Adıyaman Üniversitesi Sağlık Bilimleri Dergisi, 2023;9(3):215-222
doi:10.30569.adiyamansaglik.1327740

E-ISSN: 2458-9176

ADIYAMAN ÜNİVERSİTESİ SAĞLIK BİLİMLERİ DERGİSİ
JOURNAL OF HEALTH SCIENCES OF ADIYAMAN UNIVERSITY

Research Article/Özgün Araştırma

The impact of maternal age distribution on pregnancy-related complications and neonatal outcomes: a single-center retrospective experience

Anne yaşı dağılımının gebelikle ilişkili komplikasyonlar ve neonatal sonuçlar üzerindeki etkisi: tek merkezli retrospektif bir deneyim

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Atıf gösterme/Cite this article as: Başkıran Y, Tanoğlu FB, Uçkan K, Çeleğen İ, Karaçor T. The impact of maternal age distribution on pregnancy-related complications and neonatal outcomes: a single-center retrospective experience. *ADYÜ Sağlık Bilimleri Derg*. 2023;9(3):215-222. doi:10.30569.adiyamansaglik.1327740

Abstract

Aim: To determine possible risks for mother and baby in advanced age pregnancies.

Materials and Methods: This study is a retrospective archive review examining 14192 cases who gave live births between 24 and 42 weeks between 2020-2023.

Results: The frequency of preeclampsia, gestational hypertension, gestational diabetes mellitus, rupture of membranes and possible miscarriage was high in advanced-age pregnant women compared to other groups. When the groups were compared according to neonatal outcomes, the frequency of low birth weight in adolescence was high than in advanced-age pregnant women. When the groups were compared in terms of macrosomia, the frequency of macrosomia was high in the older age group than in the other groups.

Conclusion: It should be known that pregnancies at an advanced-age can be more complicated for both mother and baby, and pregnancy follow-up should be done more carefully.

Keywords: Advanced age pregnancy; Adolescent pregnancy; Pregnancy complications; Premature rupture of membranes; Neonatal outcomes.

Öz

Amaç: İleri yaş gebeliklerde anne ve bebek için olası riskleri belirlemektir.

Gereç ve Yöntem: Bu çalışma, 2020-2023 yılları arasında 24 ila 42 haftalar arasında canlı doğum yapmış 14192 vakayı inceleyen retrospektif bir arşiv taramasıdır.

Bulgular: İleri yaş gebelerde preeklampsi, gestasyonel hipertansiyon, gestasyonel diabetes mellitus, membran rüptürü ve olası düşük sıklığı diğer gruplara göre yüksekti. Neonatal sonuçlara göre gruplar karşılaştırıldığında Adölesan yaşta düşük doğum ağırlığı sıklığı ileri yaş gebelere göre daha yüksekti. Makrozomi açısından gruplar karşılaştırıldığında makrozomi sıklığı ileri yaş grubunda diğer gruplara göre daha yüksekti.

Sonuç: İleri yaştaki gebeliklerin hem anne hem de bebek için daha komplike olabileceği bilinmeli ve gebelik takipleri daha dikkatli yapılmalıdır.

Anahtar Kelimeler: İleri yaş gebelik; Adölesan gebelik; Gebelik komplikasyonları; Erken membran rüptürü; Neonatal sonuçlar.

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Geliş Tarihi/Received:15.07.2023 **Kabul Tarihi/Accepted:**10.10.2023 **Yayım Tarihi/Published online:**31.12.2023

Introduction

In recent years, there have been significant changes in the age of pregnancy, the number of births, and the rate of pregnancy-related complications in women. In the United States alone, while a total of 3,613,647 births were recorded in 2020, there was a 4% decrease compared to 2019. Also, there has been an 8% decline in the number of births in the adolescent female population aged 15-19. The number of births for women aged fifty and over has generally increased since 1997.[1] Globally, while there were 64.5 births per 1000 women in the adolescent age group in 2000, this number decreased to 41.3 births per 1000 women in 2023. This decline shows a general decrease, although it varies proportionally in countries with different socioeconomic levels.[2] According to data from the General Directorate of Population and Citizenship of Turkey, 2.3% of all women giving birth in 2009 were aged 40 and over, while this rate rose to 2.8% in 2014.[3]

The decrease in birth rates and the postponement of the age of pregnancy are associated with the increase in education level, the awareness of protection methods, and the increase in women playing an active role in the workforce. Family planning strategies developed to prevent grandmultiparity, adolescent pregnancies, and related complications, as well as assisted reproductive techniques (ART) implemented for advanced-age infertile groups, also contribute to this process. However, in societies where grand multiparity is common due to socio-cultural structuring, beliefs, the existence of inadequate education level, and low economic development, where adolescent girls are married at a young age and are not sufficiently knowledgeable about birth control methods, advanced-age pregnancies are also frequently encountered. There are many studies in the literature that reveal the relationship of maternal morbidity and mortality with these parameters.[4-6]

The postponement of the age of pregnancy has increased the rate of advanced-age pregnancies; hence, the investigation of complications developing due to advanced-age pregnancies has recently come to the fore. Maternal complications include gestational diabetes mellitus (GDM), gestational hypertension (GHT), and cesarean delivery, while adverse perinatal outcomes include a high rate of chromosomal abnormalities, miscarriage, threatened preterm labour (TPTL), admissions to the neonatal intensive care unit (NICU), and stillbirth.[7] Although there are many studies investigating the effect of advanced maternal age on prenatal and postnatal outcomes, the results are contradictory. Again, studies investigating the complications caused by advanced maternal age, which arises independently of the postponement of pregnancy and ART, due to socio-cultural, and socio-economic conditions, are limited. The aim of this study is to reveal and compare the peri-postpartum complications and neonatal outcomes occurring in pregnant women who gave birth in the same socio-economic level region without resorting to family planning and assisted reproductive techniques in different age groups. To evaluate the complications in advanced age and adolescent pregnancies in the most homogeneous way.

Materials and Methods

The adolescent pregnancy age was determined as 18 and under; advanced maternal age was considered 35 and over in line with the literature.11 Patients were divided into three groups 18 and under (Group 1), between 19 and 34 (Group 2), and 35 and over (Group 3) and these parameters were compared and analyzed using statistical methods. Verbal consent was acquired from the participants or their legal representatives in the study, which was managed in accordance with the principles of the Declaration of Helsinki. The primary aim was to determine maternal complications associated with age, and the secondary purpose was to reveal neonatal outcomes related to maternal age.

Type of the study

The study is a retrospective archive review.

The sample size of the study

A total of 14192 pregnant women who had a live normal vaginal delivery between 24-43 weeks of gestation in Van Regional Training

and Research Hospital between 2020-2023 were included in the study.

Data collection tools

Multiple pregnancies, patients who had cesarean deliveries, patients who got pregnant through ART, intrauterine dead fetuses, and stillbirths were excluded from the study. The demographic characteristics of the patients (age, body mass index, gravida, antepartum and postpartum haemoglobin values, socio-economic status information); pregnancy-related diseases (GDM, GHT, preeclampsia, PROM, EDT, post-term pregnancy, abortus imminens, hyperemesis gravidarum); neonatal outcomes (estimated fetal weight, 1st and 5th minute APGAR scores, need for intensive care, low birth weight evaluated as below the 10th percentile, macrozomy referring to birth weight of 4000 gr and above) were collected from the hospital database. We excluded patients with fetal death from the study, as the neonatal results of birth weight and week of birth may affect apgar results

Patients' socio-economic statuses were separated as low, medium, and high. This classification was determined based on the household income-expenditure level of the patients. Due to the variable income level of our country and the inflation rate not being constant, those with an income level lower than the expenditure level were evaluated as low-income level, those equal to the expenditure level as medium, and those with an income level high than the expenditure level as high economic level. We considered the education level from demographic data as the social level and evaluated it accordingly. The diagnosis of GDM was made when the fasting glucose value was above 92mg/dL; the 1st-hour postprandial glucose value was above 180mg/dL; 2nd-hour postprandial glucose value was above 153mg/dL in patients who had a 75mg OGTT (oral glucose tolerance test) applied between 24-28 gestational weeks.8 The diagnosis of GHT was made when the systolic blood pressure was 140mmHg/ diastolic blood pressure was 90mmHg and above measured at least 4 hours apart from the 20th gestational week. The diagnosis of preeclampsia was made when proteinuria accompanied hypertension or when end-organ effects appeared (platelet count in the blood being below 100 X 109/L, serum creatinine level being above 1.1 mg/dL or the development of renal failure with a two-fold increase from the start, impaired liver function tests with transaminases increased more than twice the normal, pulmonary oedema, the presence of new-onset headache with visual symptoms).[9] The diagnosis of PROM was made when the gestational membrane rupture was observed before the 37th gestational week.[10]

Ethics committee approval

The study received non-interventional ethics committee approval from the Ethics Committee of Van Regional Training and Research Hospital. The approval number is 2023/01-05.

Data analysis

Data analysis was done with a licensed SPSS 22.0 program. ANOVA test was used to compare more than three normally distributed groups. Tukey's HSD post hoc test was used to determine the differentiations between the groups. Paired sample t-test was used to compare dependent groups. Fisher's Exact test was used to compare categorical variables. The statistical significance level was determined as α=0.05.

Results

A total of 14,192 individuals were included in the study: 1,185 (8.4%) from Group 1, 11,147 (78.5%) from Group 2, and 1,860 (13.1%) from Group 3. The average age of the pregnant individuals was 26.89±5.94 years.

The distribution of age groups according to maternal characteristics is presented in Table 1. There was a significant differentiation between the groups in terms of gravida, antepartum and postpartum haemoglobin values. The numbers of parity and gravida were similar in Groups 2 and 3 and significantly high than in Group 1. There was a significant differentiation between the groups in terms of antepartum and postpartum haemoglobin values. Haemoglobin values decrease from Group 1 to Group 3. There was no significant differentiation between the groups in terms of body mass index. No

statistically significant differentiation was between the groups in terms of socioeconomic status.

Table 1. Distribution of groups according to maternal characteristics.

		Grup 1 n:1185 (%)	Grup 2 n:11147 (%)	Grup 3 n:1860 (%)	*p*
Gravida (Mean±SD)		1.00±0.0[a]	1.42±1.52[b]	1.44±1.04[b]	**0.001****
Parity (Mean±SD)		0.00±0.0 [a]	2.27±1.44 [b]	2.32±1.15 [b]	**0.001****
Antepartum Hemoglobin (Mean±SD) (g/dL)		13.14±1.19[a]	12.73±1.37[b]	11.23±1.28[c]	**0.01****
Postpartum Hemoglobin (Mean±SD) (g/dL)		12.14±1.3[a]	11.47±1.46[b]	10.39±1.39[c]	**0.03****
Differentiation Of Antepartum And Postpartum Hemoglobin (Mean±SD) (g/dL)		1.00±0.53[a]	1.26±0.71[b]	0.84±0.35[c]	**0.001****
Economic status	**Low**	281	2356	387	0.345*
	Medium	769	7729	1273	
	High	135	1062	200	
Body mass index (BMI) (kg/m²)	**25 and below**	252 (21.3)	2341 (21.0)	404 (21.7)	0.237
	Over 25	933 (78.7) [a]	8806 (79.0) [a]	1456 (78.3) [a]	

Abbreviations: SD; Standard deviation. * Fisher exact test ** ANOVA test, Values in bold represent statistically significant results. Column percentages are given. [a,b, c] shows the differentiations between the groups.
Patients were divided into three groups 18 and under (Group 1), between 19 and 34 (Group 2), and 35 and over (Group 3). Subgroup comparisons are indicated in superscript (a, b, c). The same letters indicate that the groups are similar, and different letters indicate that the groups are different

The distribution of age groups according to maternal complications is presented in Table 2. There was a significant differentiation between the groups in terms of GDM. The frequency of GDM was highest in Group 3 (p<0.05). There was a significant difference between the 1st and 2nd groups and the 3rd group in terms of GHT and premature rupture of membranes (PROM). The frequency of PROM and GHT was highest in Group 3 (p <0.05). There was a significant differentiation between the groups in terms of TPTL and post-term pregnancy. The frequency of TPTL and post-term pregnancy was high in Group 1 (p<0.05). There was a significant differentiation between the groups in terms of preeclampsia. The frequency of preeclampsia in Group 3 was significantly high than in the other groups (p<0.05). There was also a significant differentiation between the groups in terms of abortus imminens. The frequency of threatened miscarriage was significantly high in Group 3 (p<0.05). However, there was no differentiation between the groups in terms of hyperemesis gravidarum (p>0.05).

Table 2. Distribution of groups according to maternal complications.

		Grup 1 n:1185 (%)	Grup 2 n:11147 (%)	Grup 3 n:1860 (%)	*p*
Gestational Diabetes n(%)	**Yes**	32 (2.7) a	346 (3.1) a	337 (18.1)b	**0.001***
Gestational Hypertension n(%)	**Yes**	5 (0.04) a	56 (0.05) a	87 (4.7) b	**0.001***
Premature rupture of membranes n(%)	**Yes**	37 (3.1) [a]	479 (4.3) [a]	478 (25.7) [b]	**0.001***
Premature birth threat n(%)	**Yes**	84 (7.1) [a]	123 (1.1) [b]	22 (1.2) [b]	**0.009***
Post-term pregnancy n(%)	**Yes**	254 (21.4) [a]	134 (1.4) [b]	28 (1.5) [b]	**0.001***
Preeclampsia n(%)	**Yes**	3 (0.3) [a]	42 (0.4) [a]	507 (27.3) [b]	**0.001***
Abortus imminens n(%)	**Yes**	18 (1.5) [a]	212 (1.9) [a]	422 (22.7) [b]	**0.001***
Hyperemezis gravidarum n(%)	**Yes**	28 (2.4)	256 (2.3)	41 (2.2)	0.240*

Abbreviations: SD; Standard deviation. * Fisher exact test ** ANOVA test, Values in bold represent statistically significant results. Column percentages are given. a,b, c shows the differentiations between the groups.
Patients were divided into three groups 18 and under (Group 1), between 19 and 34 (Group 2), and 35 and over (Group 3).

The distribution of groups according to newborn characteristics is presented in Table 3. There is a significant difference between the groups in terms of estimated birth weight. The average estimated birth weight also increases from group 1 to group 3. While there is no difference between group 1 and group 2 in terms of intensive care needs, group 3 is different from these two groups. The frequency of need for intensive care is higher in Group 3.

There is significant differentiation between the groups regarding low birth weight. Groups 1 and 2 are similar, but they have a high frequency of babies with low birth weight compared to Group 3. Significant differentiation was found in terms of macrosomia between the groups. Group 3 has a high frequency of having macrosomic babies than Groups 1 and 2. However, there is no significant differentiation between the groups when considering APGAR scores

Table 3. Distribution of groups according to neonatal outcomes.

		Grup 1 n:1185	Grup 2 n:11147	Grup 3 n:1860	*p*
Estimated fetal weight		2969.29±350.90 [a]	3079.58±610.47 [a]	3273.18±351.69 [b]	**0.003****
APGAR 1 min		7.71±0.58	7.72±0.59	7.77±0.51	0.718**
APGAR 5 min		9.05±0.29	9.03±0.36	9.05±0.35	0.760**
NICU) n(%)	**Yes**	108 (9.1) [a]	1215 (10.9) [a]	432 (23.2) [b]	**0.026***
Low birth weight n(%)	**Yes**	63 (5.3) [a]	613 (5.5) [a]	233 (12.5) [b]	**0.001***
Macrosomia n(%)	**Yes**	122 (10.3) [a]	1092 (9.8) [a]	294 (15.8) [b]	**0.001***

Abbreviations: NICU; Neonatal intensive care unit, , SD; Standard deviation. * Fisher exact test ** ANOVA test, Values in bold represent statistically significant results. Column percentages are given. [a,b, c] shows the differentiations between the groups
Patients were divided into three groups 18 and under (Group 1), between 19 and 34 (Group 2), and 35 and over (Group 3).

Discussion

The significant correlation between maternal age at conception and pregnancy outcomes, as well as maternal health, has been well established over time. Numerous studies have been conducted on the maternal and neonatal outcomes of adolescent pregnancies. In these studies, advanced maternal age is typically examined within groups using assisted reproductive technologies, while adolescent pregnancy studies are usually carried out in regions with lower socioeconomic status. As a result, no homogeneous studies have been conducted. Our aim is to evaluate the maternal complications of both advanced maternal age and adolescent pregnancies in a homogeneous population, with the goal of predicting the prognosis and treatment approach for these patients.

In a study conducted in Japan analyzing the outcomes of 325 adolescent pregnancies and 2029 pregnancies in women aged 28-30, it was found that adolescent pregnancy did not have a correlation with adverse obstetric outcomes, aside from TPTL. [12] In alignment with previous literature, our study also identified that the risk of TPTL was significantly high in the adolescent pregnancy group (p=0.009). Furthermore, the rate of post-term pregnancy was also found to be significantly high in the adolescent group in comparison to other groups (p=0.001).

In a 2019 study investigating pregnancy-related complications of advanced maternal age, the risk of GDM and preeclampsia was found to be significantly high in the advanced maternal age group compared to the control group. The incidence of TPTL was also found to be statistically high in the advanced maternal age group .[13] Similarly, in our study, we found that the incidence of GDM, GHT, preeclampsia, and abortus imminens was statistically high in the advanced maternal age group compared to the adolescent and control groups (p=0.001, p=0.001, p=0.026, respectively). When our study evaluated hyperemesis gravidarum, no significant differentiation was identified between the groups (p=0.240).

In a large population study by Althabe et al. encompassing seven middle-income countries, they reported no increase in the risk of adverse maternal outcomes in adolescent pregnancies compared to adults. However, the risk of TPTL and low birth weight was reported to be statistically high in the adolescent group, with the highest risk in the group under 15 years of age.[14] In a cohort study examining the maternal risk factors of low birth weight in neonatal complications, it was found that women under the age of 19 and over the age of 39 had a 4% and 14% high rate of having low birth weight babies compared to mothers aged 19-34.[15] In another study related to low birth weight, it was reported that this risk was high in pregnant women over the age of 45. The incidence of macrosomia independent of parity was also

statistically significantly increased with advanced maternal age.[13] In our study, we found that the incidence of low birth weight was significantly high in Group 3 (p=0.001). Unlike previous literature, we did not find a statistically significant differentiation when comparing the rates of low birth weight babies between Group 1 and Group 2.

In a study on the neonatal outcomes of advanced maternal age, the incidence of macrosomia was found to be significantly high in pregnancies over the age of 40.[16] In our study, while no differentiation was found between Groups 1 and 2, the incidence of macrosomia was significantly high in Group 3 (p<0.05).

In the literature, studies evaluating the relationship between advanced maternal age and the APGAR scores and need for NICU in neonates generally found no significant differentiation. Contrary to the literature, in a meta-analysis published in 2019, it was reported that the incidence of GDM, GHT, TPTL, low birth weight, and NICU need to increase in the advanced maternal age group.[17] In our study, when we compared Group 3 with other groups, we found that the incidence of NICU need for newborns was statistically significantly high (p=0.001, p=0.001). However, there was no significant differentiation between the groups in terms of APGAR scores of newborns at 1 and 5 minutes (p=0.718, p=0.760, respectively).

Several hypotheses have been proposed to explain the adverse effects of advanced maternal age on the later periods of newborn life. However, these hypotheses are not supported by clinical and epidemiological evidence.[18] Considering the pathophysiology of GDM, GHT, and preeclampsia, we believe that advanced-age mothers adapt poorly to the physiological changes of pregnancy. Therefore, we think that pregnancy and potential complications progress worse in mothers of advanced age. In our study, we found the incidence of abortus imminens in Group 3 to be high than in other groups. We attribute this situation to several reasons.

1. As the maternal age progresses, the endometrial condition, which is an important factor in the settlement and development of the fetus, and hormonal support may physiologically be insufficient in the advanced age group,
2. Increased accumulation of environmental pollutants in the body,
3. Disruption of cellular anabolic and catabolic balance

Also, when we look at the reasons for abortus imminens, the most common reason is chromosomal abnormalities. The frequency of chromosomal anomalies in embryos will increase as maternal age increases.

For PROM, maternal risk factors can be listed as GHT, preeclampsia, short cervical length (history of conization), and autoimmune diseases.[19] There is no study in the literature that reveals the relation between maternal age and PROM development. In our study, we observed that the incidence of PROM in Group 3 significantly increased compared to other groups.

Our study has some limitations, primarily its retrospective design and the imbalanced patient count according to age distribution. However, it holds significant strengths in its unique approach. Contrary to many studies in the field, our research incorporates socioeconomic status. This allows for a deeper exploration into traditional childbearing roles in the context of prospective mothers' educational and professional backgrounds, which could offer insights into the societal influences potentially leading to spontaneous pregnancies at an advanced maternal age with a high birth rate in the highlighted region.

This investigation specifically targets pregnancies that occurred spontaneously amongst women of advanced maternal age who, due to sociocultural factors, did not employ contraception or family planning measures. It intentionally excludes patients who opted for assisted reproductive techniques, thus postponing motherhood. By focusing solely on birth data from a specific province, our study provides a unique perspective on the complications associated with advanced maternal age within a homogeneous society sharing a common sociocultural environment.

To the best of our knowledge, this research also marks a first in the literature by elucidating the association between preterm rupture of membranes (PROM) – a recognized maternal and neonatal complication – and advanced maternal age, setting it apart from other studies.

Conclusion

Advanced maternal age is considered a parameter associated with maternal and neonatal complications. It should be acknowledged that pregnancies at later ages, formed with postponed pregnancies and assisted reproductive techniques, could be more complicated for both mother and baby, and these pregnancies should be monitored more closely. Examinations of advanced-age mother candidates in terms of systemic diseases prior to pregnancy will assist in the early diagnosis and management of complications that may arise during the pregnancy process. Middle-aged women should be informed that pregnancies occurring at advanced maternal age can be more complicated for both mother and baby when receiving family planning counselling. We believe that this information could lead to a decrease in the rate of pregnancies at advanced ages.

Ethics Committee Approval

The study received non-interventional ethics committee approval from the Ethics Committee of Van Regional Training and Research Hospital. The approval number is 2023/01-05. The study was managed in accordance with the principles of the Declaration of Helsinki.

Informed Consent

Verbal consent was acquired from the study participants or their legal representatives.

Authors Contributions

All of the authors contributed at every stage of the study

Conflict of Interests

There is no conflict of interest to declare.

Financial Disclosure

No person/organization is supporting this study financially.

Statements

These research results have yet to be presented anywhere previously. Data related to the study is available on request.

Peer-review

Externally peer-reviewed.

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