

ORIGINAL ARTICLE

## A hidden burden on public health: Adolescent pregnancy and increased adverse perinatal outcomes



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### Abstract

**Objective:** Adolescent pregnancy, associated with increased adverse pregnancy outcomes, is a major public health problem. We aimed to assess adverse perinatal outcomes in adolescent pregnancies to develop preventive strategies or treatment options.

**Methods:** A total of 37248 births were registered between 2017 and 2020. Random numbers table was used to choose participants. Patients who had unavailable records, different ethnicity, education level, marital status, insurance type were excluded and 3567 pregnant were included in the study. The adolescent pregnant group comprised 1104 women while adults comprised 2463 pregnant. Fetal anomaly, gestational diabetes, preeclampsia-eclampsia, intrauterine growth restriction, intrahepatic cholestasis, polyhydramnios, placenta previa, in utero mort fetus, uterine rupture, placenta abruption, umbilical cord prolapse, acute fetal distress, preterm birth, cesarean section, labor arrest, birth weight, macrosomia, dystocia, birth trauma, APGAR scores, neonatal intensive care unit admission, postpartum hemorrhage, hysterectomy, blood transfusion, and postpartum infection were recorded.

**Results:** Rates of acute fetal distress, preterm birth, low birth weight, neonatal intensive care unit admission, postpartum hemorrhage, and blood transfusion were higher while birth weight, APGAR scores, the rates of cesarean section, prolonged and arrested labor, gestational diabetes, and macrosomia were lower in adolescents. Being adolescent increase the risk of acute fetal distress by 1.4 times (aOR=1.44;95%CI=1.03-2.01,p=0.033), preterm birth by 1.7 times (aOR=1.69;95%CI=1.10-2.60,p=0.016) and decrease the risk of gestational diabetes (aOR=0.18;95%CI=0.12-0.29,p<0.001), macrosomia (aOR=0.59;95%CI=0.40-0.9,p=0.08), labor arrest (aOR=0.50;95%CI=0.27-0.95,p=0.033) and cesarean section (aOR=0.33;95%CI=0.27-0.39,p<0.001) after adjusting for confounders.

**Conclusion:** Considering increased acute fetal distress, preterm birth, low birth weight, neonatal intensive care unit admission, postpartum hemorrhage, blood transfusion risk for adolescent pregnancies, adolescents and healthcare providers should be informed and follow-ups must be performed in well-equipped centers.

**Keywords:** Adolescent Pregnancy, Cesarean Section, Gestational Diabetes, Labor Arrest, Preterm Birth

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## INTRODUCTION

Adolescent pregnancy is defined as a pregnancy that occurs between 10-19 years old<sup>1</sup>. The prevalence of these pregnancies was reported to be 11% of all births worldwide<sup>2</sup>. In Türkiye, the frequency of adolescent pregnancies was 4.6% in 2013, it increased to 7.9% between 2015 and 2017. In 2018, The Demographic and Health Survey for Türkiye notified that 3.5% of adolescents had children and 0.2 % of women had children before the age of 15<sup>3,4</sup>.

Adolescent pregnancy is a major public health problem, especially in low and middle income countries. It is known that gender inequality poses a big role in this condition. Adolescent girls tend to marry and have pregnancy at younger ages. Mostly, they are pressured to have sexual intercourse to please their partners. When they become pregnant, they are blamed. Mostly, they take the risk of an abortion under inappropriate conditions. Adolescent pregnancies are still one of the leading causes of perinatal mortality, especially in low and middle income countries<sup>5</sup>. Furthermore, it is associated with increased adverse pregnancy outcomes when it is compared with adult pregnancies<sup>6</sup>. The main reason for this risk is not fully elucidated. It could be related to physiological and psychological immaturity, inadequate antenatal care, and insufficient knowledge of sexual issues<sup>7</sup>.

In the literature, many studies have searched for the relationship between adolescent pregnancy and perinatal outcomes. Unfortunately, conflicting results were reported in these studies<sup>7,8</sup>. Similarly, a limited number of studies from Türkiye have inconsistent findings. In a meta-analysis from Türkiye, Karacam et al showed that

preterm birth, early membrane rupture, anemia, low birthweight/intrauterine growth retardation and fetal distress were more common in adolescents while cesarean section, gestational diabetes, placenta previa, polyhydramnios and macrosomia were less common among adolescents compared to adults. In the studies involved in meta-analysis, some reports have concluded that preeclampsia has an higher rate while some of them report contrary results. Other conflicting results in the meta-analysis are about breech presentation, postpartum hemorrhage, amniotic fluid abnormalities, and neonatal death<sup>3</sup>.

This study aimed to assess adverse perinatal outcomes in adolescent pregnancies at a tertiary reference hospital, in Bursa, Türkiye to develop preventive strategies for adolescent pregnancies or treatment options for common adverse outcomes.

## METHODS

This is a retrospective, cohort study conducted in a university-affiliated research and training hospital between January 1, 2017, and December 2020. SBU Bursa Yuksek Ihtisas Training and Research Hospital ethics committee approved the study (approval number: 2011-KAEK-25 2021/10-06) and it was in accordance with the Declaration of Helsinki.

A total of 37248 births were given between 1 January 2017 and December 2020. Random numbers table were used to choose participants. The inclusion criteria consisted of singleton and nulliparous pregnancies below 35 years old. All patients had regular antenatal visits and gave birth in our clinic. Patients who had unavailable antepartum

and peripartum records were excluded from the study. Also, patients who had a different ethnicity, education level, marital status, and insurance type were excluded. Consequently, a total of 3567 pregnant women were included in the study. The adolescent pregnant group comprised 1104 women while the adult group comprised 2463 pregnant women.

Age, maternal, fetal, and neonatal data were collected from medical records. Antepartum features were composed of fetal anomaly, gestational diabetes, preeclampsia, eclampsia, intrauterine growth restriction, intrahepatic cholestasis of pregnancy, polyhydramnios, placenta previa, and in utero mort fetus. Peripartum characteristics that were recorded were uterine rupture, ablatio placenta, umbilical cord prolapse, acute fetal distress, preterm birth, cesarean section, prolonged or arrested labor, birth weight, low birth weight, macrosomia, dystocia, birth trauma, APGAR scores, neonatal intensive care unit (NICU) admission, postpartum hemorrhage, peripartum hysterectomy, blood transfusion, and postpartum infection.

Gestational age was calculated from the last menstrual period and confirmed by sonography. Adverse perinatal outcomes were confirmed as explained below. The deliveries that occurred before the 37<sup>th</sup> gestational week were accepted as preterm birth<sup>9</sup>. Low birth weight was used to define birth weights below 2500 grams while macrosomia was used for babies over 4500 grams<sup>10</sup>. For the diagnosis of gestational diabetes mellitus, 75 grams of oral glucose tolerance test was performed. The presence of any of the following parameters in the measurements was considered as GDM: i) Fasting glucose  $\geq 92$  mg/dL, ii) 1-hour glucose  $\geq 180$  mg/dL, and iii) 2nd-hour glucose  $\geq 153$

mg/dL<sup>11</sup>. Preeclampsia presents the condition which hypertension after 20 weeks of gestation accompanied by at least one of the followings: proteinuria, liver, kidney failure, and hematological or neurological complications. Eclampsia was accepted as a form of preeclampsia complicated by generalized convulsions<sup>12</sup>. Intrauterine growth restriction was diagnosed when the estimated fetal weight was lower than 10 percentile with the deceleration of intrauterine growth in routine antenatal visits<sup>13</sup>. Intrahepatic cholestasis of pregnancy was defined when the pregnancy was complicated by pruritus and elevated bile acids<sup>14</sup>. The diagnosis of polyhydramnios was made by ultrasound with an amniotic fluid index  $\geq 25$  cm or a single deepest measure fluid pocket  $> 8$  cm<sup>15</sup>. Placenta previa was defined as the implantation of the placenta over the cervical os and abruptio placenta was defined as the early separation of a normally implanted placenta<sup>16</sup>. When additional delivery maneuvers were required in delivery, dystocia was diagnosed<sup>17</sup>. Postpartum hemorrhage was defined as blood loss greater than 1000 ml within 24 hours of birth<sup>18</sup>. NICU admission indications were severe jaundice, early prematurity, extremely low birth weight, the necessity of cardiorespiratory monitoring, and neonatal sepsis.

### **Statistical Analysis**

The Shapiro Wilk test was used to assess the normality of the distribution. The continuous variables did not distribute normally, hence descriptive statistics were given as median (minimum-maximum) and groups were compared by Mann-Whitney U test. For categorical variables, Chi-square or Fisher's exact test was used for group comparisons and the variables were expressed as frequencies

and percentages. Regression analysis was performed to determine the effect of being adolescent on antepartum and peripartum characteristics. Statistical analysis was performed by using SPSS Version 21.0. (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp.) software. The level of significance was set at  $p < 0.05$ .

## RESULTS

A total of 3567 pregnant women were included in the study. The adolescent pregnant group was composed of 1104 women while the adult group consisted of 2463 pregnant women. The median age of all study groups was 26, the youngest patient was 13 and the

oldest patient was 30 years old. The median age was 18 (13-19) in the adolescent group and 27 (25-30) in the adult group.

The antepartum features of adolescent and adult pregnancies were demonstrated in Table 1. According to the table, there was no significant difference between adolescent and adult groups in terms of fetal anomaly, insulin usage for gestational diabetes, preeclampsia, eclampsia, intrauterine growth restriction, polyhydramnios, intrahepatic cholestasis of pregnancy, placenta previa and in utero mort fetus. Gestational diabetes mellitus was significantly lower in adolescent pregnant women as compared to adult ones (1.9% vs 9.6%,  $p < 0.001$ ).

Table 1: Antepartum features of adolescent and adult pregnancies					
	Adolescent pregnancies (n=1104)	%*	Adult pregnancies (n=2463)	%**	p
Fetal anomaly	2	0.2	11	0.4	0.367
Gestational diabetes	21	1.9	237	9.6	<0.001
Insulin usage for GDM	1	4.8	14	5.9	1.000
Preeclampsia	17	1.5	32	1.3	0.568
Eclampsia	0	0	0	0	1.000
IUGR	21	1.9	37	1.5	0.383
Intrahepatic cholestasis	0	0	5	0.2	0.333
Polyhydramnios	2	0.2	6	0.2	1.000
Placenta previa	13	1.2	22	0.9	0.540
In utero mort fetus	13	1.2	27	1.1	0.967

GDM: Gestational diabetes mellitus, IUGR: Intrauterine growth restriction

(%)\*: Line percentage of Adolescent pregnancies (%)\*\*: Line percentage of Adult pregnancies

The peripartum characteristics of adolescent and adult groups were shown in Table 2. No significant difference was found between adolescent and adult pregnant groups with regards to uterine rupture, ablatio placenta, umbilical cord prolapse, dystocia, birth trauma, APGAR scores of first minutes, peripartum hysterectomy, and postpartum infection. The rates of acute fetal distress (5.3% vs 3.8%,  $p = 0.032$ ), preterm birth (4%

vs 2.2%,  $p = 0.002$ ), low birth weight (9.2% vs 7.1%,  $p = 0.031$ ), NICU admission (7% vs 5%,  $p = 0.016$ ), postpartum hemorrhage (1.2% vs 0.2%,  $p < 0.001$ ) and blood transfusion (2.2% vs 1.2%,  $p = 0.044$ ) were significantly higher in adolescent pregnant women as compared to adult pregnant women. Contrary to these, the rates of cesarean section (21.2% vs 40.2%,  $p < 0.001$ ), prolonged and arrested labor (1.1% vs 2.1%,  $p = 0.033$ ) and macrosomia

(3% vs 5.8%,  $p<0.001$ ) were significantly lower in adolescent group. Furthermore, birth weight (3125 (600-4885) vs 3250 (500-

4900),  $p<0.001$ ) and APGAR scores of fifth minutes (9 (0-10) vs 10(0-10),  $p<0.001$ ) were significantly lower in the adolescent group.

**Table 2: Peripartum features of adolescent and adult pregnancies**

	Adolescent pregnancies (n=1104)	%*	Adult pregnancies (n=2463)	%**	p
Uterine rupture	0	0	5	0.2	0.333
Ablatio placenta	3	0.3	10	0.4	0.765
Umbilical cord prolapse	1	0.1	4	0.2	1.000
Acute fetal distress	59	5.3	93	3.8	0.032
Preterm birth	44	4	54	2.2	0.002
Cesarean section	234	21.2	991	40.2	<0.001
Prolonged and arrested labor	12	1.1	52	2.1	0.033
Birth weight (gram)	3125 (600-4885)		3250 (500-4900)		<0.001
Low birth weight	102	9.2	176	7.1	0.031
Macrosomia	33	3	142	5.8	<0.001
Dystosia	7	0.6	5	0.2	0.057
Birth trauma	1	0.1	5	0.2	0.673
APGAR 1. minutes	8 (0-9)		9 (0-9)		0.130
APGAR 5. minutes	9 (0-10)		10 (0-10)		<0.001
NICU admission	76	7	122	5	0.016
Postpartum hemorrhage	13	1.2	4	0.2	<0.001
Peripartum hysterectomy	1	0.1	4	0.2	1.000
Blood transfusion	24	2.2	30	1.2	0.044
Postpartum infection	4	0.4	12	0.5	0.788

(%)\*: Line percentage of Adolescent pregnancies (%)\*\*: Line percentage of Adult pregnancies

In regression analysis, confounding factors were determined for each adverse outcomes and regression models were constructed according to each condition. A p value <0.05 was considered significant for regression models. Searching the effect of being adolescent on preterm birth after adjusting for preeclampsia, eclampsia, gestational diabetes, macrosomia, polyhydramnios, intrauterine growth restriction, ablatio placenta, umbilical cord prolapse, and intrahepatic cholestasis of pregnancy, it was found that being adolescent increased the risk of preterm birth nearly 1.7 fold (aOR=1.69; 95% CI=1.10-2.60;p=0.016). Moreover, being adolescent increased the risk of acute fetal distress by 1.4 times (aOR=1.44; 95%CI=1.03-2.01;p=0.033). Contrary to

these, adolescents had decreased risk of gestational diabetes (aOR=0.18; 95% CI=0.12-0.286;  $p<0.001$ ), macrosomia (aOR=0.59; 95% CI=0.40-0.87;  $p=0.08$ ), prolonged and arrested labor (aOR=0.50; 95% CI=0.27-0.95;  $p=0.033$ ) and cesarean section (aOR=0.33; 95% CI=0.27-0.39;  $p<0.001$ ) after excluding the effects of possible confounders. No significant effect of being adolescent on low birth weight ( $p=0.731$ ), postpartum hemorrhage ( $p=0.977$ ), blood transfusion ( $p=0.448$ ), and neonatal intensive care unit admission ( $p=0.104$ ) was detected after adjusting for confounding factors.

## DISCUSSION

The present study showed that pregnant

adolescents had a higher incidence for acute fetal distress, preterm birth, low birth weight, neonatal intensive care unit admission, and postpartum hemorrhage. Contrary to these, they had a lower incidence for cesarean section, labor arrest, gestational diabetes, and macrosomia. After adjusted for confounding factors, we found that the risk of preterm birth was increased while the risk of gestational diabetes and cesarean section was decreased.

Adolescents are one of the most important populations for reproductive problems. First, they have increased adverse pregnancy risk due to their structural immaturity and inadequate sexual knowledge. Moreover, adolescent pregnancies are usually unwanted due to early sexual intercourse, cultural beliefs, marriage at an early age, and inadequate contraception knowledge<sup>1,2,5,10</sup>. The available literature on adverse perinatal outcomes in adolescent pregnancies has reported an increased risk for eclampsia, puerperal infection, low birth weight, preterm birth, and stillbirth<sup>2,6,10,19-21</sup>.

Peripartum complications are still one of the leading causes of maternal and fetal mortality and morbidity. In low- and middle-income countries, nearly half of maternal and fetal mortality is due to hemorrhage and hypertensive disorders in pregnancy<sup>22,26</sup>. Unfortunately, adolescent pregnancies are more prone to these complications than adults. A study from Zambia reported a higher risk of vaginal bleeding and anemia in adolescent pregnant women<sup>23,26</sup>. The study from Nigeria and Latin America showed a higher incidence of postpartum hemorrhage in adolescent pregnancies<sup>6,15,24</sup>. This risk can be attributed to an increased risk of placental abruption, uterine rupture, and amnion fluid

abnormalities in adolescents. Contrary to these, another study conducted in Thailand showed a decreased risk of postpartum hemorrhage<sup>25,26</sup>. Kassa et al reported no difference in the incidence of postpartum hemorrhage between adolescents and adults<sup>26</sup>. Likewise, a study conducted in Nepal found a nonsignificant difference in terms of postpartum hemorrhage<sup>27</sup>. In our study, increased rates for postpartum hemorrhage and blood transfusion were detected while no difference was found in terms of placental abruption, uterine rupture, and polyhydramnios. When the risk was evaluated after excluding confounding factors, being adolescent was not found to be a risk factor for postpartum hemorrhage. We suggest that these inconsistent results between studies can relate to race, study population characteristics, and medical skills of healthcare personnel. A meta-analysis of 38 Turkish studies concluded that adolescents and adults were similar in terms of the prevalence of postpartum hemorrhage<sup>3</sup>. This result supports our explanation about race and study population characteristics.

Preeclampsia is another debating and common adverse perinatal outcome for adolescent pregnancies. A study searching 51142 adult and 7305 adolescent pregnant women demonstrated higher rates of preeclampsia and eclampsia in adolescents<sup>28</sup>. Similarly, Demirgöz et al and Medhi et al found an increased risk for preeclampsia in the Turkish population<sup>29,30</sup>. Immaturity of the immune system and decreased blocking antibody levels of chorion villus are claimed to be a critical role in this increased risk<sup>31</sup>. Contrary to these studies, a multicenter study reported a lower risk of preeclampsia among

adolescents<sup>2,26</sup>. Moreover, studies from Wales and India showed a lower risk of pregnancy-induced hypertension in adolescents<sup>26,32-34</sup>. Besides these, some studies found no difference in the proportion of preeclampsia in adolescent pregnancies<sup>20,26,35</sup>. Likewise, we found no difference in the incidence of preeclampsia in adolescents as compared to adult pregnancies. We suggest that the differences in the incidence of preeclampsia can be due to confounding factors such as primiparity and maternal age. Also, adolescents in the present study were older adolescents and no data were present for very early ages. Supporting our results, the meta-analysis from Türkiye reported no significant increased risk for preeclampsia in adolescents<sup>3</sup>.

Although the immature pelvic structure can be a candidate for prolonged and arrested labor, it is known that adolescents tend to have vaginal delivery<sup>1,2,36,37</sup>. This condition seems to be preventive for future cesarean sections and complications such as placenta invasion abnormalities. Zhang et al reported that adolescents had reduced cesarean risk by 25% than adults<sup>20</sup>. Consistent with the literature, we found decreased cesarean section rates in our study in adolescents. This condition could be explained by the delivery of more preterm and low birth weight fetuses owing to less weight gain, malnutrition and concomitant diseases in adolescents. Another explanation could be having a better myometrial function and tissue elasticity of adolescents<sup>6,26,38</sup>.

The frequency of GDM would be expected to be higher due to a non-developed endocrine regulating system in adolescents, but we found a lower incidence of GDM in our study. This result was consistent with the study of

Zhang et al and Wang et al<sup>20,39</sup>. We suggest that future studies searching for the underlying reason for reduced risk in GDM are needed.

Many studies are showing higher incidences of preterm birth in adolescent pregnancies. These studies reported a relative risk varying from 1.18 to 2.15<sup>1,2,20,39,40</sup>. Kassa et al found 1.65 times increased risk of preterm birth in adolescent pregnancies. In our study, we found 1.7 times increased risk of preterm birth in adolescents after excluding confounding factors. Impaired prostaglandin production due to the immaturity of decreased cervical blood supply and anatomical immaturity of adolescents could be a contributor to preterm birth<sup>41</sup>.

The babies born to adolescent pregnant women are prone to have low birth weight<sup>26,42</sup>. Ganchimeg et al found that adolescent pregnancies have low birth weight fetuses with low Apgar scores<sup>2</sup>. In another study, 2.14 times increased risk was reported for low birth weight in adolescent pregnancies. We found higher incidence of low birth weight in adolescents which was consistent with the literature. After the effect of confounding factors was excluded, the risk of low birth weight was not different than adults. This condition could be related to preterm birth, micronutrient deficiencies, and immaturity<sup>41</sup>. Moreover, depressive mood, commonly seen in teenagers, could stimulate releasing of placental corticotropin releasing hormone and results in preterm birth<sup>43</sup>.

This study also found a significant difference in Apgar score and neonatal intensive care unit admission between adolescent and adult pregnancies. Previous studies conducted in USA and Thailand showed consistent findings for neonatal intensive care unit admission with

our study<sup>1,41,44</sup>. These increased risks could be associated with increased adverse outcomes, different sociodemographic features, small sample size, and access to health care services.

In a study by Shrim et al, higher congenital anomaly rates were reported while no significant difference was reported in other studies<sup>45,46</sup>. In our study, we did not find any difference in terms of fetal anomaly. However, inconsistent findings are present in the literature about stillbirth, intrauterine growth restriction, intrahepatic cholestasis of pregnancy, polyhydramnios, postpartum infection, placental anomalies, uterine rupture, and birth trauma. We did not find a significant difference in the incidence of these outcomes.

### **Strengths of the Study**

Assessing adverse perinatal outcomes in adolescent pregnancies at a tertiary reference hospital can provide local but valuable data for developing preventive strategies for adolescent pregnancies or treatment options for common adverse outcomes. By this way, it can be concluded which patients will be followed in well-equipped tertiary centers. Besides this, our study had a big sample size. The regression analysis was performed by taking account confounders for each outcome.

### **Limitations**

The present study had some limitations. First, the median age for adolescents was 18 which shows that the majority of the study group was composed of older adolescents. Second, factors that might affect pregnancy outcomes such as smoking, ethnicity, education, economic status, and body mass index were not taken into account in this study. Third, this was a retrospective study and lack of the effects of

psychological challenges posed a negative effect on well-being in adolescent pregnancies which could change both prevention and treatment.

### **CONCLUSION**

Preventing adolescent pregnancies is more difficult but more necessary than preventing the medical problems that can arise from such pregnancies. Prevention of adolescent pregnancies should be considered one of the main health policy strategies to improve the socio-economic development of a country. Optimal perinatal care, sufficient support from both family and physicians, and promotion of education programs for the safe sexual practice among adolescents seems to be crucial for low and middle income countries. Moreover, encouragement of adolescents to avoid unwanted pregnancies via contraceptive methods should be a main focus. Additionally, we must keep in mind that the incidence of adverse perinatal outcomes of adolescent pregnancies could be minimized with optimal, multidisciplinary prenatal care.

Besides all of these, one of the main points about adolescent pregnancies are psychosocial challenges which were ignored in the present study. Pregnant adolescents might be more prone to depression, anxiety, suicide, alcohol and substance abuse. Adolescents feel ashamed, are stigmatised by their family and rejected by friends and partners because of the pregnancy. Their academic performance is damaged. While all of these are happening, the pregnant adolescent must be healthy for herself and her baby. Thus, public health professionals must focus on this issue. We suggest that, studies searching the effects of psychosocial challenges in adolescent pregnancies are needed to clarify the adverse



outcomes in adolescent pregnancies.

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**Ethical Approval:** SBU Bursa Yuksek Ihtisas Training and Research Hospital ethics committee approved the study (approval number: 2011-KAEK-25 2021/10-06).

**Authorship Contributions:** Concept: EFT, DB, SD Design: EFT, DB, SD, Supervising: EFT, DB, SD Data collection and entry: SD, Analysis and interpretation: EFT, BD, Literature search: EFT, DB, SD Writing: EFT, SD, Critical review: EFT, DB, SD.

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