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Do Early Adolescent and Advanced Maternal Age Pregnancies Affect Term Birthweight?

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ABSTRACT

Although it is known that there is a relationship between birthweight and maternal age, adverse pregnancy outcomes are reported more frequently in adolescent pregnancies (AP) and advanced maternal age pregnancies (AMA). We aimed to compare the mean maternal age at delivery for the last 5 years in our hospital. And also we evaluated birthweights and adverse pregnancy outcomes in full-term births for maternal age categories.
We evaluated 63,432 singleton birth between 2013 and 2018. In a subgroup, 21.575 full-term births were analyzed according to the birthweight, type of delivery, maternal age category (including early AP and AMA), and over the years. In the statistical comparisons, ANOVA-test was performed for continuous data and Tukey-test was performed as an advanced analysis. The relationship between maternal age and birth weight in the subgroup was analyzed by Pearson Correlation, and chi-square test was used for categorical values. A $P<.05$ value was taken as significant.
The mean maternal age was 26 years and no significant change was found according to years. Stillbirth rates were determined as significantly higher in AMA (2.6%; $p<0.001$). In the early AP, the rate of low birthweight infants was highest (16%). The mean birthweight was found to be the highest in the AMA directly proportional to the maternal age ($r = 0.13$, $p<0.001$). The average birthweight was 3167 ± 339 g and when the subgroups were considered, it was 3167 ± 339 g in early AP and 3336 ± 459 g in the advanced maternal age group of 40 years and older.
Birthweights increases in direct proportion to maternal age, although it does not make a clinically significant difference.

Key Words: Low birth weight; stillbirths; live birth; cesarean; delivery

Introduction

The effects of the maternal age on pregnancy outcomes have been shown in many studies. Adolescent (ages 10 to 19 years) and older age (≥35 years) pregnancies have been reported that they have higher maternal and fetal risks than pregnancies between the ages of 20-34, which is accepted as the normal reproductive age (NRA) (1, 2). The frequency of adolescent pregnancies (AP) has decreased over the years, being reported as 11%. While the adolescent fertility rate in Turkey was 32 per thousand in 2011, it was reported to have decreased to 24 per thousand in 2016, and 21 per thousand in 2017. In our country, frequency of AP between regions varies widely (3, 4). Those under 15 years of age are defined as early adolescent pregnancy (EAP) and 15 -19 years of age are defined as late adolescent pregnancy (LAP) (2). The age range definition in EAP is generally based on statistical studies. Phipps et al. show in their study that 15-year-old pregnancies have similar risks with <15 years of pregnancy. The risk decreases slightly at the age of 15 (5). Advanced maternal age (AMA) at birth has been accepted as 35 years of age and above and the frequency of AMA reaches to 14.3%. The frequency of AMA pregnancies aged 40 years and older (AMA ≥ 40) was reported as 2.3%, which are more important in terms of maternal and fetal risks. Today, AMA pregnancies are increasing all over the world (6). It may cause an increase in the risk of perinatal morbidity/mortality as well as an increase in maternal morbidity/mortality risk at the ages of both ends of the reproductive period (7-9).

Genetic, environmental and intrauterine factors impact birthweight. There are only a few studies investigating the effect of maternal age on birthweight during term pregnancies and no effect has been reported (6, 10). Globally, 84% or more of newborn babies are born as full-term (≥37 completed weeks of gestation) annually. Babies over 2,500 g and above are fortunate to survive, otherwise there are severe disabilities and morbidity (11, 12). However, in these full-term babies may be needed neonatal units in cases such as jaundice and respiratory disease (13, 14). Full-

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term infants who need neonatal care can also increase health problems in advanced age (15). The gestational age is inversely proportional to the risks of respiratory morbidities and possible long-term morbidities (such as asthma, hay fever, respiratory and food allergies, and diarrhea) (16, 17).

The primary purpose in our study is to investigate the effect of maternal age on birthweight in term pregnancies. As a secondary purpose is to examine the change of maternal age according to years. Furthermore, we evaluated the relationships between maternal age groups and stillbirths/delivery/low birthweight rates in full-term pregnancies.

Material and Methods

63,432 women who performed singleton birth between June 2013 and June 2018, at our hospital were retrospectively reviewed. Approval of the study protocol was granted by the Ethics Committee for Clinical Research (reference no: 10, 10/10/2017). The research adhered to the Declaration of Helsinki. All singleton births (≥ 500 g or ≥20 weeks) were examined in terms of maternal age, stillbirth, birthweight, low birthweight (LBW), gender and delivery mode. Birthweight was recorded in grams (g). The age at delivery was considered as the maternal age (years). Maternal ages were categorized as follows; AP 12-19 years old (EAP ≤ 15 years old, LAP 16-19 years old), 20-34 years old (NRA), and AMA ≥ 35 years old (also AMA ≥ 40 years old). The gestational age was reported in terms of completed weeks and was calculated as the interval between the date of delivery and the date of the last menstrual period that was confirmed by ultrasonographic measurements in the first or second trimester. For patients where a discrepancy existed, gestational age was calculated via measurements during antenatal care at the initial ultrasonographic examination performed at the 1st or 2nd trimester. A gestational age greater than 36 weeks and 6 days was defined as a full-term birth as a singleton.

All multiple gestations were excluded. All singleton births were analyzed according to maternal age categories, regardless of the birth order. The changes in the mean maternal age and maternal age categories were analyzed according to years. All births were examined in terms of the gender of infants. Stillbirths were removed from all births and live births were analyzed. LBW rates in live births were analyzed according to maternal age groups and years. Cesarean delivery rates in live births were analyzed according to maternal age categories.

Fetal growth retardation, LBW and small for gestational age (SGA) infants (10, 18), <37 weeks pregnancies, presence of maternal systemic diseases, mothers with gestational diabetes mellitus, presence of hypertensive diseases of pregnancy, drug user, smoker, pregnant women who use alcohol and have had a history of any medicine use, those who gave birth without any ultrasound examinations (birth at home), those who could not be dated and the pregnancies with missing information were excluded from the live births and formed a term subgroup. In this subgroup which was formed by excluding the factors that would affect the birthweight, birthweights were analyzed according to the maternal age categories and years.

SPSS for Windows version 20 software (Chicago, Ilin, USA) was used for statistical analyses. Ordinal data is presented as frequency (number) and percentages (%) and continuous data is presented as mean ± standard deviation. The Shapiro-Wilk test for normality distribution analysis was used for all continuous variables analyses. As continuous data was not normally distributed ($p<0.05$), non-parametric tests were applied. The comparison of continuous data (maternal age, birthweight) based on groups (years, maternal age groups, birthweight groups of babies, gender) was performed with an ANOVA test. The Tukey test was performed for further analysis. Pearson correlation is performed between maternal age and birthweight in the subgroup. The Chi-Square test was used to compare ordinal data and $p<.05$ was taken as statistical significance.

Results

When 63,432 births in the determined years were examined, the mean maternal mean age was found as 26.00±6.40 (12-55) years. When comparison was made according to years, the means of maternal age showed a statistically significant difference ($p<0.001$). When the average age of the mothers is examined according to years, it is seen that the average age of mothers in 2014 and 2015 is lower than the other years and the difference between the average age is statistically significant ($p<0.001$). The Tukey test was conducted to determine in which year/years the difference occurred. It was found that the difference was caused by the mean age of the mothers in 2014 and 2015 ($p<0.001$) (Table 1).

Table 1. Maternal age means and comparisons by years

Years of births	n (%)	Maternal age mean±SD* (min-max)	Test P
2013a	753 (1.2)	26.05±6.21 (13-46)	
2014b	13422 (21.2)	24.96±6.28 (13-52)	
2015c	14751 (23.3)	25.45±6.30 (12-53)	F**=166.338
2016d	16232 (25.6)	26.51±6.27 (13-55)	<0.001
2017e	14199 (22.4)	26.81±6.50 (14-52)	
2018f	4075 (6.4)	26.53±6.64 (12-51)	
Total	63432 (100.0)	26.00±6.40 (12-55)	

[a-f] Means in the same column not sharing the same superscript are significantly different (Tukey-adjusted; p<0.05), *SD; standart deviation, **F; Anova

Table 2. Change of number and rate of maternal age categories by years

Years	Maternal Age Groups n (%)				
	12-15 ages	16-19 ages	20-34 ages	35-39 ages	40-55 ages
2013 (n=753)	8 (1.1)	106 (14.1)	563 (74.8)	54 (7.2)	22 (2.8)
2014 (n=13422)	129 (1.0)	2779 (20.7)	9299 (69.3)	913 (6.8)	302 (2.3)
2015 (n=14751)	148 (1.0)	2578 (17.5)	10478 (71.0)	1216 (8.2)	331 (2.2)
2016 (n=16232)	107 (0.7)	2012 (12.4)	12065 (74.3)	1537 (9.5)	511 (3.1)
2017 (n=14199)	110 (0.8)	1803 (12.7)	10339 (72.8)	1503 (10.6)	444 (3.1)
2018 (n=4075)	22 (0.5)	494 (12.1)	2946 (72.3)	487 (12.0)	126 (3.1)
Total (n=63432)	524 (0.8)	9772 (15.4)	45690 (72.1)	5710 (9.0)	1736 (2.7)

Maternal age measurement value; years

The frequencies and percentages of all births according to years and maternal age groups are shown in Table 2. The AP ratio was analyzed as 10,296 women and 16.2%. Pregnancies with AMA were 11.7% with 7446 women. In terms of sex, in all birth, the male ratio was 50.5% and the female rate was 49.5% at all birth.

Stillbirths were 1.6% with 1032 patients. While the rate was 1% with 5 cases in EAP, the LAP was 1.4% with 137 cases. While the number of stillbirths in the AP was 142 (1.4%), NRA was found to be 694 (1.5%) and 196 (2.6%) in AMA pregnant women. Significantly higher stillbirth rates were found in AMA pregnancies (p <0.001). When the AMA group pregnancies are evaluated in themselves, these losses were mostly in AMA ≥ 40 pregnancies (62 cases 3.6%).

There were 6,960 (11.2%) LBWs in 62,400 live births. The numbers and percentages of LBWs in live births according to maternal age groups are shown in Table 3. When the maternal age was examined in only a 3rd category, no difference was found in LBW ratios when the AP group is compared with the NRA and the AMA groups (11.4%, 11.0 and 11.5% respectively, p> 0.05). However, in the analyses of pregnancies in the EAP and AMA ≥ 40 subgroups, the increase in LBW was found to be statistically and clinically significant (16.0% and 12.8%, respectively; p = 0.001).

Table 3. Distribution of low birthweight ratios in live births according to maternal age groups

Maternal Age Groups (years)	Birthweights		Test* / p
	<2500 grams n (%)	≥2500 grams n (%)	
≤15 (n=519)	83 (16.0)	436 (84.0)	
16-19 (n=9635)	1074 (11.1)	8561 (88.9)	17.638/
20-34 (n=44996)	4972 (11.0)	40024 (89.0)	0.001**
35-39 (n=5576)	616 (11.0)	4960 (89.0)	
≥40 (n=1674)	215 (12.8)	1459 (87.2)	
Total (n=62400)	6960 (11.2)	55440 (88.8)	

*Test: Chi-Square, **p<0.05

The cesarean delivery rate in the EAP group in live births was 49.5%, 45.6% in the LAP group, 45.8% in the AP group, 32.8% in the NRA group, 22.7% in the AMA group and 23.7% in the AMA ≥ 40 group. As age increases, cesarean rates decrease (p <0.001).

In the analysis made in the term subgroup, the mean maternal age was 26.48±6.7 (12-53) years old, the cesarean delivery rate was 32.3%, and the mean birthweight was 3242 ± 414 (2500-5530) g. The mean birthweight was 3167 ± 339 g in the EAP group (0.6%) in the subgroup, the mean birthweight was 3173 ± 372 g in the LAP group (14.4%) and no statistically significant difference was found between the two groups (p = 0.98). In the subgroup, it was seen that the mean birthweight at the AP (3173 ± 371 g) was lower than at ≥20 years of age (3254 ± 420 g) (p <0.001). In the subgroup of 14,920 mothers in NRA, the mean birthweight was 3235 ± 406 g, in the AMA group (3408) the mean birth weight was 3334 ± 467 g and the birthweight mean was 3336 ± 459 g in the AMA ≥ 40 group. When the mean birthweights in AP, NRA and AMA categories in this subgroup were compared, the statistical difference was found significant (p <0.001). When the Pearson correlation is performed between maternal age and birthweight in the subgroup, a positive low-level correlation was found (r = 0.130, p = 0.000). Table 4 shows the mean birthweight levels for every year according to each maternal age categorization in the subgroup.

Discussion

Recently, most OECD countries have seen the mean maternal age increase where between 1970 and 2015, the mean age increased between 2-5 years (19). In the USA, the mean age of mothers increased from 2000 to 2014 (20). The average maternal age was around 26 in 2011 in Turkey, which is the same as in 2016 (approx. 26 years of age) (3). It was reported that the age range was 25-29 in 2017 (4). Our study is consistent with the age results in Turkey, being 26 years old. Due to the high number of adolescent pregnancies in our hospital, the average age was expected to be lower, but the increase in advanced maternal age kept the mean at the same level. No significant change was observed over the years for mean maternal age. Adolescent pregnancies are decreasing in Turkey, as well as in the world (2, 4). While it was 5.8% in 2015 in the USA, it decreased to 5.4% in 2016 (21, 22). AP rate in our clinic (16.2%) is significantly higher than both in Turkey and in the world, but its frequency decreases over the years (2, 4). The early adolescent pregnancy rate of 0.8% is even more important. In a study conducted in the USA between 1995 and 2000, the EAP rate was 0.85%, but declined over the years but no decrease was found in 2016 (7, 21, 22). In our clinic, with a similar decreasing trend, the EAP ratio decreased from 1% to 0.5% for these years. This situation can be caused by the fact that we are both socio-culturally and economically behind compared to other regions. The decline in AP and EAP rates is also observed in our hospital over the last five years which is similar globally and in our country. This may be related to public awareness. As in the world and in Turkey but also in our hospital, the frequency of AMA and AMA ≥ 40 pregnancies have been increasing steadily over the years (22). In our region, rates of AMA are increasing due to the spread of infertility treatments, decrease in prices, increase in success rates and postponement of the age of having children for various reasons.

One of the major problems in AP is the increased risk of term LBW (birthweight <2500 or <37 weeks) (23). Other studies have found that teenage mothers have increased risk for LBW compared to NRA (7, 8, 18). In the USA the LBW ratio increased over the years, and it was reported as 8.17% in 2016 (21, 22). The rate of LBW is reported as 10.81% in EAP and 8-12% in AP (7, 18). In our study, LBW was higher with 16.3%.

Table 4. Maternal age categorization in subgroups and change of birthweights by years

Years	Maternal Age Groups Birthweights (grams) - (n)					
	12-19 ages	20-34 ages	≥35 ages	Total	≤15 ages	≥40 ages
	mean±SD	mean±SD	mean±SD	mean±SD	mean±SD	mean±SD
	(n)	(n)	(n)	(n)	(n)	(n)
2013	3220±395 (31)	3223±405 (113)	3262±399 (43)	3231±400 (187)	None	3164±385 (22)
2014	3210±395 (97)	3251±463 (88)	3497±537 (93)	3319±483 (278)	2987±332 (4)	3526±398 (26)
2015	3218±404 (145)	3247±399 (1106)	3396±447 (230)	3267±411 (1481)	3066±1525 (3)	3389±423 (64)
2016	3164±370 (1250)	3227±405 (5206)	3318±454 (1630)	3236±413 (8086)	3103±296 (70)	3320±454 (413)
2017	3171±362 (1503)	3239±405 (7279)	3329±476 (1216)	3240±411 (9998)	3274±385 (52)	3337±467 (274)
2018	3180±400 (221)	3238±414 (1128)	3373±501 (196)	3247±427 (1545)	3150±272 (6)	3375±535 (47)

SD; standart deviation

Additionally, in our analyses, the EAP category was the highest group with the outcome of LBW. In the study conducted on the Finnish population, the LBW ratio in AMA was found to be 2.7%. However, when all age groups were examined, the highest rate was found in 3.6% of patients at AMA≥40 (6). In the USA, LBW rates were reported as 8.74% in the 35-39 age range, 10.8% in the 40-44 age range and 19.75% in the 45-54 age range (21). In our study, the rate of LBW in the 35-39 age groups was 11%, while in AMA ≥ 40 it was 12.8%. These rates are similar to previous studies. Our results show an increase in LBW risk at both ends of maternal ages. It is stated that the increase in LBW is due to other factors rather than age, and other multifactorial events may be more effective (6). In our clinic, it is suggested that there may be other factors, such as environmental and nutritional factors affecting the high LBW rates.

The rate of cesarean in Turkey has exceeded 50%. However, it is around 35% in public hospitals like ours (24). In contrast to the studies showing that Cesarean delivery rate increases with age, in our study it has decreased (6, 22). AMA pregnancies are also at the lowest rate. This can be explained by the fact that our AMA pregnancies patients are usually multiparous. We do not know the exact reasons for the increase in the Cesarean rate as age decreases.

Infant birthweight is a strong indicator of intrauterine growth and also a sensitive forecaster of a newborn's chances of survival, growth and long-term physical and psychosocial development. Spada et al. compared an Italian group of mothers, whose average age was 33 (30-37) years old with the non-Italian group whose average age was 29 (25-33) and it was reported that maternal age did not affect birthweight (birthweight averages were 3289 and 3321 g respectively) (10). Goisis et al. found a negligible relationship between maternal age and birthweight in LBW and preterm births. They have not been evaluated full-term pregnancies (6). Contrary to limited literature, in this current study the mean birthweight showed a statistically significant difference in the term subgroup. We found an increase in birthweight as maternal age increased. We found a statistically significant difference of 169 g between mean birthweight in the AMA ≥ 40 category and the mean birthweight in the EAP category ($p < 0.001$).

Our hospital is owned and managed by the national goverment and is a women's hospital with 10,000-15,000 deliveries per year. Our hospital serves the mothers with the lowest income level and education levels in this region for births. Therefore, it is homogeneous in these respects. Furthermore, it was possible to only access the archive on the dates we set. We could not find the following information since these records were not kept well or patients did not know: the period between births, maternal age in first pregnancies and maternal weight gain. There are studies with a large series of publications reporting that maternal weight gain during pregnancy may not have an effect on birthweight (7). Birth order has not been analyzed in our study. However, APs are mostly the first pregnancy and AMA pregnancies are generally acceptable for multiparous patients and because of this, the fertility rate is high in our country. While the AMA cesarean section rate is high in Western societies, it may be lower in our country probably due to the higher birth order. Goisis et al. reported that there was an increase in the LBW rate in both primigravidas and multiparas pregnancies (6). Lean et al. in their study found no relationship between the effects of AMA and parity (9). We did not compare the levels of education, because teenager pregnancies would already have low levels of education due to their age. Negative effects of smoking to birthweight have been shown in several studies (25). Since smoking is one of the criterion of exclusion in the subgroup, leaving this factor out of the analyses is a strong aspect of the study.

As a result, in accordance with the literature, APs (especially EAPs) and AMA pregnancies (especially AMA≥40) are more risky for adverse obstetric outcomes. Furthermore, the more the extreme ends exist, the more the risks increase. In term pregnancies, maternal age and birthweight increase in parallel to each other.

Contrary to the fact that the mean maternal age in births has increased in recent years, no significant change has been observed in our country and in our clinic. Although the rate of EAP decreases, the rate of AP is still found to be high in our clinic. For various reasons, the number of patients in the AMA group is increasing. As the maternal age increases, stillbirths occur more frequently. Further research is required to identify the unknown confounding factors that explain the link between AP/AMA and negative birth outcomes. Furthermore, such research is important for the design of new prevention programs designed to reduce these negative birth outcomes. The family should be informed carefully about the risk increases and measures should be taken to prevent all these negative outcomes for the mothers.

Footnote: This text was presented as a poster at the Maternal Fetal Medicine and Perinatology Society of Turkey XIth Congress between 31st October- 03rd November, 2018 at Wyndham Grand Levent Hotel, Istanbul, Turkey.

Conflict of interest: The authors declare that they have no conflict of interest.

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