes and weight gain that become more evident as pregnancy progresses. An increase in abdominal circumference can lead to dysfunction of deep and superficial muscles, which is associated with an increased likelihood of decreased maintenance of posture stability [4]. These findings emphasize the need for trimester-specific interventions. Healthcare providers should encourage and guide pregnant women to engage in safe exercises that target core muscle strength and balance, particularly as pregnancy advances. Moreover, routine fall risk screening in prenatal visits could help to detect deterioration in postural stability early.

It was reported that most falls occurred in the third trimester and approximately 10% of women fell at least three times [25, 28]. The risk of falls increases as the pregnant woman's center of gravity changes with the increase in weight gain. Studies also reported that health problems such as gestational diabetes, hypertension, and preeclampsia, which increase the risk of falls in pregnant women, are more common in overweight and obese women during pregnancy [8, 27]. Studies indicated more frequent traumas in pregnant women in the third trimester compared to the first and second trimesters [8, 29]. Increased weight gain in the third trimester was associated with higher PFRAS scores. From a clinical perspective, these associations suggest that pregnant women with comorbidities and higher BMI may benefit from closer monitoring and targeted education on fall prevention and lifestyle modifications to manage weight gain and improve safety.

According to our research, women who have given birth to more than one child were found to have higher PFRAS scores, indicating an association with increased fall risk during pregnancy. Women with multiple children often have more domestic responsibilities, which may be related to their higher fall risk. The results of our research support the fact that the more children pregnant women have, the more domestic difficulties and responsibilities they have, and the more the risk of falls is. This social dimension underlines the importance of including family-centered counseling and support services in prenatal care. Practical assistance and guidance for managing household tasks safely could reduce fall risks in multiparous women. Unintended pregnancies are among the risk factors affecting falls in our research, as in the literature [24]. Unintended pregnancies are associated with poor health-seeking behaviors and adverse pregnancy outcomes [4, 24]. The reason why the mother easily puts herself in danger is considered to be due to

Table 4 Univariate and multivariate regression analyses for PFRAS and MFES total scores

		Univariate Analysis					Multivariate Analysis					
Dependent	**Independent**	**β**	**t**	***p***	**95% CI Lower**	**95% CI Upper**	**β**	**t**	***p***	**95% CI Lower**	**95% CI Upper**	**VIF**
PFRAS total	Age (years) (↑)	-0.008	-0.291	0.771	-0.059	0.044	-	-	-	-	-	
	Educational status (↑)	-0.104	-3.885	< 0.001*	-1.092	-0.359	-0.050	-1.729	0.084	-0.738	0.046	1.254
	Employment status (Employed; ref: Not employed)	-0.063	-2.339	0.019*	-1.248	-0.109	-0.027	-1.005	0.315	-0.865	0.279	1.113
	Working hours per day (if employed, hours) (↑)	-0.009	-0.190	0.849	-0.331	0.272	-	-	-	-	-	
	Family type (Extended; ref: Nuclear)	0.055	2.052	0.04*	0.036	1.594	0.012	0.462	0.644	-0.590	0.953	1.082
	Monthly income? (↑)	-0.057	-2.109	0.035*	-0.835	-0.030	-0.031	-1.186	0.236	-0.622	0.153	1.025
	Number of pregnancies (↑)	0.113	4.242	< 0.001*	0.332	0.903	0.010	0.333	0.739	-0.267	0.377	1.389
	Gestational age (weeks) (↑)	0.164	6.185	< 0.001*	0.729	1.406	0.034	1.076	0.282	-0.183	0.629	1.550
	Intended pregnancy (Unintended; ref: Intended)	0.071	2.644	0.008*	0.211	1.421	0.057	2.142	0.032*	0.055	1.259	1.089
	Treatment-aided conception (Unaided; ref: Aided)	-0.058	-2.156	0.031*	-2.244	-0.106	-0.025	-0.963	0.336	-1.560	0.533	1.057
	Weight gained during pregnancy (kg) (↑)	0.216	8.209	< 0.001*	0.166	0.271	0.202	4.864	< 0.001*	0.122	0.287	2.626
	Body mass index (BMI, kg/m^2) (↑)	0.136	5.105	< 0.001*	0.101	0.228	-0.048	-0.748	0.455	-0.212	0.095	6.397
	History of miscarriage or stillbirth (No; ref: yes)	-0.135	-5.059	< 0.001*	-2.933	-1.294	-0.083	-2.860	0.004*	-2.200	-0.410	1.296
	History of falls (before pregnancy) (No; ref: yes)	-0.132	-4.932	< 0.001*	-3.391	-1.461	-0.085	-3.090	0.002*	-2.574	-0.575	1.168
	Falls during current pregnancy (No; ref: yes)	-0.132	-1.424	0.157	-3.495	0.572	-	-	-	-	-	
	MFES total (↑)	-0.155	-5.814	< 0.001*	-0.039	-0.019	-0.127	-4.890	< 0.001*	-0.034	-0.014	1.035
MFES total	Age (years) (↑)	-0.004	-0.160	0.873	-0.294	0.250	-	-	-	-	-	
	Educational status (↑)	0.048	1.780	0.075	-0.181	3.734	-	-	-	-	-	
	Employment status (Employed; ref: Not employed)	0.016	0.584	0.559	-2.130	3.936	-	-	-	-	-	
	Working hours per day (if employed, hours) (↑)	0.008	0.165	0.869	-1.529	1.809	-	-	-	-	-	
	Family type (Extended; ref: Nuclear)	-0.083	-3.076	0.002*	-10.620	-2.350	-0.065	-2.405	0.016*	-9.277	-0.942	1.051
	Monthly income (↑)	0.015	0.566	0.572	-1.525	2.761	-	-	-	-	-	
	Number of pregnancies (↑)	-0.059	-2.201	0.028*	-3.239	-0.186	-0.025	-0.933	0.351	-2.278	0.810	1.062
	Gestational age (weeks) (↑)	-0.033	-1.209	0.227	-2.951	0.700	-	-	-	-	-	
	Intended pregnancy (Unintended; ref: Intended)	-0.048	-1.796	0.073	-6.176	0.273	-	-	-	-	-	
	Treatment-aided conception (Unaided; ref: Aided)	0.064	2.365	0.018*	1.168	12.539	0.056	2.100	0.036*	0.394	11.590	1.006
	Weight gained during pregnancy (kg) (↑)	-0.081	-3.038	0.002*	-0.723	-0.156	-0.045	-1.657	0.098	-0.528	0.044	1.052
	Body mass index (BMI, kg/m^2) (↑)	0.016	0.606	0.544	-0.235	0.445	-	-	-	-	-	
	History of falls (before pregnancy) (No; ref: yes)	-0.002	-0.068	0.946	-4.553	4.246	-	-	-	-	-	
	Falls during current pregnancy (No; ref: yes)	0.013	0.486	0.627	-3.895	6.460	-	-	-	-	-	
	Falls during current pregnancy No; ref: yes)	-0.071	-0.761	0.448	-13.569	6.038	-	-	-	-	-	
	PFRAS total (↑)	-0.155	-5.814	< 0.001*	-1.100	-0.545	-0.132	-4.868	< 0.001*	-0.988	-0.421	1.064

*$p < .05$ statistically significant correlation; β: Standardized beta coefficient; CI: Confidence Interval; ↑: Indicates an increase in the respective variable." For PFRAS total model R^2=0,105 and For MFES total model R^2=0,044. Effect estimates (β), 95% confidence intervals, and p-values are shown. Variables with $p < 0.05$ in univariate analyses were included in the multivariate model. Variance Inflation Factor (VIF) values were examined to assess multicollinearity

her lack of effort to exhibit healthy behavior. Healthcare providers should prioritize counseling and education for women with unintended pregnancies to encourage proactive health behaviors and awareness about fall risk, potentially integrating fall prevention advice into broader prenatal health promotion.

Fear of falling is a crucial psychological factor that may itself increase fall risk by limiting mobility and activity levels [30]. Integrating psychological assessment and support in prenatal care can help address this fear, encouraging safe activity and improving overall well-being. Fear of falling can serve as a protective mechanism by encouraging caution and preventing injuries. However, when the fear of falling becomes excessive and leads to anxiety, it can cause a decrease in self-confidence and avoidance of physical and social activities, thereby initiating a vicious cycle in which physical inactivity leads to muscle weakness and increased fragility, which in turn increases the risk of falling [23, 31]. The result of our research that higher PFRAS scores have a significant decreasing effect on MFES scores supports this information. Our findings that higher self-confidence (reflected in higher MFES scores indicating lower fear) is associated with lower fall risk align with this model and emphasize the beneficial role of moderate levels of fear in maintaining activity and preventing falls. This inverse relationship between fear of falling and fall risk is consistent with previous studies. These studies report that excessive fear of falling is linked to increased fall risk [22, 23, 30, 32]. Additionally, higher PFRAS scores, having an extended family type, and treatment-unaided conception were associated with higher MFES scores, indicating a relationship with increased fear of falling during pregnancy. Factors such as the mother's greater responsibilities in an extended family and the treatment-unaided nature of the pregnancy may be related to this association. These findings suggest that prenatal programs should not only focus on physical health but also consider family dynamics and psychological well-being. Tailored interventions including family education and psychological counseling may reduce fear and improve safety behaviors during pregnancy.

Limitations

This study has several limitations that should be acknowledged. First, anthropometric measurements such as height and weight were self-reported by participants. Although participants were advised to refer to their most recent clinical records or medical documents to enhance accuracy, the inherent reliance on self-reported data introduces potential recall bias and reporting inaccuracies, which may have affected the precision of Body Mass Index (BMI) calculations and subsequent analyses.

Second, it is important to note that weight gain during pregnancy is a natural and expected physiological process. In this study, BMI was calculated based on participants' current height and weight at the time of data collection, which includes gestational weight gain. Therefore, BMI was used as a dynamic measure reflecting the physical status during pregnancy rather than a static pre-pregnancy indicator. This may limit the interpretation of BMI in relation to risk factors, and longitudinal studies are needed to clarify the impact of gestational weight changes. Third, the cross-sectional design of the study restricts the ability to infer causal relationships between variables. The findings represent associations observed at a single time point, and longitudinal studies would be required to establish temporal or causal links.

Finally, the use of convenience and snowball sampling, combined with online data collection, may limit the generalizability of the findings to the broader population of pregnant women. Individuals with limited internet access or lower digital literacy may have been less likely to participate, potentially introducing selection and coverage biases. Despite these limitations, the study provides valuable insights into fall risk and associated factors during pregnancy.

Conclusion

Nurses and midwives should determine the risks of falls of pregnant women and take initiatives regarding the fall risks of pregnant women, evaluate pregnant women's history of falls, risky medications used, physical problems, pregnancy history, and living conditions, and raise women's awareness accordingly. However, due to clinic overcrowding and limited resources, assessing fall risk during prenatal visits may not always be feasible. Therefore, it is recommended that the scales be administered to all pregnant women at least once in early pregnancy and repeated at follow-up visits for pregnant women identified as at risk. This approach will increase effectiveness in terms of applicability and follow-up, ensure that preventive interventions are targeted to at-risk groups, and raise awareness of falls prevention in all pregnant women. In particular, our finding that higher fear of falling scores were significantly associated with higher fall risk scores suggests that addressing fear of falling may be beneficial in managing fall risk. These results highlight the importance of considering psychological well-being alongside physical health during prenatal care. Interventions such as family education and supportive counseling may help pregnant women adopt safer behaviors and enhance maternal and fetal safety.

Abbreviations

PFRAS Pregnancy fall risk assessment scale
MFES Modified falls efficacy scale

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Author contributions
EÖ: Study conception, designed data analysis, wrote of the manuscript, approvedfinal version to be published. AD: Study conception, data analysis, approved final version to be published. MD: Study conception, wrote first draft of the manuscript, approved final version to be published.

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Data availability
The datasets generated and/or analyzed during the current research can be obtained from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The study adhered to the ethical guidelines set forth by the Declaration of Helsinki. Permission for the research was received from the Karabuk University Non-invasive Clinical Research Ethics Committee on 16/5/2023 (numbered 2023/1397). Participants were invited to participate via an electronic form. After clicking the form link, they were directed to an introductory section that provided brief information about the purpose and scope of the study. This section also included a statement of informed consent, and participants were required to confirm their voluntary participation before proceeding. Only those who provided informed consent were able to continue and complete the questionnaires, which were administered in Turkish. The confidentiality of participants' responses was strictly maintained; responses were accessible only through a Google Forms account assigned exclusively to the researchers. Additionally, participants were informed that there would be no financial compensation or cost associated with participation in the study.

Note
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Consent for publication
Not applicable for this study.

Competing interests
The authors declare no competing interests.

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