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Hospital-Based Study of Maternal, Perinatal and Neonatal Outcomes in Adolescent Pregnancy Compared to Adult Women Pregnancy

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Abstract

BACKGROUND: Adolescent pregnancy, defined as a pregnancy in girls aged 10 to 19 years. Adolescent mothers are at high risk for maternal and neonatal complications.

AIM: To compare maternal, perinatal and neonatal outcomes in adolescents and adult women aged 20-24 years.

MATERIAL AND METHODS: This retrospective cohort study included all singleton pregnancies during a three-year period (January 2016-December 2018) who gave birth in a Clinical Hospital in Tetovo, Republic of Macedonia. After exclusion criteria, a total of 932 cases were reviewed and divided into two groups: one of the teenage mothers (< 19 years old) (115 women) and the other of adult mothers (20-24 years old) (817 women).

RESULTS: Of the total number of 5643 births, 128 (2.27%) were from adolescent pregnancies. Of them, nulliparous adolescent women were 115 (2.04%). Adolescents compare to adult mothers had a higher rate of urinary tract infections (33% vs. 22%), increased rate of maternal anemia (26% vs. 15%), preterm birth, small for gestational age newborns (25.2% vs. 17.1%), lower high school attendance (0 vs. 21.9%) and inadequate prenatal care. Spontaneous labour was more common in adolescents (73% vs 63.5%), while Caesarean sections were less common than in women aged 20-24 years (25.2% vs 33.5%). The rate of other perinatal outcomes was not significantly different between the 2 groups.

CONCLUSIONS: The results of the study showed that the frequencies of some maternal, perinatal and neonatal complications were considerably higher in adolescent mothers.

Introduction

Adolescent pregnancy has been defined as a pregnancy in women aged between 13-19 years [1] and as a social problem distributed worldwide, has serious implications on maternal and child health, especially in the developing countries [2]. More than 16 million babies (11% of all births globally) are born to adolescent girls [3]. Globally, adolescent birth rates for every 1000 births in the year 2016 were 0.045 in the World, 0.047 in Arab World 0.038 in the Middle East & North Africa, 0.022 in OECD members, 0.020 in North America, 0.019 in Asia, 0.010 in European Union. Among all countries of the world, the highest rate (206/1000) belongs to Niger. The countries with the lowest birth rates among adolescents in the range of age 15-19 are Slovenia and Denmark (0.004), Hong Kong and Switzerland (0.003), South Korea (0.002). In our country, the adolescent birth rate was 0.017 in the year 2016 [4].

Teenage mothers are at high risk of maternal and neonatal complications include maternal anemia, hypertensive disease in pregnancy, preterm birth, urinary tract infection [5], postpartum hemorrhage, eclampsia and cephalopelvic disproportion, as well as adverse infant outcomes including preterm birth, poor fetal growth, low birth weight, neonatal mortality [6], respiratory diseases and birth trauma, besides a higher frequency of neonatal complications and infant mortality [7]. Although adolescent pregnancies, especially unintended pregnancies, might carry a greater risk of adverse consequences in developing countries with limited health resources and restrictive abortion laws, pregnancy and childbirth among young women in developed countries can also pose challenges to their social, economic and physical well-being. Studies on complications in teenage pregnancy

have yielded conflicting results, and opinions of different authors vary in this regard [8], [9]. Given the characteristics of adolescence, pregnancy during the period is different from other age groups and creates different feelings in women. Pregnancy during adolescence is considered a social issue associated with medical, emotional and social outcomes for the mother, child and family [11]. Early marriage, in some traditional rural communities, low educational level, low level of sexual education and contraceptive use, high rate of poverty are important factors in the rate of adolescent pregnancy. Adolescent mothers are more likely to have poor prenatal health behaviours and poorer health status [12]. In these group of women, pregnancy and delivery are not only associated with adverse pregnancy outcomes, but also associated with low school achievement, increased health care costs, and living in poverty [13].

This study aimed to determine maternal, perinatal and neonatal outcomes in nulliparous singleton adolescent pregnancies compare to nulliparous singleton adult pregnancies aged 20-24 years.

Material and Methods

This is a retrospective comparative hospital-based cohort study of all singleton pregnancies and deliveries that occurred in a teenage group (< 19 years old) compared with an adult group (aged 20-24 years) at Clinical Hospital in Tetovo, Republic of Macedonia, which is the regional secondary referral center for the region of north-western region of the country. Data were collected from the hospital's electronic database in the period between January 2016 and December 2018. Inclusion criteria included maternal age of 15 to 24 years, primigravida, gestational age more than 22 weeks. Because most of the adolescents (85%) were nulliparous women [14], we limited the analysis to nulliparous women. Age between 20 and 24 years as a control group, was considered since this age-group is generally regarded as safe for childbirth. Exclusion criteria were second or more pregnancy, multiple pregnancies, chronic diseases, diabetes mellitus, any known systemic disorders and gestational age less than 21 weeks. The total number of subjects was 932 women, and we divided these mothers into a teenage mother group (115) and a non-teenage mother group (817).

Study parameters

The choice of study parameters was based on previous literature and clinical relevance. Maternal parameters reviewed were maternal demographic characteristics, antenatal complications and mode of delivery. Maternal age was defined as the completed age of the mother at the time of delivery and was further categorised into 2 groups: adolescence (< 19.9 years) and adult (between 20-24.9 years of age). The adult classification was considered to be the control group. We used the World Health Organization's definition of adolescent pregnancy that is a pregnancy in a woman aged 10-19 years [15]. The area of residence at the time of delivery was divided into an urban and rural area. The maternal educational level was classified as primary (class 1-9), secondary school (class 9-13) and high-level school. A number of prenatal visits was categorised as less than four or four and more.

Mode of delivery was vaginal delivery, instrumental vaginal delivery (vacuum extraction or forceps) and caesarean section. Cervical laceration, perineal tear, postpartum haemorrhage, and uterine curettage were delivery outcomes which also were studied.

Antenatal complications included urinary tract infection (asymptomatic bacteriuria, acute cystitis or pyelonephritis) [16], anemia (hemoglobin concentracion < 11 g/dL) [17], preterm rupture of membrane (PROM) [18], gestational hypertension (GH, blood pressure > 140/90 mmHg in women with proteinuria < 0.3 g/24h urine collection), pre-eclampsia (PE, blood pressure > 140/90 mmHg and proteinuria > 0.30 g/24h urine collections in women) [19] third trimester bleeding including placenta previa and placental abruption [20].

Perinatal outcomes included preterm delivery (< 37 completed weeks) [21], intrauterine fetal death (delivery of a dead infant after 22 week' gestation) [22], low Apgar score (A/S) at 1st minute < 7 and admission to neonatal intensive care unit (NICU), birth weight adjusted for gestational age according to the previously published curves standardized for gestational age [23] (divided into small-for-gestational-age (SGA, defined as < -2 SD), average-for-gestational-age (AGA) and large-for-gestational-age (LGA, defined as > +2 SD). Gestational age at birth was calculated as a number of weeks from the first day of the last menstrual cycle until the delivery date. Descriptive analyses were carried out by calculating the numbers and percentages for categorical variables and calculating mean and standard deviation for continuous variables.

Bivariate analyses for the association between maternal age and development of maternal, fetal and neonatal complications were carried out. P-values were calculated using Pearson's chi-squared test or the Student's t-test as appropriate. Odds ratios and 95% confidence intervals were calculated for categorical variables and categorized continuous variables. P-value < 0.05 was considered to be statistically significant.

Results

During the study period, in our hospital were born 5643 infants. Overall 128 (2.27%) infants were born to adolescents aged 19 years and younger. Of the total deliveries, only singleton pregnancies were included in this study. In the beginning, 5491 adult pregnancies were recruited for the control group. After the restriction of analyses to singleton primiparous women, 817 adult pregnancies aged 20-24 were analysed as a control group. The singleton pregnancies were divided into two groups: pregnant nulliparous teenage women (n = 115, 2.04%) and as the control group, nulliparous pregnant women aged 20-24 (n = 817, 14.54%).

The age of the study group patients ranged from 15 to 19 years, with a mean age of 18.02 ± 0.98 years. Women aged 17-19 years represented 92% of the total number, while only 8% of women were aged between 15-16 years. The age of the control group ranged from 20 to 24 years, with a mean age of 22.42 ± 1.54. Maternal demographic characteristics are shown in Table 1. All the demographic characteristics of the teenagers versus the adult women differed significantly, except for the level of secondary school. Pregnant teenagers were more live in a rural area (77.4% vs. 61.9%, p = 0.0001, OR = 2.1, 95% CI = 1.33-3.33), were more likely to be Roma ethnicity (39.1% vs. 88.8%, p = 0.0001, OR = 6.85, 95% CI = 4.37-10.71) and have low educational level (63.5% vs.31.9%, p = 0.0001, OR = 3.70, 95% CI = 2.46-5.56).

Table 1: The demographic characteristics of women in the two age groups

	Maternal age (years)		p-value	Odd ratio	95% CI
Characteristics	< 19 (n. 115)	20-24 (n. 817)			
Maternal age	18.02 ± 0.98	22.42 ± 1.54			
Educational level n (%)					
Primary school	73 (63.5)	261 (31.95)	0.00001	3.70	2.46-5.56
Secondary school	42 (36.5)	377 (46.15)	0.0572	0.67	0.44-1.00
High school	0	179 (21.90)	0.00001	0.03	0.00-0.22
Ethnicity n (%)					
Macedonian	2 (1.73)	123 (15.05)	0.00001	0.09	0.02-0.40
Albanian	66 (57.39)	597 (73.07)	0.0009	0.5	0.33-0.74
Roma	45 (39.13)	72 (88.81)	0.00001	6.85	4.37-10.71
Others	2 (1.73)	25 (3.05)	0.5643	0.52	0.12-2.21
Area of residence n (%)					
Rural	89 (77.40)	506 (61.93)	0.0001	2.1	1.33-3.33
Urban	26 (22.60)	311 (38.06)	0.0012	0.47	0.30-0.75

Complications during pregnancy. Registered obstetrical characteristic and comorbidities are presented in Table 2. The association between the age-group of mothers and number of antenatal visits and folic acid intake was significant (p < 0.01). When compared with adult mothers, the proportion of anemia (26.0% vs.15.1%) and urinary tract infection (33% vs. 22%) were significantly higher in teenage mothers (p = 0.0042, OR = 1.97, 95% CI = 1.24-3.11and p = 0.013, OR = 1.74, 95% CI = 1.14-2.66 respectively).

There were no significant differences between the teenage and adult group in GH (3.47% vs. 7.71%), pre-eclampsio (0.86% vs. 1.10%), placenta previa (1.73% vs. 1.71%), placental abruption (1.73% vs.1.22%), PROM (22.6% vs. 31.9%), IUFD (0.86% vs.1.46%), preterm birth (10.4% vs. 16.9%), (p = 0.12, p = 1, p = 1, p = 0.65, p = 0.49, p = 1, p = 0.07, respectively).

Table 2: The characteristics of pregnancy in the two age groups

	Maternal age (years)		p value	Odd ratio	95% CI
Characteristics n (%)	<19 (n.115)	20-24 (n.817)			
Antenatal visits					
< 4 times	67 (58.26)	148 (18.11)	0.0001	6.30	4.18-9.51
> 4 times	48 (41.73)	669 (81.88)	0.0001	0.15	0.10-2.23
Folic acid intake	82 (71.30)	767 (93.88)	0.0018	0.16	0.09-0.26
Anemia	30 (26.08)	124 (15.17)	0.0042	1.97	1.24-3.11
GH	4 (3.47)	63 (7.71)	0.12	0.43	0.15-1.20
Pre-clampsia	1(0.86)	9 (1.10)	1	0.78	0.09-6.27
Urinary tract infection	38 (33.04)	180 (28.03)	0.0132	1.74	1.14-2.66
Placenta previa	2 (1.73)	14 (1.71)	1	1.01	0.22-4.52
Placental abruption	2 (1.73)	10 (1.22)	0.6531	1.42	0.30-6.60
PROM	26 (22.60)	261 (31.94)	0.49	0.62	0.39-0.98
IUFD	1 (0.86)	12 (1.46)	1	0.58	0.07-4.56

PROM-Preterm rupture of membranes, IUFD-Intrauterine fetal death, GH-gestational hypertension.

Delivery characteristics. The outcomes of deliveries are presented in Table 3. The teenage mothers had significantly higher proportion (73% vs. 63.5%), of normal vaginal delivery compared to the adult mothers, (p = 0.048, OR = 0.64, 95% CI = 0.41-0.99). The association between the age of mothers and operative and instrumental mode of delivery was non-significant (p = 0.08 and p = 0.76 respectively).

Perineal ruptures of 1st and 2nd degrees and cervical lacerations were in significantly higher proportion in adult mothers compared to teenage mothers (p = 0.049, OR = 0.06, 95% CI = 0.01-0.49). Postpartum blood transfusion and instrumental revision of uterus were non-significant different between adolescent and adult mothers.

Table 3: Association between outcomes of deliveries and maternal age

	Maternal age (years)		p value	Odd ratio	95% CI
Variables n. (%)	<19	20-24			
Vaginal delivery	84 (73.04)	519 (63.52)	0.048	0.64	0.41-0.99
Caesarean Sectio	29 (25.21)	274 (33.53)	0.085	0.66	0.42-1.04
Vacuum extraction	2 (1.73)	24 (2.93)	0.760	0.58	0.13-2.50
Blood transfusion	11 (9.56)	92 (11.26)	0.750	0.83	0.43-1.60
Perineal tear	0	42 (7.73)	0.049	0.06	0.01-0.49
Complications of third stage of labor	4 (4.65)	50 (9.20)	0.39	0.56	0.19-1.58

The fetal outcome. The teenage mothers had a significant higher proportion (25.1%) of SGA deliveries compared to the adult mothers (17.1%), (p = 0.039, OR = 1.63, 95% CI = 1.03-2.57). It was less common for newborns of adolescents to have low Apgar score < 7 at 1st minute (3.47% vs. 13.21 %) compared to adult mothers, (p = 0.001, OR = 0.23, 95% CI = 0.08-0.65).

There was no statistically significant difference in AGA and LGA newborns, preterm birth and admission to NICU between two age groups (Table 4).

Table 4: The newborn status between two age groups

	Maternal age (years)		p value	Odd ratio	95% CI
Status of the newborn, n. (%)	< 19	20-24			
AGA	78 (67.82)	601 (73.56)	0.2178	0.75	0.49-1.54
LGA	8 (6.95)	76 (9.30)	0.4894	0.72	0.34-1.55
SGA	29 (25.21)	140 (17.13)	0.039	1.63	1.03-2.57
Preterm birth (<37 weeks)	12 (10.43)	138 (16.89)	0.0794	2.01	1.25-3.23
A/S <7	4 (3.47)	108 (13.21)	0.0012	0.23	0.08-0.65
NICU	8 (6.95)	96 (11.75)	0.15	0.56	0.26-1.18

AGA-Average for gestational age, LGA-Large for gestational age, SGA-Small for gestational age, A/S-Apgar score, NICU-Neonatal intensive care unit.

Discussion

In this study, we investigated the correlation between maternal age and the risk of adverse maternal, perinatal and neonatal outcomes in our hospital. 2.40% of births occurred to women younger than 19.9 years old. 2.04% of teenage mothers were with the first pregnancy. This proportion is higher compared to the national level of 1.7% of all pregnancies [4]. The results demonstrated that our population had a high teenage birth rate, similar to most of the studies from developed and developing countries. UNFPA reported the similar results of the adolescent birth rate per 1000 women aged 15 to19 in other countries, like a Serbia 15, Albania 20, Hungary 23, Slovakia 24 birth rate per 1000 women [25]. Low levels of literacy adversely affect reproductive, sexual health and quality of life. An early start of childbearing greatly reduces the educational and employment opportunities of women and is associated with higher levels of fertility [2]. In our study, the educational level is significantly higher among the adult mothers compared to teenage mothers. Younger maternal age is associated with being unmarried, primiparous and under-educated, heavy smoking and inadequate prenatal care, which may cause adverse pregnancy outcomes as reported in Taiwanese national survey and a study from Slovenia [27], [28]. Our results showed that pregnant teenagers were more live in rural area and the adolescent birth rate is significantly higher among Roma minority compared to the other ethnicities. The high adolescent birth rates among Roma populations are linked to the practice of child marriage which remains prevalent in Roma communities. Roma girls often have no choice but to follow tradition, leave school and get married in young age, thus perpetuating a cycle of lack of education, poverty and early childbirth [29], [30].

The results of the study showed that adolescent pregnancy is related to poorer prenatal care compared to adult women. This finding is supported by other studies in Tertiary Centers in Slovenia, Greece and Turkey [28], [31], [32]. In addition to the fact that teenage pregnancy is more likely to occur in a socially deprived society, social factors themselves can also affect the adequacy of prenatal care among teenagers. Because of economic and social barriers, teenage mothers are less likely to attend prenatal care clinics, which can affect maternal and neonatal outcomes. This conclusion is supported by the study for evaluating the social determinants of teenage pregnancy in the United Kingdom and Korea [6], [33].

Consumption of prophylactic folic acid tablets was significantly lower among teenage mothers. These results are consistent with those reported by other research studies in Turkey and the United States. Kirbas et al., (2016) reported a lower prevalence of both preconception and prenatal folic acid supplementation in adolescents compared with healthy pregnant women aged 20-34 years [34]. Branum et al., (2013) demonstrated a 2.5 times lower prevalence of supplement use among pregnant women aged < 25 years compared with older women [35]. However, two other studies researched in North Mexico and Brasil did not reveal a significant difference in folic acid intake between pregnant adolescents and adults [9], [36]. Consistent with other studies, the results showed significantly higher risks of maternal anaemia and urinary tract infections in adolescent mothers. This high proportion of anaemia may be attributed to the fact that teenage pregnant women are usually uneducated and are likely to come from relatively low-income families, so they do not appreciate the importance of regular antenatal care, blood tests for anaemia and taking iron supplements during pregnancy to prevent and treat anaemia. Studied from Slovenia, Oman and India reported for high rate of anemia in adolescent women ($p = 0.012$, 0.005, 0.001, respectively) [28], [37], [38]. In the present study a high prevalence of urinary tract infections in pregnant adolescents (33% vs 22% in adults), also is reported in other studies from Finland, Turkey, Romania and North-West Russia (OR 2.5, 0.72, 1.10, 1.17 respectively) [23], [32], [39], [40].

In contrast no excess risk was found in a Latin American study in which teenagers were analysed in sub-groups by age [41]. Researchers speculate that teenagers might be sexually more active during pregnancy and have reduced resistance to infections compared with older women. This reason placed them at a higher risk of urinary tract infections [23].

Previous studies carried out in industrialized countries, like a Korea, Canada, Slovenia and Iran have revealed no excess risks of preeclampsia among adolescents [6], [10], [28], [42], whereas higher risks have been reported in developing countries, like a Turkey and Zambia [43], [44]. Our results do not support earlier findings of a higher risk of gestational hypertension and preeclampsia in teenage mother's compared to adults [45]. The relatively small number of pregnant mothers aged 15-16 years in our study places some uncertainty on this finding. In our study pregnancy comorbidities placenta praevia, placental abruption, PROM, IUFD, occurred similarly across age groups. These results for placenta praevia and placental abruption support the findings of most authors [10], [32], [46] in the previous studies. More

frequent preterm birth in adolescents was also found in other studies. Mayo et al., (2017) reported for the highest prevalence of preterm birth among the youngest (13-year-olds, 14.5%) and lowest among the oldest (20-year-olds, 6.7%) mothers. Keskinoglu et al., (2007) reported for the rates of preterm birth and low birthweight of teen mothers were 18.2% and 12.1%, respectively [47], [48]. In the Slovenian study from Korencan et al., (2017) have reported that young mothers aged < 19 years had increased rates of preterm birth compared to 20-24-year-olds (7.9% vs.5.4%) [28]. The mechanisms responsible for preterm birth are still unclear: the immaturity of cervical blood supply in young mothers stimulates prostaglandin production that could lead to preterm birth [28]. The other explanation of preterm delivery for adolescents is that short cervix (< 25mm) and small uterine volume may also be more common among younger mothers [32]. Furthermore, competition between the fetus and adolescent mother for nutrition, and relative nutritional deprivation of both the fetus and adolescent mother may explain the risk of maternal anaemia, low birth weight, and preterm delivery [49]. We did not find significant difference in the prevalence of PROM between adolescents and adult women. The findings of our study are not consistent with those of previous studies from Fleming et al., (2013) and Pergialiotis et al., (2015) who reported for significantly higher incidence rates of PROM ($p < 0.001$, RR 1.16 respectively) in teenage mothers compared to adult mothers [10], [31].

The rate of cesarean section was higher in adult women compared with teenagers. These findings are supported by others [28,48]. Fleming N et al., (2013) and Ganchimeg et al., (2013) also reported for lower rate of cesarean delivery in adolescents compared to adult women (OR 0.57 and OR 0.75, respectively) [10], [50] who attributed this to the presence of more functional myometrium, greater connective tissue elasticity, and lower cervical compliance that allowed for more spontaneous vaginal deliveries in teenage women [34], [38]. In our study, adolescent mothers were significantly more likely to have a vaginal delivery, as reported in any studies from Brasil (65%) [51] and from Germany where younger maternal age was associated with a higher chance of spontaneous delivery (OR 2.07 95% CI 1.45-2.93) [52]. Concerning vaginal operative delivery, our findings suggest a lower risk in women < 19 years of age compared with those between 20 and 24 years of age. A lower risk for instrumental delivery in adolescents has been cited by Torvie et al., (2015) (RR, 0.87; 95% CI, 0.78-0.97) compared to adults and Usta et al. (2008) reported that vacuum was used more frequently in multiparous controls (0.2 vs 2.7%, $p = 0.011$) [53], [54], but other authors found a contradictory result. Shah et al., (2011) presented that the teenagers had instrumental deliveries more often than non-teenagers (7.1% vs. 2.2%, $p < 0.01$) [55]. The teenagers were also less prone to perineal damage, and cervical laceration compare to adult mothers. There are conflicting data regarding the risk of major perineal lacerations in adolescents [13], [28]. A previous study of 325 women aged 16-19.9 found an increased risk of any perineal laceration compared to women aged 20-24.9 (4.53% vs 2.80%), OR 0.82 (95% CI, 0.71-0.95) [13]. The incidence of uterine curettage after childbirth was lower among teenagers, but differences were non-significant. Some authors reported for the higher incidence in the teenage group [32], but others did not find a significant difference between both groups [6], [55].

Regarding neonatal outcomes, this study confirmed the higher risk of SGA among infants of adolescent mothers, as found in the most previous studies [23], [39] and more commonly birth of LGA and AGA among infants of adult mothers. A previous study of 3891 women aged < 19,9 found higher rate of SGA infants compared to 9479 women aged 20-24 (13.77% vs. 10.40%, $p < 0.001$) [39]. The results are corresponding with previous results of other authors [32], [56]. Tyrberg (2013) et al., found that the rate of SGA infants is higher in adolescents compared to adult women (3.5% vs.2.3%) while the rate of LGA infants is higher in adult mothers (3.2% vs 1.8%) [56]. Other authors did not find a significant difference between both groups [57].

Previous studies have not found an increased risk of admission to a NICU [23], [32] in infants born to adolescent women compared to adult women's babies. In our study, we have found a decreased risk of the need for neonatal transfer in adolescents compared to adults. Other authors reported contradictory results [43]. Usynina A et al., (2018) reported for a higher rate of neonatal transfer to higher level hospital of adolescent women compared to adults (11.2% vs 9.8%, $p = 0.042$) [40]. Lower Apgar score in a 1st minute was more common in newborns of adult mothers, compared to adolescent mothers. Some studies have found lower Apgar scores similarly in adolescents' newborns [31] while others have not [39].

In this study, adolescent mothers gave birth to 2.27% of all infants born in our hospital from 2016 to 2018. The results of the study show that adolescent mothers have a lower educational level and were from rural areas, more are Roma ethnicity, have a lower number of antenatal visits and a lower rate of intake of folic acid. The adolescent pregnancy is related to higher risks for anaemia, urinary tract infection, preterm birth and SGA newborns. Adolescent mothers were more likely to have a vaginal delivery, lower risk of cesarean delivery and a lower rate of instrumental vaginal delivery, so the labour in adolescents must be treated similarly as with adult women, to reduce the operative intervention based on age alone. With optimal antenatal care, high standard labour and delivery management, postnatal psychological counselling and support of adolescents, we will reduce adverse maternal and neonatal outcomes.

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