

Maternal and Perinatal Outcomes of Primiparous Saudi Women of Different Age Groups: A Prospective Cohort Study

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ABSTRACT

Introduction: Adolescent pregnancies are at an increased risk of operative delivery, preeclampsia, anaemia, Postpartum Haemorrhage (PPH), and perineal tears. Advanced maternal age is associated with a higher-risk of hypertensive disorders, gestational diabetes, and caesarean sections. The present study compared multiple age groups of primigravidae in Saudi Arabia regarding their maternal and perinatal outcomes, providing age-specific insights that have not been previously documented.

Aim: To examine maternal, obstetric, and clinical factors associated with caesarean delivery and preterm birth, and to evaluate major neonatal outcomes among a cohort of primigravida women in Saudi Arabia.

Materials and Methods: The present prospective cohort study included 932 primigravida women with complete data from a tertiary-care setting in Makkah, Saudi Arabia, from January 2023 to December 2024. Patients were assigned to three groups according to their age and were followed up until delivery. Group A adolescents (13-19 years), Group B included adults (20-34 years), and Group C included the elderly (≥ 35 years). Their antenatal records, delivery room notes, and neonate assessment sheets were used to collect the data. Group differences were evaluated using Chi-square, Fisher's-exact, or likelihood-ratio tests as appropriate. Multivariable logistic regression models were fitted to identify predictors of

caesarean delivery, preterm birth, and key neonatal outcomes. A p-value < 0.05 was considered statistically significant.

Results: Adult mothers had lower odds of caesarean delivery compared with adolescents Adjusted Odds Ratio (AOR=0.54). Underweight and overweight women showed reduced odds relative to normal-weight women, while obesity more than doubled the odds of caesarean delivery (AOR=2.28). Gestational diabetes demonstrated a borderline association with caesarean delivery.

For preterm birth, caesarean delivery was the strongest predictor (AOR=2.72). Maternal underweight significantly increased the risk of preterm birth (AOR=2.08). Elderly mothers showed a borderline protective effect ($p=0.090$), whereas maternal anaemia demonstrated a borderline association with higher preterm risk ($p=0.099$). Neonatal outcomes showed expected trends, with low birthweight linked to maternal underweight and preterm delivery, and Neonatal Intensive Care Unit (NICU) admission associated with preterm birth and emergency delivery patterns.

Conclusion: Maternal age exhibited a non linear association with various maternal and perinatal outcomes, underscoring the need for age-specific antenatal surveillance and individualised obstetric management, particularly at the extremes of reproductive age.

Keywords: Adolescent, Advanced maternal age, Gravidity, Pregnancy Outcome

INTRODUCTION

Adolescent or teenage pregnancy is the term used to encompass all pregnancies in mothers aged 13 to 19 years or below 20 years at the time of delivery [1]. Although these pregnancies have similar maternal, foetal, or neonatal complication profiles, they are considered high-risk. Adolescence is the transitional period between childhood and adulthood [2,3]. Physically, the girl undergoes structural and functional maturation of the reproductive system, and psychologically, she matures in taking care of new responsibilities [4]. Worldwide, teenage pregnancies have been a hot topic of discussion because of their detrimental maternal and perinatal consequences [5]. According to World Health Organisation (WHO), approximately 21 million girls in developing countries between 15 and 19 years of age get pregnant, and 12 million give birth annually in developing countries [6]. In Africa, nearly one-third of teenagers become pregnant. Teenage pregnancy was predicted by age (18-19), wealth index, and marital status [7].

Significant maternal effects include operative delivery, preeclampsia, anaemia, PPH, and perineal tears [8]. Perinatal outcomes show an increased frequency of premature labour, neonatal complications, and NICU admission [9].

While adolescent pregnancy presents one extreme, the other end of the spectrum involves the elderly primigravida. An elderly

primigravida is another extreme encountered during the care of pregnant cohorts. Advanced maternal age is defined as 35 years or more, and the frequency of complications increases steeply with increasing maternal age [10]. Gestational Diabetes Mellitus (GDM), hypertensive disorders, and caesarean delivery are maternal issues, and a low 5-minute Appearance (Skin color)Pulse (Heart rate)Grimace (Reflex irritability)Activity (Muscle tone)Respiration (Breathing) (APGAR) score, NICU admission, and perinatal mortality is frequently documented neonatal issues [11]. Obstetricians should be aware of the potential complications in each group so that special, individualised care can be planned for each pregnant woman.

Saudi Arabia has rich cultural values, where early marriage is both a religious and social norm. Concurrently, the growing emphasis on women's empowerment, with increased access to higher education and professional opportunities, has led to delayed childbirth. In addition, the country has a well-developed healthcare system. This study was conducted within the framework of advanced healthcare facilities, where cultural and healthcare factors may uniquely influence pregnancy risks and outcomes.

Age-related variations in pregnancy outcomes among primiparous women are well documented worldwide, yet data specific to the Saudi population remain scarce. The present study aimed to explore maternal age at both extremes of the primigravidae spectrum

within the Saudi context, focusing on maternal and perinatal complications.

MATERIALS AND METHODS

The present prospective cohort study was conducted at a tertiary care hospital in Makkah, Saudi Arabia, from January 2023 to December 2024.

Ethical approval was obtained from the Medical Research Ethics Committee of the hospital. SFHM IRB issued approval (0477-260322) registered with the National Bio-Medical Ethics Committee, King Abdulaziz City for Science and Technology on 7/7/1436 (Registration No. HAP-02-K-052). Consent was obtained from all participants in this study. The confidentiality and anonymity of the participants were maintained according to the rules/policies of the hospital.

Inclusion criteria: All willing primigravidae aged 13 years and above with singleton pregnancies after 20 weeks of gestation who had at least three antenatal visits and delivered at the same hospital were included.

Exclusion criteria: Pregnant women with multiple pregnancies, preexisting medical illnesses, and gestation before foetal viability (i.e., 20 weeks) were excluded.

The study enrolled 932 eligible primigravida women, and the sample size was calculated by the statistician. The participants were assigned to three groups according to their age. Age groups were defined based on previous literature comparing varied obstetric outcomes at these life stages [12]. Adolescent mothers (13 to <20-year-old) were assigned to Group A, the control, i.e., Adult group (20 to <35-year-old) to Group B, and the advanced age group (≥ 35 -year-old) to Group C. A consecutive sampling technique was used to collect data.

Study Procedure

Patient demographic details, including age, education level, and Body Mass Index (BMI), were noted. The course of pregnancy and details regarding Obstetric complications include anaemia (requiring parenteral iron therapy or blood transfusion), Antepartum Haemorrhage (APH), GDM, Pregnancy-Induced Hypertension (PIH), Intrauterine Growth Restriction (IUGR), and preterm labour were collected.

Labour events were noted once the patient was admitted to the delivery room. Duration of pregnancy, mode of delivery, Normal Vaginal Delivery (NVD), or caesarean section. Furthermore, labour was either spontaneous in onset or induced. Operative vaginal delivery assisted by a ventouse or forceps was also noted. Intrapartum maternal complications such as primary PPH or perineal tears were noted.

The birth weight of the neonate, APGAR score at five minutes, birth trauma, and admission to the NICU were noted.

STATISTICAL ANALYSIS

Data were analysed using SPSS version 20.0 and Python Matplotlib. Descriptive statistics summarised maternal and neonatal characteristics, and group differences were assessed with Chi-square tests. Multivariable logistic regression identified factors related to maternal complications and neonatal outcomes. Models adjusted for maternal age, BMI, education, and clinical predictors, reporting Adjusted Odds Ratios (AORs) with 95% Confidence Intervals (CI). A p-value of <0.05 was considered statistically significant.

RESULTS

Overall these 932 women had an average of 30.3 ± 6.5 years, and the average gestational age was around 38.3 ± 2.4 weeks. Of these, 68 (7.3%) were adolescents, 750 (80.5%) were adults, and 114 (12.2%) were of the elderly age group (>35 years).

The BMI distribution varied significantly across age groups ($p < 0.001$). Most adolescents (66.2%) had a normal BMI, compared with 49.7% of adults and 69.3% of women of advanced age. Overweight status was more common among adults (27.2%) than in the other two groups. Educational attainment also differed significantly between the groups ($p < 0.001$) [Table/Fig-1].

Parameters	Category	Adolescent n (%)	Adult n (%)	Elderly n (%)	p-value
BMI category	Underweight	8 (11.8%)	75 (10.0%)	10 (8.8%)	< 0.001
	Normal weight	45 (66.2%)	373 (49.7%)	79 (69.3%)	
	Overweight	9 (13.2%)	204 (27.2%)	14 (12.3%)	
	Obese	6 (8.8%)	98 (13.1%)	11 (9.6%)	
Education (LR)	Primary school	8 (11.8%)	30 (4.0%)	6 (5.3%)	< 0.001
	Secondary school	58 (85.3%)	143 (19.1%)	26 (22.8%)	
	University	2 (2.9%)	505 (67.3%)	72 (63.2%)	
	Others	0 (0%)	72 (9.6%)	10 (8.8%)	

[Table/Fig-1]: Baseline characteristics of study participants by age groups. LR: p-value is calculated by the likelihood ratio test

The GDM was most frequent among women of the elderly group (14.0%), followed by adults (11.9%) and adolescents (2.9%). However, this difference was statistically non-significant ($p = 0.057$) [Table/Fig-2].

Complications	Category	Adolescent n (%)	Adult n (%)	Elderly n (%)	p-value
Anaemia	Yes	17 (25.0%)	248 (33.1%)	32 (28.1%)	0.255
	No	51 (75.0%)	502 (66.9%)	82 (71.9%)	
GDM	Yes	2 (2.9%)	89 (11.9%)	16 (14.0%)	0.057
	No	66 (97.1%)	661 (88.1%)	98 (86.0%)	
PIH	Yes	7 (10.3%)	115 (15.3%)	19 (16.7%)	0.479
	No	61 (89.7%)	635 (84.7%)	95 (83.3%)	
APH	Yes	6 (8.8%)	53 (7.1%)	12 (10.5%)	0.255
	No	62 (91.2%)	697 (92.9%)	102 (89.5%)	
IUGR	Yes	4 (5.9%)	72 (9.6%)	10 (8.8%)	0.588
	No	64 (94.1%)	678 (90.4%)	104 (91.2%)	
Stillbirth (LR)	Yes	0 (0%)	8 (1.1%)	0 (0%)	0.174
	No	68 (100%)	742 (98.9%)	114 (100%)	

[Table/Fig-2]: Maternal complications in participants by age groups. Likelihood ratio test, Chi-square test

Mode of delivery showed a marked difference ($p < 0.001$). Induction of labour also differed significantly ($p < 0.001$), with elderly women having the highest induction rate (32.5%). Foetal distress was most common among elderly women (28.1%), followed by adolescents (22.1%) and adults (14.4%), ($p < 0.001$). In contrast, PPH and perineal tears did not differ significantly across age groups ($p = 0.770$ and $p = 0.309$, respectively), with similar low frequencies reported in all three categories [Table/Fig-3].

Variables	Category	Adolescent n (%)	Adult n (%)	Elderly	p-value
Mode of delivery	Normal vaginal delivery (NVD)	32 (47.1%)	474 (63.2%)	43 (37.7%)	<0.001
	Operative vaginal delivery (OVD)	6 (8.8%)	52 (6.9%)	19 (16.7%)	
	Emergency LSCS	19 (27.9%)	142 (18.9%)	32 (28.1%)	
	Elective LSCS	11 (16.2%)	82 (10.9%)	20 (17.5%)	
Induction of labour (IOL)	Yes	18 (26.5%)	106 (14.1%)	37 (32.5%)	<0.001
	No	50 (73.5%)	644 (85.9%)	77 (67.5%)	
Foetal distress	Yes	15 (22.1%)	108 (14.4%)	32 (28.1%)	<0.001
	No	53 (77.9%)	642 (85.6%)	82 (71.9%)	

Postpartum Haemorrhage (PPH) (LR)	Yes	2 (2.9%)	23 (3.1%)	5 (4.4%)	0.770
	No	66 (97.1%)	727 (96.9%)	109 (95.6%)	
Perineal tear (2 nd /3 rd degree)	Yes	3 (4.4%)	23 (3.1%)	8 (7.0%)	0.309
	No	65 (95.6%)	727 (96.9%)	106 (93.0%)	

[Table/Fig-3]: Delivery characteristics and intrapartum complications.

Birthweight distribution did not differ significantly between adolescents, adults, and elderly mothers (p=0.725). APGAR score <7 at five minutes showed a significant association with maternal age (p=0.036). NICU admissions were also significantly different among age groups (p=0.022). Perinatal deaths were rare, though eight of nine were among adults and one among adolescents, but showed no statistically significant difference among the groups (p=0.294) [Table/Fig-4].

Neonatal outcome	Category	Adolescent n (%)	Adult n (%)	Elderly n (%)	p-value
Birthweight (LR)	LBW	2 (2.9%)	75 (10.0%)	12 (10.5%)	0.725
	Average birth weight (3098±520 gram)	Normal (2.5-3.9 kg)	57 (83.8%)	652 (86.9%)	
APGAR <7 at 5 min	Yes	0 (0%)	25 (3.3%)	8 (7.0%)	0.036
	No	68 (100%)	725 (96.7%)	106 (93.0%)	
NICU admission	Yes	11 (16.2%)	74 (9.9%)	20 (17.5%)	0.022
	No	57 (83.8%)	676 (90.1%)	94 (82.5%)	
Perinatal death (LR)	Yes	1 (1.5%)	8 (1.1%)	0 (0%)	0.294
	No	67 (98.5%)	742 (98.9%)	114 (100%)	

[Table/Fig-4]: Neonatal outcomes.

Age was found to have a significant association only with GDM. Elderly women had nearly twice the odds of developing GDM compared with adults (AOR 1.91; 95% CI 1.01-3.61), whereas adolescents had lower odds (AOR 0.26; 95% CI 0.06-1.15), although this estimate was not statistically significant [Table/Fig-5].

Predictors	GDM AOR (95% CI)	PIH AOR (95% CI)	Anaemia AOR (95% CI)
Age group			
Adolescent vs Adult	0.26 (0.06-1.15)	0.60 (0.25-1.44)	0.74 (0.39-1.41)
Elderly vs Adult	1.91 (1.01-3.61)	1.07 (0.62-1.83)	0.93 (0.53-1.66)
BMI category			
Underweight vs Normal	6.65 (3.08-14.32)	0.76 (0.39-1.46)	2.92 (1.80-4.73)
Overweight vs Normal	8.30 (4.44-15.51)	0.76 (0.48-1.21)	0.45 (0.27-0.74)
Obese vs Normal	14.01 (7.18-27.34)	1.14 (0.67-1.94)	0.61 (0.36-1.02)
Education			
Secondary vs University	1.09 (0.63-1.87)	0.96 (0.57-1.64)	0.42 (0.22-0.80)
Primary vs University	1.72 (0.59-4.99)	1.52 (0.56-4.08)	0.81 (0.32-2.07)
Others vs University	1.08 (0.53-2.22)	0.84 (0.43-1.63)	0.68 (0.30-1.57)

[Table/Fig-5]: Multivariable logistic regression to predict maternal complications in relation to age, BMI and education.

The GDM was found to have a significant association with BMI. When compared with women of normal BMI, the odds of GDM increased significantly across all categories. Overall, BMI emerged as the strongest independent predictor of both GDM and anaemia, while maternal age and education contributed minimally after adjustment for covariates.

Elderly mothers demonstrated nearly double the odds of NICU admission (AOR 1.94; 95% CI 1.09-3.44), and a borderline increase in risk of low APGAR score (AOR 2.32; 95% CI 0.97-5.56). No significant association was observed between age and LBW. Gestational age at delivery emerged as the strongest and most consistent predictor across all neonatal outcomes. Preterm birth increased the odds of LBW (AOR 17.17), low APGAR score (AOR 10.16), and NICU admission (AOR 6.51; 95% CI 3.98-10.65) [Table/Fig-6].

Predictors	LBW AOR (95% CI)	Low APGAR AOR (95% CI)	NICU AOR (95% CI)
Age Group			
Adolescent vs Adult	1.60 (0.59-4.37)	Unstable	1.45 (0.63-3.30)
Elderly vs Adult	0.94 (0.45-1.93)	2.32 (0.97-5.56)	1.94 (1.09-3.44)
BMI Category			
Obese vs Normal	Unstable	4.15 (1.60-10.75)	1.48 (0.78-2.83)
Overweight vs Normal	0.12 (0.05-0.28)	0.09 (0.01-0.71)	0.55 (0.31-1.00)
Underweight vs Normal	0.58 (0.28-1.23)	0.44 (0.10-2.02)	0.53 (0.24-1.16)
Education			
Other vs University	0.67 (0.26-1.76)	1.72 (0.60-4.96)	0.92 (0.41-2.08)
Primary vs University	0.89 (0.30-2.60)	1.52 (0.31-7.35)	0.76 (0.25-2.30)
Secondary vs University	0.52 (0.25-1.08)	0.48 (0.14-1.70)	1.22 (0.70-2.14)
Gestational Age			
Preterm vs Term	17.17 (10.23-28.82)	10.16 (4.27-24.17)	6.51 (3.98-10.65)

[Table/Fig-6]: Multivariable logistic regression to predict neonatal outcomes in relation to age, BMI and education and gestational age.

"Unstable"=model separation due to sparse events or non-estimable CI.

Adult mothers had significantly lower odds of caesarean delivery compared with adolescents (AOR 0.54; 95% CI: 0.30-0.96). Both overweight and underweight women demonstrated a protective effect relative to normal-weight women, whereas obese women had more than twice the odds of undergoing caesarean delivery (AOR 2.28). In the preterm birth model, caesarean section emerged as the strongest predictor, with higher odds of preterm birth (AOR: 2.72). Maternal underweight status was also significantly associated with preterm delivery (AOR 2.08) [Table/Fig-7].

Predictors	MOD Model (CS vs Vaginal) AOR (95% CI)	p-value	GA Model (Preterm vs Term) AOR (95% CI)	p-value
Age: Adult vs Adolescent	0.54 (0.30-0.96)	0.036	0.52 (0.23-1.21)	0.130
Age: Elderly vs Adolescent	1.06 (0.55-2.07)	0.858	0.43 (0.16-1.14)	0.090
BMI: Overweight vs Normal	0.61 (0.42-0.89)	0.011	0.98 (0.60-1.63)	0.950
BMI: Obese vs Normal	2.28 (1.49-3.49)	<0.001	~0 (0-∞)*	0.999
BMI: Underweight vs Normal	0.58 (0.34-0.98)	0.043	2.08 (1.16-3.74)	0.014
Education: Primary vs Others	0.79 (0.34-1.83)	0.586	1.14 (0.36-3.57)	0.828
Education: Secondary vs Others	1.01 (0.56-1.82)	0.964	0.67 (0.27-1.65)	0.385
Education: University vs Others	0.98 (0.59-1.65)	0.951	1.39 (0.66-2.94)	0.392
Anemia (Yes vs No)	1.18 (0.87-1.58)	0.288	1.47 (0.93-2.32)	0.099

GDM (Yes vs No)	2.00 (1.00-4.00)*	0.093	1.79 (0.86-3.72)	0.121
PIH (Yes vs No)	—	—	1.20 (0.52-2.76)	0.669
CS (Yes vs Vaginal)	—	—	2.72 (1.80-4.09)	<0.001

[Table/Fig-7]: Maternal and clinical predictors of mode of delivery and preterm birth. GDM, PIH, and gestational age were excluded as predictors to avoid collinearity and reverse-causality effects

* BMI Obese vs Normal shows complete separation in GA model (all obese delivered at term); OR reported as driven by numerical instability.

DISCUSSION

Maternal age remains a critical determinant of the pregnancy course as it influences the physiological, psychological, and social dimensions of pregnancy. In this study, adolescents comprised 7.3%, and elderly primigravidae accounted for 12.2%. International studies show wide variability in the prevalence of advanced maternal age among primigravidae, ranging from 0.2%-0.69% in Nigeria, 0.55% in India, and up to 24% in the United Kingdom [13-16]. In Saudi Arabia, previously reported rates range from 6.2%, 17.7%, and 25.6% among elderly primigravida [17-19].

Adolescent pregnancy prevalence also varies markedly worldwide; Sedgh G et al., reported a peak of 57% in the USA and only 8% in Switzerland [19]. Such disparities likely reflect differences in cultural norms, early sexual activity, and societal expectations. Local studies report lower adolescent pregnancy rates of 4.6% and 2% [9,20]. These findings reinforce the importance of examining age-specific antenatal risks within individual populations.

In this study, maternal age exerted limited influence on most pregnancy complications. However, advanced maternal age was associated with higher rates of operative delivery, foetal distress, induction of labour, NICU admission, and borderline increases in gestational diabetes [21-23]. Adolescents showed elevated emergency caesarean rates but did not experience increased neonatal morbidity. Although foetal distress was noted in some pregnancies, this did not consistently result in low 5-minute APGAR scores. Timely recognition, expedited delivery, and effective neonatal resuscitation often facilitated rapid recovery, yielding satisfactory APGAR outcomes despite intrapartum compromise. GDM was more prevalent in the elderly group, as compared to the adults and adolescent mothers. This aligns with the findings of Al-Kadri HM et al., who reported a lower prevalence of GDM (0.6%) among adolescent mothers in Riyadh [9], and the findings of Shams T et al., who reported a higher prevalence of 32.0% among the elderly pregnant population in Jeddah, Saudi Arabia [12]. Advanced maternal age is well established as a risk factor for GDM due to age-related reductions in insulin sensitivity and metabolic changes.

No age-related trend was observed for PIH. This observation is notable, as it is not consistently supported by local or international studies, which often link advanced maternal age to increased PIH risk [12-14,22-24]. One possible explanation for this divergence in our cohort could be the regular antenatal visits, access to medical facilities, and follow-up, which may modify the spectrum of many complications

The study showed increased risks for operative delivery and neonatal distress in elderly age, reflecting a balance of competing age-related factors. On one hand, physiologic and obstetric changes at older ages (e.g., reduced uterine contractility, higher co-morbidities) may predispose to operative delivery and complications.

Similarly, no significant association was found between maternal age and preterm birth. Although Fayed AA et al., studied the Saudi population and Maqsd M et al., studied the Pakistani population, they documented a positive association between adolescent primigravidae and increased preterm delivery [17,25]. Differences in population characteristics, sample size, and clinical management practices may account for the divergence.

In the present study, low birth weight was not significantly associated with either age group of primigravidae. These observations are not consistent with findings from Egyptian and Turkish populations [1,2]. Global evidence frequently links advanced maternal age to low birth weight [20,22,23]; however, birth weight is influenced by multiple factors, including maternal nutrition, BMI, gestational weight gain, genetics, and pregnancy complications, which may attenuate the isolated effect of maternal age in this cohort.

Apparent discrepancies between descriptive findings and adjusted regression estimates warrant careful interpretation. Although elderly mothers demonstrated higher rates of caesarean delivery and NICU admission in unadjusted analyses, the multivariable model for preterm birth accounted for gestational age, BMI, and clinical factors, revealing a borderline protective association for advanced maternal age. This suggests that increased operative delivery and neonatal surveillance among elderly primigravidae may reflect precautionary obstetric practices rather than a true increase in spontaneous preterm birth risk. Similarly, underweight mothers exhibited higher odds of preterm birth but lower odds of caesarean delivery, indicating that preterm births in this group were more frequently spontaneous and vaginal in nature, whereas caesarean delivery was more strongly influenced by maternal metabolic factors such as obesity. These findings highlight the importance of distinguishing between descriptive associations and adjusted effects, as well as recognizing the role of clinical decision-making in shaping delivery patterns.

Limitation(s)

The initiation of data collection at 20 weeks gestation, which may have overlooked early-pregnancy complications, and the single-centre design involving a population with relatively high educational levels. Consequently, the findings may not fully reflect the broader Saudi population. Multicentre research across different regions is recommended to enhance generalisability and provide a more complete understanding of age-related pregnancy outcomes.

CONCLUSION(S)

Maternal age plays a significant role in the outcome of the first pregnancy. The current study reinforces the notion that maternal age should not be viewed simply dichotomously (young vs. old), but rather as a continuous variable with age-specific risk gradients. Multiple other factors, such as maternal health, access to healthcare facilities, and quality of prenatal care, can also significantly influence pregnancy outcomes.

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