ORIGINAL ARTICLE

Prevalence and Factors Associated with Preterm Birth in Urban Areas: Case-Control Study

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Abstract

Background: Preterm birth (PTB) is a significant global health issue, with the majority of preterm births occurring in low and middle-income countries (LMICs), including Iran. This study aimed to determine the prevalence of PTB and its associated factors in urban areas of Iran.

Methods: Over one year, this case-control study included 387 pregnant women (129 cases and 258 controls) in Sardashat, Iran. Data were extracted from medical records. Gestational age was estimated through ultrasound in the first trimester. Statistical analyses were performed using logistic regression.

Results: The prevalence of PTB was 7.43%. Multivariable logistic regression analysis revealed a significant association between PTB and the following factors: education levels, antenatal care (ANC) visits [Adjusted Odds Ratio (AOR)=7.91 (95% CI: 2.43–25.71)], premature rupture of membranes (PROM) [AOR=5.25 (95% CI: 2.01–13.74)], gestational diabetes mellitus (GDM) [AOR=5.27 (95% CI: 1.49–18.58)], and preeclampsia [AOR=9.47 (95% CI: 3.02–29.73)].

Conclusion: Identifying pregnant women at risk of preterm birth is crucial, and treatments are available to reduce the risk. Our research suggests that factors such as education level, ANC visits, PROM, GDM, and preeclampsia predispose pregnant women to preterm birth.

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Introduction

Preterm birth (PTB) is defined as the onset of labor before the completion of 37 weeks of gestational age, or 259 days.[1] Globally, PTB accounts for 5-18% of pregnancies;[2] every year, 15 million pregnancies result in PTB.[3] According to the World Health Organization (WHO), one out of every ten babies born is preterm, and one of these babies dies every 40 seconds.[4] Over 65 % of PTBs occur in low- and middle-income countries (LMICs) such as Iran.[4] In 2017, a systematic review and meta-analysis showed PTB as a relatively common issue in Iran.[5] The prevalence of PTB in Iran is 12.9%, ranking 38th out of 184 countries worldwide.[6]

PTB is the leading cause of death in the neonatal period and the second leading cause of mortality in children under five years old.[2] Additionally, it is responsible for a significant burden of long-term disabilities, accounting for 3.1% of all Disability-Adjusted Life Years (DALYs).[7] PTB leads to serious postnatal complications, including hypertension, respiratory issues, and gastrointestinal complications.[7,8] In one-third of preterm infants, PTB results in severe neurological impairments such as cerebral palsy and intellectual disabilities.[2] The risk of adverse health events increases with preterm delivery.[9] Moreover, the impact of these diseases can persist well into adulthood, creating substantial

economic burdens for families, communities, and healthcare systems.[10-12]

Various environmental and socioeconomic factors are associated with susceptibility to PTB.[8, 13, 14] Limited access to medical services, poor nutritional status in rural areas, harmful urban environments, and air pollution are some of the socioeconomic variables linked to the epidemiology of PTB.[13] Recent studies have suggested that neonatal death rates and PTB are higher in rural areas compared to urban areas.[8, 14] A failure to identify high-risk pregnant women has contributed to poor preventive measures and inadequate care for those at risk of preterm birth.[7]

However, the international community has committed to preventing PTB through initiatives such as the Sustainable Development Goals (SDGs) and the "Every Woman Every Child" movement.[15, 16] In alignment with these efforts, the Iranian government has shown dedication to improving neonatal care and reducing the burden of PTBs by implementing life-saving interventions in health centers and hospitals. Despite these efforts, the burden of PTB in Iran remains high.[17]

Despite recognizing contributing factors such as obstetric, biological, genetic, and socioeconomic variables, two-thirds of the risk factors for PTB remain unknown.[3] Immediate action is essential to enhance PTB prevention efforts and provide better care for affected babies and their families.[4] Identifying the associated risk factors and high-risk pregnancies is a crucial step in preventing PTB-related mortality and morbidity, enabling early specialized care for those most at-risk.[9]

Maternal age of 35 years old and above, history of stillbirth, consanguineous marriage, race, irregular menstruation cycle, pregnancy intervals of less than one year,[18] anemia,[1] history of cesarean section, previous PTB, placenta previa, placental abruption, premature rupture of membrane, preeclampsia and cervical insufficiency,[19] have all been associated with preterm delivery in Iran. However, the specific factors associated with PTB in urban areas have yet to be studied. Therefore, the present study aims to determine the prevalence of PTB and its associated factors in urban areas of Iran.

Methods

Study Setting, Design, and Period

This case-control study was conducted over one year in the urban areas of Sardasht City, located in the West Azarbaijan province in Northwest Iran. Data were extracted from the medical records of mothers and infants who participated in the study.

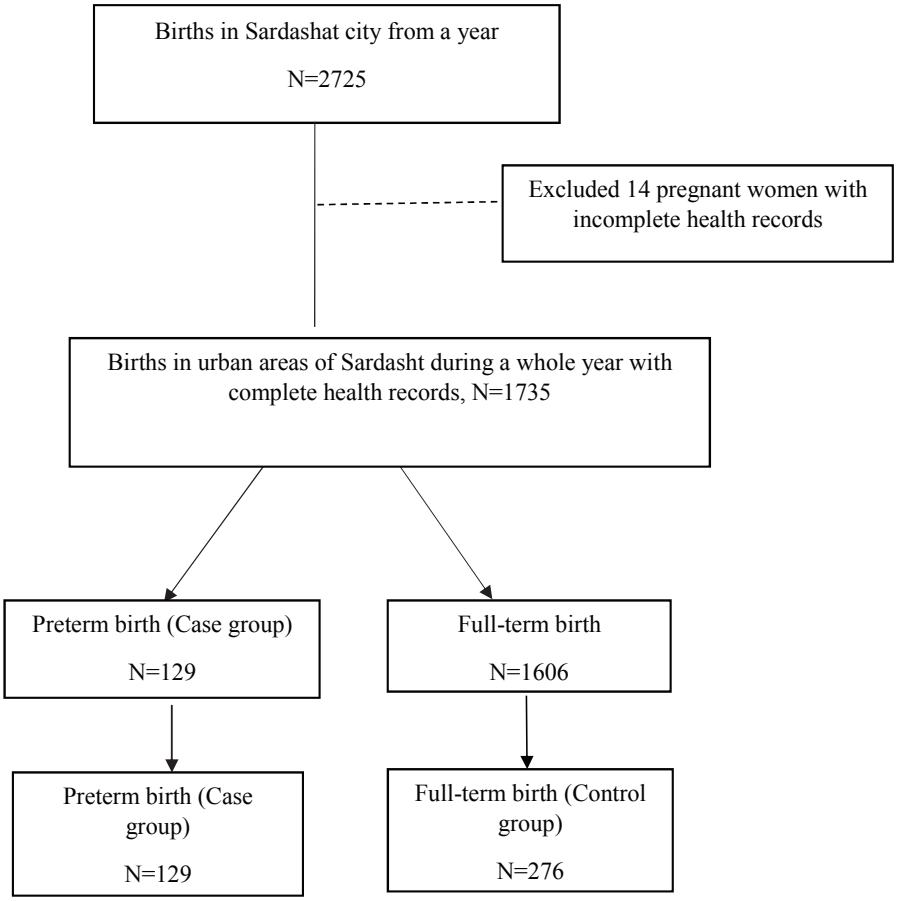

Figure 1: The practical flowchart of sample selection

Sampling Techniques and Procedures

The study included both case and control groups. The case group consisted of all preterm births (defined as births before 37 weeks of gestation) during the study period. The control group was composed of deliveries at or after 37 weeks of gestation, selected randomly with a 2:1 ratio. Data were collected by reviewing medical records. All preterm deliveries in urban areas, including those due to medical reasons, were included in the study. Pregnant women from both the case and control groups had received health and medical care during their pregnancies. Participants with incomplete health records during pregnancy were excluded from the study. (Figure 1).

Data Collection

The study identified all women who gave birth in urban areas of Sardasht City over one year using the health center's administration records. Data were extracted from the medical records of the mothers and infants, including information such as maternal age, education level, occupation, parity, previous cesarean section (C/S), history of abortion, history of low birth weight (LBW), interpregnancy interval, antenatal care (ANC) visits, presence of maternal anemia during the first and/or second trimester, underlying diseases, gestational diabetes mellitus (GDM), preeclampsia, and premature rupture of membranes (PROM) lasting more than 18 hours. A pre-designed checklist was used to extract this information from the medical records. Maternal anemia was a hemoglobin level of <11 g/dl in the first trimester and <10.5 g/dl in the second trimester.

Outcome Measurement

Gestational age at birth was calculated based on the first-trimester ultrasound results. The outcome of birth was categorized as full-term birth (≥37 weeks of gestation) versus preterm birth (PTB) (<37 weeks of gestation).

Data Analysis

The data were analyzed using Stata 10.0. The normality of continuous data was checked using the Kolmogorov-Smirnov test. Descriptive statistics were used to summarize the data, including mean, standard deviation (SD), frequencies, and percentages. Univariable and multivariable logistic regression analyses investigated the association between PTB and various risk factors. A p-value of less than 0.05 was considered statistically significant.

Results

Demographic Characteristics of Study Participants

The mean age of the study participants was 27.22±6.17 years in the case group and 26.38±4.92 years in the control group. The frequency of illiterate women was 12 (9.3%) in the case group and 6 (2.3%) in the control group. The majority of mothers in both the case and control groups were housewives. Table 1 presents the association between demographic characteristics and PTB.

Prevalence of PTB

The prevalence of PTB in urban areas was 7.43% (95% CI: 6.24%-8.77%) (Figure 2).

Previous Pregnancy Characteristics and Antenatal Characteristics

Women with a parity of ≥4 were 5.1 times more likely to experience PTB compared to those with a parity of <4 [COR=5.1, (95% CI: 2.33-11.13)]. The odds of PTB in mothers with a history of previous PTB were 8.71 times higher than in women without a history of PTB [COR=8.71, (95% CI: 2.41-31.47)]. The odds of PTB in mothers with a history of C/S were 1.85 times higher than in women without a history of C/S [COR=2.01, (95% CI: 1.13-3.55)]. Women with a history of low birth weight (LBW) were 6.65 times

Table 1: Crude logistic regression analyses of PTB and demographic factors

Variable	Urban areas			
	Term birth N (%)	Preterm birth N (%)	COR (95% CI)	P value
Age (years)				
≤19	14 (5.4)	11 (8.5)	Ref	Ref
20-24	87 (33.7)	36 (27.6)	0.52 (0.22-1.27)	0.15
25-29	90 (34.9)	36 (27.9)	0.51 (0.21-1.22)	0.13
30-34	55 (21.3)	30 (23.3)	0.69 (0.28-1.71)	0.43
≥35	12 (4.7)	16 (12.4)	1.69 (0.57-5.03)	0.34
Education level				
Illiterate	6 (2.3)	12 (9.3)	Ref	Ref
Primary school	28 (10.9)	34 (26.4)	0.6 (0.2-1.82)	0.37
Secondary school	50 (19.4)	39 (30.2)	0.39 (0.13-1.13)	0.083
High school and Diploma	114 (44.2)	36 (27.9)	0.16 (0.05-0.45)	0.001
University	60 (23.3)	8 (6.2)	0.06 (0.02-0.23)	<0.001
Occupation				
Employed	36 (14)	8 (6.2)	0.4 (0.18-0.9)	0.027
Housewife	222 (86)	121 (93.8)	Ref	

more likely to experience PTB compared to women without a history of LBW [COR=6.65, (95% CI: 2.36-18.76)]. Pregnant women with an interpregnancy interval of <24 months were 3.8 times more likely to have PTB compared to those with an interpregnancy interval of ≥24 months [COR=3.8, (95% CI: 2.36-18.76)]. Table 2 shows the association between previous pregnancy characteristics and PTB.

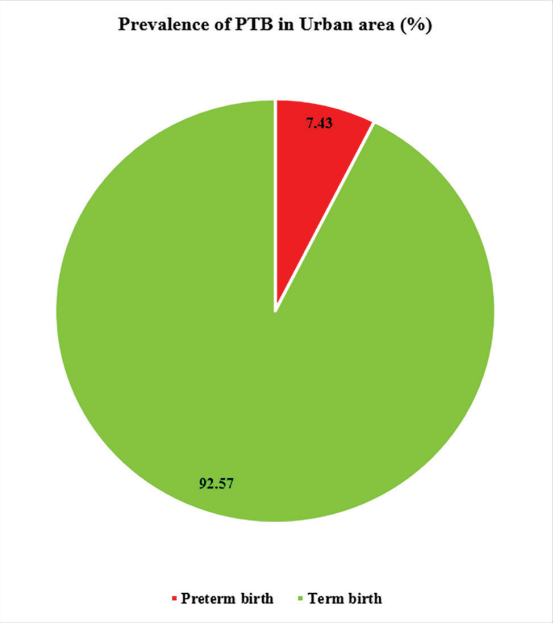

Figure 2: Prevalence of PTB in case and control groups

In urban areas, the results of univariate logistic regression analysis showed a significant association between PTB and the following antenatal factors: ANC visits during pregnancy [COR=7.25 (95% CI; 2.82-18.66)] and maternal anemia during the first trimester [COR=5.07 (95% CI; 2.03-12.68)] (Table 2).

Obstetric Factors

In the urban areas, the results of univariate logistic regression analysis showed a significant association between PTB and the following Obstetric factors: GDM [COR=5.34 (95% CI; 2.27-12.56)], Preeclampsia [COR=5.9 (95% CI; 2.25-15.44)], and PROM [COR=6.67 (95% CI; 2.90-15.36)] (Table 3).

Multivariable Analysis

The adjusted odds ratios (AOR) using the logistic regression model are presented in Table 4. All crude odds ratios for the assessed variables were statistically significant (P<0.25), and therefore, they were included in the multiple logistic regression model.

Table 2: Crude logistic regression analyses of PTB and previous pregnancy factors, antenatal factors

Variable	Urban areas			
	Term birth N (%)	Preterm birth N (%)	COR (95% CI)	P value
Parity				
≥4	10 (3.9)	22 (17.1)	Ref	<0.001
<4	248 (96.1)	107 (82.9)	5.1 (2.33-11.13)	
Previous PTB				
Yes	3 (1.2)	12 (9.3)	8.71 (2.41-31.47)	0.001
No	255 (98.8)	117 (90.7)	Ref	
Previous C/S				
Yes	30 (11.6)	27 (20.9)	2.01 (1.13-3.55)	0.016
No	228 (88.4)	102 (79.1)	Ref	
History of abortion				
Yes	35 (13.6)	27 (20.9)	1.68 (0.97-2.93)	0.064
No	223 (86.4)	102 (79.1)	Ref	
History of LBW				
Yes	5 (1.9)	15 (11.6)	6.65 (2.36-18.76)	<0.001
No	253 (98.1)	114 (88.4)	Ref	
Interpregnancy interval (months)				
<24	8 (3.1)	14 (10.9)	3.80 (1.55-9.23)	0.003
≥24	250 (96.9)	115 (89.1)	Ref	
No. of ANC visits				
<4	6 (2.3)	19 (14.7)	7.25 (2.82-18.66)	<0.001
≥4	252 (97.7)	110 (85.3)	Ref	
Maternal anemia in the first trimester				
Yes	34 (13.2)	24 (18.7)	5.07 (2.03-12.68)	0.001
No	224 (86.8)	104 (81.3)	Ref	
Maternal anemia in the second trimester				
Yes	14 (5.4)	16 (12.4)	1.52 (0.85-2.69)	0.151
No	244 (94.6)	113 (87.6)	Ref	
Underlying diseases				
Yes	36 (14)	28 (21.7)	1.71 (0.99-2.95)	0.055
No	222 (86)	101 (78.3)	Ref	

Table 3: Crude logistic regression analyses of PTB and obstetric factors

Variable	Urban areas			
	Term birth N (%)	Preterm birth N (%)	COR (95% CI)	P value
GDM				
Yes	6 (2.3)	21 (16.3)	8.16 (3.2-20.8)	<0.001
No	252 (97.7)	108 (83.7)	Ref	
Preeclampsia				
Yes	6 (2.3)	23 (17.8)	9.11 (3.6-23.02)	<0.001
No	252 (97.7)	106 (82.2)	Ref	
PROM				
Yes	10 (3.9)	21 (16.3)	4.82 (2.19-10.58)	<0.001
No	248 (96.1)	108 (83.7)	Ref	

Table 4: Multivariable logistic regression analyses of PTB and associated factors in urban areas

Variables	AOR (95% Confidence Interval)	P value
High school and diploma education	0.1 (0.03-0.4)	0.001
University education	0.05 (0.01-0.25)	<0.001
No. of ANC visits <4	7.91 (2.43-25.71)	0.001
PROM	5.25 (2.01-13.74)	0.001
GDM	5.27 (1.49-18.58)	0.010
Preeclampsia	9.47 (3.02-29.73)	<0.001

After adjusting for potential confounders, the results of multivariable logistic regression analysis in urban areas showed a significant association between preterm birth (PTB) and the following factors: education levels, ANC visits [AOR=7.91 (95% CI; 2.43-25.71)], PROM [AOR=5.25 (95% CI; 2.01-13.74)], GDM [AOR=5.27 (95% CI; 1.49-18.58)], and preeclampsia [AOR=9.47 (95% CI; 3.02—29.73)] (Table 4).

Discussion

This study aimed to determine the prevalence and factors associated with preterm birth (PTB) in urban areas of Sardasht, located in the West Azarbaijan province in northwest Iran. Our findings highlight PTB as a significant health concern in this population, with a prevalence rate of 7.43 per 100 live births in urban areas. The study identified several factors independently associated with PTB in urban areas, including education levels, ANC visits, PROM, GDM, and preeclampsia.

The prevalence rate of PTB observed in this study is consistent with the WHO estimates, which report varying rates of PTB across different countries, ranging from 4% to 16% of all live births in 2020.[20]

Our results showed that education level was associated with PTB in urban areas. Specifically, a higher level of education was identified as a protective factor against PTB. This finding is consistent with other studies.[18, 21] It is essential for future research to explore the factors that mediate the influence of socioeconomic inequality on PTB,

The current study also revealed that the odds of PTB were 7.91 times higher in mothers with fewer than four ANC visits than those with four or more visits [AOR=7.91 (95% CI; 2.43-25.71)]. This finding is in line with previous research.[21-23] Ensuring that all pregnant women receive adequate ANC can significantly reduce the likelihood of PTB and other adverse birth outcomes. The World Health Organization (WHO) recommends a minimum of eight ANC visits throughout the pregnancy, starting with the first visit within the first four months.[24]

In our study, anemia during the first trimester of pregnancy was found to be a significant risk factor for preterm birth (PTB), but this was not the case for anemia in the second trimester. This result is in line with the findings of Rahmati et al., whose study also showed that maternal anemia during the first trimester increased the risk of PTB but not in the second and third trimesters.[25] Additionally, our previous research similarly indicated that maternal anemia during pregnancy could significantly increase the odds of PTB.[1] To prevent maternal anemia and its associated risks, a comprehensive approach, including PTB, is recommended. This approach should include daily iron and folic acid supplementation and ensure that women can access micronutrients that support pregnancy health and promote optimal intervals between pregnancies.

The results of the current study revealed that the odds of PTB were 5.25 times higher in mothers with PROM compared to those without PROM [AOR=5.25 (95% CI; 2.01-13.74)]. PROM is often associated with asymptomatic chorioamnionitis and chlamydial vaginitis, which can lead to intrauterine infections. These infections may occur due to the ascending bacterial vaginosis during prolonged PROM. Subclinical chorioamnionitis and other undetected infections can trigger the release of inflammatory mediators like interleukin-1. These mediators, in turn,

stimulate the production of prostaglandins from the uterine decidua, ultimately inducing labor and leading to PTB.[26] Our findings are consistent with the study by Sari et al., which also highlighted PROM as an important risk factor for PTB, even after adjusting for factors such as maternal education, previous PTB history, and anemia.[27]

In this study, we found that mothers with GDM had 5.27 times higher odds of experiencing PTB than those without GDM [AOR=5.27 (95% CI; 1.49-18.58)]. This result aligns with findings from Preda et al.[28] It is essential to highlight that effectively managing GDM through lifestyle changes and medical treatments can reduce the odds of PTB. Monitoring blood sugar levels, following a healthy diet, engaging in consistent physical exercise, and using insulin therapy when necessary are essential for maintaining blood sugar control.

Moreover, mothers with preeclampsia had 9.47 times higher odds of PTB compared to those without preeclampsia [AOR=9.47 (95% CI; 3.02–29.73)]. These results are consistent with previous studies.[26, 29, 30] Preeclampsia is a condition that requires close monitoring during pregnancy to facilitate early detection and proper management, which can help prevent PTB.

Strengths and Limitations of the Study

The strength of this study lies in its sample size, which included all PTB cases over a year, making it representative of the study population. However, the study's limitations include those inherent to its retrospective design.

Conclusion

PTB is a significant health issue among women delivering in urban areas of Sardasht, in West Azarbaijan province, Northwest Iran. PTB is independently associated with education level, ANC visits, PROM, GDM, and preeclampsia. We recommend targeting these key factors by emphasizing early screening for GDM and more frequent monitoring of high-risk pregnancies, such as those involving PROM and preeclampsia.

Authors' Contribution

R.K: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. SH.S: Methodology, Writing – review & editing. S.J: Writing – review & editing.

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Ethical Approval and Consent to Participate

The ethics committee of Urmia University of Medical Sciences granted ethical approval for this study (approval number: IR.UMSU.REC.1393.32). As this was a record-based study, the requirement for informed consent was waived. All methods followed relevant guidelines and regulations, and the study adhered to the Declaration of Helsinki.

Conflict of Interest: None declared.

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