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Perinatal outcomes of adolescent pregnancies: A retrospective study

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Abstract

Aim: Adolescent pregnancies constitute a very important health issue for maternal and fetal with social and economic consequences. The purpose of this study is to analyze the perinatal outcomes of adolescent pregnancies in a training and research hospital.

Materials and Methods: Perinatal outcomes for adolescents between the ages of 10 and 19 years old and adults between the ages of 20 and 30 years old between 2015 and 2019 were evaluated and compared retrospectively, using an obstetric and neonatal database from Van Training and Research Hospital.

Results: Cesarean section (CS) rates were 19,4 % vs. 30% in the adolescent and control groups, respectively ($p<0.05$). The rates of preterm delivery (PD), premature rupture of membranes (PROM), preeclampsia, and eclampsia were significantly higher among adolescents ($p<0.05$). After adjusting for maternal age, gravida, parity, hemoglobin level, education, socioeconomic status, and pregnancy follow-up, the rates of NVD (aOR 2.004, 95% CI 1.739-2.309), PB (aOR 1.419, 95% CI 1.122-1.794), PROM (aOR 4.401, 95% CI 3.066-6.319) and low birth weight (<2,500 g; aOR 2.480, 95% CI 1.442-4.264) were elevated in the adolescent group.

Conclusion: Adolescent pregnancy is associated with increased risk of PD, low birth weight, PROM, fetal mortality, and preeclampsia in our study. In this study, which evaluated adolescent pregnancies, maternal and fetal outcomes, risk of preeclampsia increased among maternal outcomes, and it was found to be associated with preterm birth, low birth weight, premature rupture of the membrane and increased fetal mortality from fetal outcomes. However, there are different results between studies because there are many factors affecting the results. More studies are needed to confirm these results. There is a need for more studies on adolescent pregnancies with important maternal and fetal outcomes not only for our country but also for many countries.

Introduction

Adolescence refers to the transition from childhood to adulthood. Definition of the adolescent by World Health Organization (WHO) includes young individuals between 10 and 19 years of age. Every year, 17 million adolescents give birth [1]. Adolescent birth rate (ABR) worldwide is 54 per thousand women 15–19 years old, with 95% of these births occur in low and middle-income countries [2]. The highest ABR in low-income countries world is in Africa (115 births per 1000 women 15–19 years) and Latin America - the Caribbean (64 births per 1000 women 15–19 years) [2]. Among high-income nations, the rates are also high as in the United States (57 births per 1000 women 15–19 years) and the UK (24 births per 1000 women 15–19 years) [3].

Adolescent pregnancies are considered important health and social issues in both high and low resource countries [4] as they are associated with perinatal outcomes such as maternal anemia, maternal mortality, postpartum infection, preeclampsia, eclampsia, emergency caesarean deliveries, postpartum depression, preterm deliveries and, fetal respiratory distress syndrome. Young mothers may also face stigmatization, rejection by their family, and/or violence from intimate partners, parents, and peers. Furthermore, educational disruption and other social consequences may limit future education and employment opportunities [2-7].

There is controversy in literature, whether poor Perinatal outcomes for young mothers should be attributed to biological immaturity or social stigma and low socioeco-

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nomic status [6]. A multicenter study demonstrated that poor outcomes for adolescent mothers persisted even after complex factors such as socioeconomic status, level of education, race, and marital status were adjusted [8]. Conversely, Lawlor et al. have argued that pregnancy before the age of 20 is not necessarily a biological concern with a negative effect on women's health but social factors may lead to poor outcomes [9]. Nutritional deficiencies in young mothers and insufficient weight gain in pregnancy can contribute to poor fetal and maternal outcomes [10].

According to the Turkish Statistical Institute Birth Statistics 2021 data, the adolescent pregnancy rate in Turkey is 13 births per 1000 women 15–19 years, which is a large proportion of the total population [7]. Adolescent pregnancies constitute a very important health issue for our country. We performed a detailed analysis of maternal and neonatal data in a large group of adolescent women. We aimed to evaluate the Perinatal outcomes for pregnancies of adolescents aged 10-19 years within a tertiary care hospital, in the current study.

Materials and Methods

This retrospective, case-control study was conducted at a training and research hospital in Turkey between December 2015 and January 2019. Ethical approval was obtained for our study from the Van Training and Research Hospital Clinical Research Ethics Committee (Decision no: 2019/08). Our hospital is a tertiary care and referral center where 15,000 deliveries take place per year. A total of 44994 women who delivered after 20 weeks of gestation were examined. Pregnant women with 10-19 and 20-30 years of age were categorized as adolescent and control groups, respectively. 2041 adolescent and 28224 pregnant of control group with live births were included.

Demographic characteristics (age, gravida, parity, socioeconomic status, level of education, pregnancy follow-up), obstetric outcomes (gestational week at birth, hemogram at presentation, birth weight, APGAR score, umbilical artery pH (UApH), birth asphyxia (BA), pregnancy complications including preeclampsia, eclampsia, postpartum hemorrhage (PPH), gestational diabetes mellitus (GDM), placental anomaly (PA), intrauterine growth restriction (IUGR), preterm membrane rupture (PROM), preterm delivery (PD), fetal distress (FDS), multigestational pregnancies, congenital anomalies (CA), newborn hospitalization in the first 48 hours, maternal mortality, neonatal mortality, and delivery type (Cesarean section (CS)), normal vaginal delivery (NVD), and operative vaginal delivery (OVD)) were evaluated. Infants whose birth weight between 1500-2500g were categorized as low birth weight (LBW), and those below 1500 g were considered as very low birth weight (VLBW). Pregnant women who underwent episiotomy and/or vacuum/forceps were classified as Operative Vaginal Deliveries (OVD). Among the fetal results, fetuses with an umbilical artery ph <7 at birth were categorized as having experienced birth asphyxia (BA).

A pregnant woman should be evaluated at least four times during pregnancy: at 16^{th}, 24^{th} -28^{th}, 32^{th}, and 36^{th} weeks of gestation for minimum antenatal care, according to WHO [3]. Pregnant women who did not receive prenatal care were categorized as "unfollowed." Postpartum hemorrhage was defined as postpartum uterine atony and related interventions such as blood transfusion, Bakri postpartum balloon, or other medical treatments. Maternal deaths that were pregnancy-related based on post-mortem review were included along with the cause of death. Gestational age was calculated using 1st-trimester crown-rump length (CRL, 0-136mm) by ultrasonography, last menstrual period (LMP), and 2nd-trimester ultrasonography (under 20 weeks) in some cases [11]. Study exclusion criteria were: pregnant women older than 30 years of age, those who had miscarriages or stillbirths at less than 20 weeks of gestation, those with smoking or alcohol use disorder, women with systemic disease (diabetes, rheumatic, heart disease, etc.), and all maternal deaths not related to pregnancy or pregnancy complications. Those with unknown LMP or ultrasonography, women who became pregnant as a result of rape, and mothers with IVF pregnancies and stillbirths were also excluded from the study.

Statistical analysis

The suitability of the data for normal distribution was tested. Results are presented as mean ± SD, median-interquartil range (IQR) or as percentages and numbers for categorical data. The Shapiro-Wilk normality test was used for all variables. A Chi-square test was employed to compare categorical variables between the groups. The Student's t-test was used if the independent variables were normally distributed, and the Mann-Whitney U test was used if they were not normally distributed. The sample width was calculated using the G*Power V.3.1.9.6 program.

Crude odds ratios (OR) and adjusted odds ratios (aOR) were calculated for maternal age and other potentially confounding factors in relation to perinatal outcomes. Binary logistic regression analyses were used to calculate the adjusted odds ratios. Calculations were made using a 95% confidence interval (CI). A p-value < 0.05 was considered statistically significant. Statistical Package for the Social Sciences (SPSS) (version 22) was used for analysis.

Results

The data of a total of 44,994 women who gave birth after the 20th gestational week were analyzed. We evaluated 2,041 adolescent and 28,233 pregnant of control group with live births after excluding pregnant women who did not meet the criteria (Figure 1).

The mean age at birth was 18.3 ± 0.88 (range 14 -19 years) and 25.15 ± 2.94 (range 20 – 30 years) in the adolescent and control groups, respectively.

The number of previous pregnancies and births, multiple pregnancies, socioeconomic status, and the adequacy of pregnancy follow-up was compared according to WHO minimum standards.

Pregnancy follow-up status was significantly poor in the adolescents relative to the control group ($p<0.001$). Socioeconomic status was similar between the groups ($p = 0.318$), but statistically lower levels of education were observed in adolescents ($p<0.001$) (Table 1). NVD vs. CS

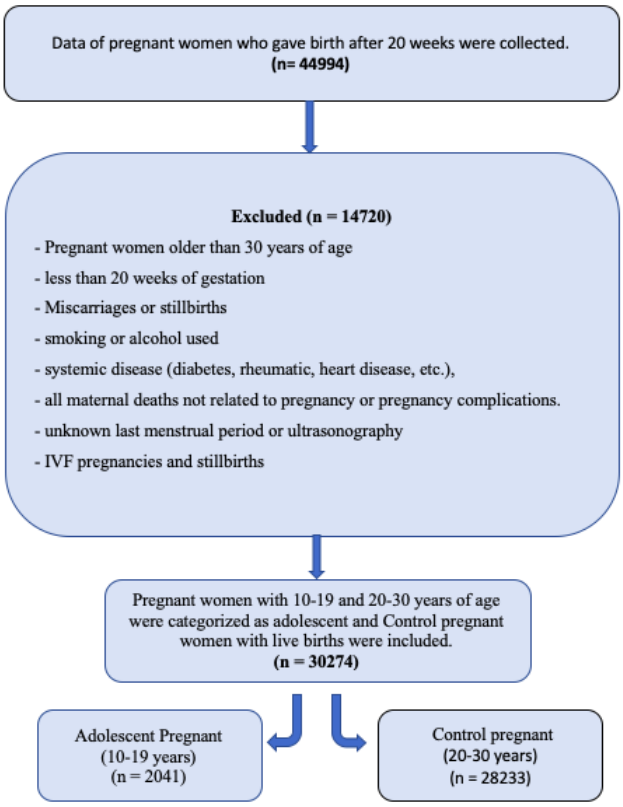

Figure 1. Flowchart to distribution of the groups.

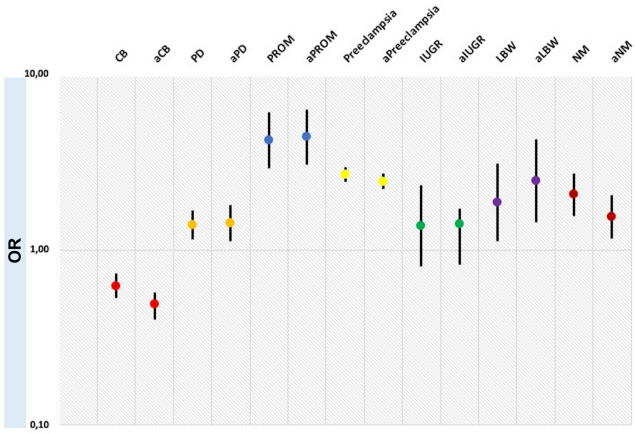

Figure 2. Adjusted Odds ratios *(Error bars: 95% CI)*. CI: confidence interval; OR = odds ratio; PROM, Premature Rupture of Membranes; GDM, gestational diabetes mellitus; IUGR, intrauterine growth retardation; VLBW, Very Low Birth Weight; LBW, Low Birth Weight; HBW, High Birth Weight; UA, Umblical Artery; NICU, Neonatal Intensive Care Unit; BA, Birth Asphyxia.

rates were 80.6% vs 19.4% and 70% vs 30% in the adolescent and control groups, respectively (p<0.05). Fifty one percent of adolescent pregnant women with normal vaginal delivery and 48.6% of the control group who delivered vaginally experienced operative vaginal deliveries (p<0.05) (Table 2).

Table 1. Demographic characteristics of the adolescent and control groups.

	Adolescent (n=2041)	Control (n=28233)	p-value
Age (year)	18.3 ± 0.88	25.15 ± 2.94	<0.001*
Gravida (%, n)			
1	86.3% (n=1762)	80.4% (n=22688)	<0.001*
2	12.9% (n=262)	13.8% (n=3907)	0.256
>2	0.7% (n=15)	5.8% (n=1638)	<0.001*
Parity (%, n)			
0	87.9% (n=1794)	80.9% (n=22827)	<0.001*
1	11.9% (n=244)	13.4% (n=3795)	0.056
>2	0.1% (n=3)	5.7% (n=1611)	<0.001*
Multigestational Pregnancy (%, n)	2.6% (n=53)	1.7% (n=483)	0.060
Socioeconomic Status (%)			
Working Yes	45.8%	55.6%	<0.001*
Pregnancy Follow-up according to WHO (%, n)			
Yes	23.6% (n=481)	45.8% (n=12927)	<0.001*
No	76.4% (n=1560)	54.2% (n=1574)	<0.001*
Level of Education (%, n)			
Primary school or less	70.8% (n=1446)	39% (n=11012)	<0.001*
Secondary school	27.7% (n=564)	33.8% (n=9543)	<0.001*
High school and above	1.5% (31)	27.2 (n=7679)	<0.001*

(*) Statistical significance was defined as p<0.05. WHO: World Health Organization.

Mean hemoglobin level (HGB) was significantly lower in adolescent pregnancies compared to the control group (10.8 ± 1.5 vs 11.6 ± 1.74, p<0.001).

Rates of LBW and infants < 2,500g were significantly higher in the adolescent group (p<0.001) (Table 2). Rate of neonatal mortality was significantly higher in adolescents (3.3% vs 1.5%, p<0.001).

Crude odds ratios (OR) and adjusted odds ratios (aOR) were calculated for maternal age and other potentially confounding factors in relation to perinatal outcome (Table 3). According to Crude OR logistic regression analysis, NVD, PD, PROM, preeclampsia, LBW, and neonatal mortality rates increase with adolescent pregnancy (Table 3, Figure 2). Adolescent mothers are at greater risk for PROM, preeclampsia, and neonatal mortality. However, the risk of GDM and PPH is lower in adolescent pregnancies. Increased risk of PPH, CS, and GDM is observed in the control pregnancy group.

After adjusting for gravidity, parity, HGB value, level of education, socioeconomic status, and pregnancy follow-up, rates of NVD, PD, and PROM were higher among adolescents. One-minute APGAR scores were lower and rates of low birth weight infants were higher among adolescent mothers compared with adults. There was also a decrease in the risk of preeclampsia and neonatal mortality in the adolescent group.

Table 2. Comparison of Adolescent and Control group perinatal outcomes.

	Adolescent (n=2041)	Control (n=28233)	p-value
Hemoglobin (g/dl) (mean ± SD)	10.8 ± 1.56	11.6 ± 1.74	<0.001*
Gestational age (mean ± SD)	37.19 ± 1.77	38.19 ± 1.6	0.137
Normal Vaginal Delivery	80.6% (n=1645)	70.0% (21415)	<0.001*
Operative Vaginal Delivery	51.1% (n=842)	48.6% (n=10419)	<0.001*
Cesarean Section	19.4% (n=396)	30.0% (n=8454)	<0.001*
Preterm Delivery (PD)	12.3% (n=251)	10.6% (n=3005)	0.020*
PROM	2.5% (n=52)	0.6% (n=162)	<0.001*
Preeclampsia	40.1% (n=819)	20.5% (n=5780)	<0.001*
Eclampsia	0.9% (n=19)	0.4% (n=99)	<0.001*
GDM	0.3% (n=6)	0.8% (n=234)	0.012*
Postpartum Hemorrhage	4.0% (n=81)	7.7% (n=2178)	<0.001*
Placental Anomaly	0.5%(n=11)	0.6%(n=179)	0.415
IUGR	0.9% (n=18)	0.9% (n=252)	0.986
Maternal mortality	0.1% (n=3)	0.1% (n=21)	0.311
First minute APGAR score (mean ± SD)	7.3 ± 1.8	8.3 ± 1.1	0.045*
Fifth minute APGAR score (mean ± SD)	8.7 ± 1.2	8.8 ± 1.5	0.438
BA (UA pH< 7)	1.6% (n=33)	1.3% (n=370)	0.244
Fetal Birth Weight(gr)	2930,05 ± 510,27	3087,36±506,31	0.448
VLBW (<1500gr)	1.2% (n=24)	0.9% (n=249)	0.194
LBW (1500-2500gr)	13.5% (n=275)	10.9% (n=3083)	<0.001*
Macrosomia (>4000gr)	2.4% (n=50)	3.2% (n=898)	0.067
Congenital malformation	0.5% (n=10)	0.4% (n=120)	0.637
NICU	11.1% (n=226)	9.9% (n=2788)	0.082
Neonatal mortality	3.3% (n=67)	1.5% (n=414)	<0.001*

(*) Statistical significance was defined as p< 0.05. VLBW, Very Low Birth Weight; LBW, Low Birth Weight; HBW, High Birth Weight; UA, Umblical Artery; PROM, Premature Rupture of Membranes; GDM, gestational diabetes mellitus; IUGR, intrauterine growth retardation; CPD, Cephalopelvic Disproportion; PA, presentation anomalies; PUS, Previous Uterine Surgery; RDS, Respiratory Distress Syndrome; PreEC, preeclampsia; EC, eclampsia; NICU, Neonatal Intensive Care Unit; FDS, fetal distress; PE, Pulmonary Embolism; BA, Birth Asphyxia.

Discussion

Adolescent pregnancy is an important health issue with clearly known causes and social-economic consequences in many countries, both developed and developing [2,12]. In Turkey, because of young marital age, which results from socioeconomic, religious, and traditional factors, the population of Adolescent pregnancy is large [7,13]. Thus, the high pregnancy rate among young women constitutes a significant obstetric problem In addition it seriously affects the socio-economic life of the mother and child [13].

The risk of caesarean section is reported as increased, decreased, or unchanged in adolescent pregnancies compared to that for adults, in different studies [14]. The risk of cesarean birth is decreased especially in late adolescents [14], whereas the OVD rate of adolescent pregnant women is high [15]. Leppalahti et al. reported that the OVD rate was low in young mothers in developed countries like Canada, France, and the United Kingdom, but this rate increased in developing countries such as India, Nigeria [16]. Our study found that the rate of Cesarean section was lower in adolescent pregnant women, and the rate of OVD was significantly higher in adolescent pregnant women, but no increased risk of Caesarean section was observed. We detected CPD as the most common cause of cesarean section in adolescents, in accordance with the literature [17]. However, the age-related fear of birth and the incompatibility of the patient rather than the pelvic measurements may affect the diagnosis for CPD [17].

The lowest levels of hemoglobin and hematocrit should be 11.0 g/dL and 31%, respectively, in normal pregnancies according to WHO. The incidence of anemia was higher in adolescents compared to adults, in our study. The mean value of hemoglobin was 10.8 gr/dL in adolescents, which was lower than the recommendation of WHO. Despite studies reporting no difference in anemia between adolescents and adults, the risk of anemia is also reported to be higher in adolescent pregnancies compared to control pregnancies [18]. Hemoglobin levels may be observed as less than 10,5-11 g/dL and severe anemia may be detected with hemoglobin levels less than 7 g/dL in adolescent pregnant women [19].

Pregnant women should be visited by Healthcare Providers, at least four times during their pregnancy, according to WHO [3]. Many complications that may occur before and after pregnancy can be prevented or timely controlled with antenatal care. Incomplete knowledge and experience, the lack of psychological willingness, and highly variable emotional status increase the importance of antenatal care in adolescents [20]. Maternal and neonatal mortality, morbidity do not increase in cases with adequate antenatal care [21]. Antenatal follow-up was insufficient in both adolescents and control groups, with a significantly lower rate in adolescent pregnant women, in the present study. There was only a decrease in neonatal mortality and preeclampsia risk in adolescents.

Hypertensive diseases are more common in adolescent pregnant women compared to adults. Both preeclampsia and eclampsia increase significantly in adolescent pregnancy which may be due to immature immune system and lack of antibodies blocking chorionic villi in adolescents [20, 22]. Leppalahti et al. compared 7305 adolescent pregnant women between the ages of 13-19 and 51142 pregnant women between the ages of 25-29 [16]. The rate of eclampsia was high in adolescents and the risk of preeclampsia increased at the age of 13-15 [16]. Rates of eclampsia and preeclampsia were higher in adolescent pregnancies compared to control pregnancies in the current study. The risk of preeclampsia increased 2.6 times in adolescent pregnancies.

Diabetes is rare in young pregnant women due to a decrease in insulin sensitivity, and a lower rate of GDM is observed in adolescent pregnancies [20]. In our study, although the macrosomic (HBW) infant ratio was high in the control group, no statistical difference was observed. GDM was significantly higher in the control group compared to adolescent pregnancies.

Croen and Saw showed that the distribution of the prevalence for all congenital anomalies was J-shaped according to age groups [23]. The lowest prevalence was between 20-29 years of age, a moderate prevalence was observed among adolescent women, and the highest prevalence was

Table 3. Crude and Adjusted Odds ratios of the association between maternal age and adverse perinatal outcomes.

Perinatal Outcames*	Adolescent (n=2041)		Control (n=28233)	
	Crude OR (95% CI)	Adjusted OR(95% CI)	Crude OR (95% CI)	Adjusted OR(95% CI)
Normal Vaginal Delivery	1.592(1.364-1.862) p<0,001*	2.004(1.739-2.309) p<0,001*	1.562(1.410-1.805) p<0,001*	0.499(0.433-0.575) p<0,001*
Operative Vaginal Delivery	1.009(0.895-1.138) p=0.879	0.917(0.824-1.021) p=0.115	0.991(0.879-1.117) p=0.879	1.090(0.979-1.213) p=0.115
Cesarean Section	0.628(0.537-0.733) p<0,001*	0.499(0.433-0.575) p<0,001*	1.593(1.364-1.861) p<0,001*	2.003(1.738-2.308) p<0,001*
Preterm Delivery	1.394(1.153-1.685) p=0.001*	1.419(1.122-1.794) p=0.003*	0.718(0.593-0.868) p=0.001*	0.705 (0.557-0.891) p=0.003*
PROM	4.203(2.906-6.080) p<0,001*	4.401(3.066-6.318) p<0,001*	0.203(0.164-0.344) p<0,001*	0.227(0.158-0.326) p<0,001*
Preeclampsia	2.687(2.437-2.962) p<0,001*	2.459(2.227-2.716) p<0,001*	0.372(0.338-0.410) p<0,001*	0.407(0.368-0.449) p<0,001*
Eclampsia	1.052(0.575-1.925) p=0.869	0.738(0.421-1.293) p=0.289	0.950(0.519-1.739) p=0.869	1.355(0.773-2.373) p=0.289
GDM	0.444(0.187-1.054) p=0.035*	0.463(0.198-1.083) p=0.046*	2.252(0.948-5.347) p=0.035*	2.159(0.923-5.048) p=0.046*
Postpartum Hemorrhage	0.441(0.351-0.554) p<0,001*	0.406(0.322-0.512) p<0,001*	2.269(1.804-2.852) p<0,001*	2.461(1.952-3.101) p<0,001*
IUGR c	1.374(0.806-2.342) p=0.243	1.403(0.824-1.021) p=0.115	0.728(0.427-1.241) p=0.243	0.713(0.424-1.199) p=0.202
Maternal mortality	0.780(0.147-2.052) p=0.373	1.128(0.065-1.307) p=0.107	1.282(0.487-6.794) p=0.373	0.886(0.157-2.186) p=0.107
First minute APGAR score	1.153 (0.812–1.534) p=0.115	1.302 (0.735–1.566) p=0.022*	0.867(0.651–1.231) p= 0.115	0.768(0.638–1.360) p=0.022*
Fifth minute APGAR score	0.946(0.712–1.305) p= 0.745	1.004 (0.993–1.054) p=0.965	1.057(0.766-1.404) p=0.745	0.996(0.948-1.007) p=0.965
BA (UA pH< 7)	1.739(0.739-1.656) p=0.623	0.933(0.476-1.831) p=0.891	0.904(0.604-1.353) p=0.623	1.028(0.692-1.527) p=0.891
VLBW (<1500gr)	1.234(1.145-1.594) p=0.288	1.277(1.080-1.415) p=0.344	0.810(0.627-0.873) p=0.288	0.783(0.706-0.925) p=0.344
LBW (1500-2500gr)	0.880(0.756-1.026) p=0.102	1.100(0.898-1.347) p=0.357	1.136(0.975-1.323) p=0.102	0.909(0.742-1.113) p=0.357
HBW (>4000gr)	0.873(0.618-1.232) p=0.439	1.269(0.936-1.722) p=0.126	1.146(0.812-1.617) p=0.439	0.788(0.581-1.069) p=0.126
<2500gr	1.867(1.124-3.099) p=0.016*	2.480(1.442-4.264) p=0.001*	0.536(0.323-0.889) p=0.016*	0.403(0.235-0693) p=0.001*
Congenital malformation	1.002(0.505-1.990) p=0.995	0.933(0.476-1.831) p=0.840	0.998(0.503-1.982) p=0.995	1.072(0.546-2.102) p=0.241
NICU	1.183(0.995-1.406) p=0.057	1.103(0.934-1.303) p=0.248	0.845(0.711-1.005) p=0.057	0.906(0.767-1.071) p=0.248
Neonatal mortality	2.071(1.568-2.735) p<0,001*	1.542(1.164-2.043) p=0.003*	0.483(0.366-0.638) p<0,001*	0.649(0.489-0.859) p=0.003*

(*) Statistical significance was defined as p<0.05. (a) Adjusted for gravida, parity, hemoglobin value, level of education, Socioeconomic status and Pregnancy Follow-up according to World Health Organization rates,. CI: confidence interval; OR = odds ratio; PROM, Premature Rupture of Membranes; GDM, gestational diabetes mellitus; IUGR, intrauterine growth retardation; VLBW, Very Low Birth Weight ; LBW, Low Birth Weight; HBW, High Birth Weight; UA, Umblical Artery; NICU, Neonatal Intensive Care Unit; BA, Birth Asphyxia.

over 40 years of age. Cambaz et al. examined 357 adolescent pregnant women in terms of congenital anomalies and reported no central nervous system, gastrointestinal system, and musculoskeletal system anomalies [22]. In our study, we detected 10 fetal congenital anomalies in the adolescent group and 120 fetal anomalies in the control group but there was not any statistically significant difference among them.

There is no complete consensus in the literature about placental anomalies in adolescent pregnancies. Both lower and higher risk for placental anomalies is reported for adolescent pregnant women whereas some publications indicate no difference between adolescents and adults [24, 25]. The placental anomaly was observed rarely in adolescent pregnant women in our study, without any statistically significant difference compared to the control group. PPH was more common and was the second most common cause of maternal death in the control group. The risk of PPH in the control group increased 2.2 times compared to the adolescent group and the risk increased with adjusted OR in our study. There are inconsistencies among the publications for PPH. Similar rates of PPH may be observed in adolescent and control group whereas some publications report an increased rate of hemorrhage in adolescent pregnant women [7, 24].

According to WHO data, approximately 70,000 adolescent pregnant women die due to complications related to pregnancy and delivery each year [26]. WHO reported that 808 mothers died every day due to pregnancy or its complications in 2017 and the most common causes were hemorrhage, preeclampsia, infection, and indirect causes [27]. Çim et al. reported that maternal mortality was 20.1 per 100000 in all pregnant women. The most frequent direct causes were preeclampsia, hemorrhage, PE, and suicide as an indirect cause [24]. Maternal mortality was not statistically different among the study groups, in the present study. Eclampsia was the most common cause of death in adolescent pregnant women.

Most studies report a strong relationship between adolescent pregnancy and PD [7]. Rauf et al. observed a significantly higher rate of PD in adolescent pregnant women [25]. PROM is defined as rupture of fetal membranes before 37 weeks and increases fetal and maternal mortality and morbidity as it is a common cause of PD [28]. PD was high in adolescent pregnant women, although they did not smoke in our study. We observed a significantly increased rate of PROM in adolescent pregnant women compared to the control group. The factors affecting this may be socioeconomic level, because there is less work, or the low level of education may be the lack of personal hygiene requirements.

LBW is defined as the fetus below 2500 g and very low birth weight is defined as below 1500 g [7]. Adolescents have an incomplete growth stage and maturity in terms of the skeletal system. Therefore, it is predicted that adolescent women give birth to premature and LBW infants, and consequently, neonatal and infant mortality are higher [29]. LBW in adolescent pregnant women was significantly

higher than the control group correlated to PD, in the current study. LBW and PD is cause neonatal and infant mortality. The reason for this may be those adolescent pregnant women have not completed their physical development and are malnutrition.

The rate of IUGR was similar between the groups in our study. Several studies report, significantly higher rate of IUGR in adolescent pregnant women [29]. Gordon et al. suggested that there was no significant difference between adolescent and control group in terms of IUGR when adjusted for smoking [28].

APGAR score of 1 to 5 minutes and umbilical artery pH values indicating fetal well-being of babies are evaluated after birth. The examination of pH values stated that fetal results are worse in infants with umbilical pH < 7 [30]. In our study, the statistical difference was observed only between first minute APGAR scores and adjusted OR increased the risk by 1.3 times in adolescent pregnancies. Although BA (UA pH < 7) ratio was higher in adolescent pregnant women, no statistical difference was observed. Again, although the number of hospitalizations in the neonatal intensive care unit was higher in adolescents, we did not observe a statistical difference.

Limitations

One of the limitations of our study is that it is a retrospective case-control article. Also, We did not form subgroups for the adolescent pregnancy due to the lack of an early adolescent group and the small sample size of the middle adolescence. However, the number of adolescent pregnant women in our region is one of the highest in our country. In addition, all mothers and newborns were cared for in a tertiary center; it was also a hospital with an infrastructure that has provided home care services since 2018. Therefore, the quality of prenatal care has increased.

Conclusion

Adverse effects on the perinatal outcomes of adolescent pregnancies are evaluated as a multifactorial effect. We report that adolescent pregnancy increases the risk of preterm delivery, PROM, low birth weight, neonatal mortality, and preeclampsia.

Therefore, we think adolescent pregnancies should always be regarded as risky pregnancies and thus ut- most care should be taken for the problems they may encounter during the prenatal and perinatal, periods. However, in order to generalize adverse perinatal outcomes in adolescent pregnancy, It should be done with multi-center and wider participation. Further studies are required to indicate pregnancy complications specific for adolescent pregnancies and in effort to determine measurable and adjustable variables to obtain better outcomes.

Ethical approval

Ethical approval was obtained for our study from the Van Training and Research Hospital Clinical Research Ethics Committee (Decision no: 2019/08).

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