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Does paternal age affect the course and outcome of pregnancy and the parameters of infants?

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ABSTRACT

Background: Parental age plays a significant role in reproductive outcomes, and this age has been rising continually in the recent past for many reasons. Thus, the aim of this study was to examine the influence of paternal age on the course and outcome of pregnancy and the parameters of the newborn.

Methods: The sample consisted of 401 pregnant women and their newborn babies. The main parameter was the father's age, and participants were subsequently divided into three groups: the first group consisted of fathers between the ages of 20 and 29, the second group comprised fathers between 30 and 39, and the third group were fathers over the age of 40. All other parameters were analyzed in relation to this parameter.

Results: The results indicate that with older fathers, parity was 2+, and spontaneous abortions were more frequent among women with older partners. The findings also show that newborns with a head circumference larger than 37cm were less common among older fathers.

Conclusion: Our study shows that maternal age increases in accordance with paternal age, as does the possibility of complications in the mother's pregnancy and in the perinatal outcome of the newborn baby. Poorer perinatal outcomes were observed in cases with older fathers. This impacts health system costs and should prompt further research, particularly due to the ever-greater challenges of older parents and the potential implications for their offspring.

Key words: pregnancy, paternal age, newborn

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INTRODUCTION

Parental age plays a key role in reproductive outcomes, and this age has been rising continually in the recent past for many reasons (1). The majority of studies on the perinatal outcomes of older parents have focused on mothers, whereas verified data on the outcome of infants of older fathers are scarce (2). A more advanced paternal age is connected to negative effects on the mother and her newborn. Studies have suggested that the risk of detrimental conditions connected to paternal age is higher and begins around the age of 35 (3). Preliminary evidence indicates that an older paternal age can increase the incidence of detrimental pregnancy outcomes, such as spontaneous abortions (4) or premature birth (5). The majority of research on paternal age and its influence on perinatal outcomes is frequently limited to factors which are pertinent to hereditary diseases. However, recently, a connection has been identified between paternal age and a higher risk of developing autism, genetic abnormalities such as various psychiatric conditions (6) and a higher risk of stillbirth (7). According to studies to date, an older paternal age can also impact the course of pregnancy. Pregnant women whose partners are older than 45 are exposed to a higher risk of developing complications in pregnancy, such as hypertension, placental abruption and placental previa (8). A rise in the incidence of Caesarean sections has also been noted over the past few years, and one of the additional factors which affect this incidence is the father's age (9). An older paternal age can also result in premature birth, a lower birth weight and lower Apgar scores (10). It has been established that the newborns of fathers older than 35 are at a greater risk of premature birth, lower birth weights and higher morbidity (mechanical ventilation, intensive care, antibiotics) during the perinatal period (11, 12). As paternal age has doubled over the past generation (1, 5), it is necessary to conduct further research on the impact of paternal age on birth outcomes and public health. Thus, the aim of this study, conducted in our region, is to examine the influence of paternal age on the course and outcome of pregnancy and the parameters of the newborn.

PARTICIPANTS AND METHODS

Subjects

The sample consisted of 406 pregnant women who gave birth at the Clinic for Gynecology and Obstetrics at the University Clinical Hospital (UCH) Mostar and their newborn babies. Data were collated from medical documentation, histories of illnesses and discharge letters at the Clinic for Gynecology and Obstetrics, and from the protocols, histories of illness and discharge letters of the newborn babies, transferred to the NICU and the Department of Neonatology at the Clinic for Children's Diseases, UCH Mostar. The research was conducted during the period from January 1 to February 28, 2021. All pregnant women who gave birth at our maternity clinic were included in the study, and information regarding the father's age was provided in the documentation. The pregnant women who did not provide information on the age of the newborn's father in their documentation were excluded from the study. The retrospective research did not require the approval of the ethics committee. The approval of the head of the clinic, where the data were collected, was obtained.

Methods

The study is a cross-sectional, epidemiological, retrospective study. The main parameter was paternal age, and participants were subsequently divided into three groups: the first group consisted of fathers between the ages of 20 and 29 (there were no fathers under the age of 20 included in this study), the second group comprised fathers between 30 and 39 years of age and the third group were fathers over the age of 40. All other parameters were analyzed in relation to this parameter. The parameters analyzed for the mothers were age, parity, spontaneous abortion, course of pregnancy, pathological conditions during

pregnancy and type of labor. The parameters analyzed for the newborn babies were anthropometric measurements (birth weight, birth length, head circumference), gestational age, gender, Apgar index and subsequent transfers to the Clinic for Children's Diseases. The parameters for the newborns that were transferred to the NICU or the Department of Neonatology were the pathological conditions for which the newborns were being treated, the manner and outcome of treatment, mechanical ventilation and duration of treatment. Hyperbilirubinemia is a condition defined as elevated serum or plasma bilirubin levels above the laboratory reference range (>100 μmol/L) and caused by metabolic disorders of bilirubin. Neonatal infection may be confirmed or suspected; it may be accompanied by clinical symptoms (e.g., vomiting or poor feeding, increased drowsiness or lethargy, fever or hypothermia, tachypnea, rashes, diarrhea, abdominal distention) and laboratory parameters (C-reactive protein >4 mg/dL).

Statistical analysis

The statistical analysis was calculated using IBM SPSS Statistics, Version 25.0. (Armonk, NY: IBM Corp.). The results were expressed as numbers and percentages. The Chi-squared test was used to test the significant difference between the parameters/characteristics relating to the age of the father, and Fisher's exact test was used when there was no expected frequency. The limits of statistical significance were set at $p<0.05$. P values that could not be expressed to three decimal places were expressed as $p<0.001$.

RESULTS

The study included 401 pregnant women who gave birth at the Clinic for Gynecology and Obstetrics at UCH Mostar and their partners, i.e., the fathers of the newborns, over a two-month period at the beginning of 2021. Five women gave birth to twins, amounting to a total of 406 newborn babies. The twins' fathers were between 30 and 39 years of age.

Table 1. The distribution of characteristics of the pregnant women in relation to the paternal age of the fathers of the newborn babies

	Age of father (years) n (%)			χ^2	p
	20-29 (N=63)	30-39 (N=275)	40+ (N=68)		
Age of mother				143.179 [a]	**<0.001**
-19	0	2 (0.7)	0		
20 - 29	54 (85.7)	73 (27.0)	3 (4.4)		
30 - 39	9 (14.3)	193 (71.5)	50 (73.5)		
40 +	0	2 (0.7)	15 (22.1)		
Parity				7.775	**0.021**
1	29 (46.0)	84 (31.1)	16 (23.5)		
2+	34 (54.0)	186 (68.9)	52 (76.5)		
Spontaneous abortion				7.789	**0.021**
No	54 (85.7)	204 (75.6)	44 (64.7)		
Yes	9 (14.3)	66 (24.4)	24 (35.3)		
Course of pregnancy				1.004	0.610
healthy	42 (66.7)	196 (72.6)	50 (73.5)		
pathological	21 (33.3)	74 (27.4)	18 (26.5)		
Childbirth				0.717	0.946
natural	32 (50.8)	138 (51.1)	33 (48.5)		
induced	17 (27.0)	63 (23.3)	18 (26.5)		
C-section	14 (22.2)	69 (25.6)	17 (25.0)		

[a]Fisher's exact test

The results in Table 1 illustrate that there is a significant difference in the parameters of the mothers with respect to parity and spontaneous abortion in relation to paternal age. The findings indicate that with older fathers, the parity was 2+, and spontaneous abortions were more frequent among women with older partners. Older fathers often had older partners, which is significant. The results in Table 2 do not show any significant difference between the newborns in relation to paternal age.

Table 2. The distribution of characteristics of newborns in relation to paternal age

	Age of father (years) n (%)			χ^2	p
	20-29 (N=63)	30-39 (N=275)	40+ (N=68)		
Gestational age (weeks + days)				0.893[a]	0.655
< 37	3 (4.8)	18 (6.5)	6 (8.8)		
>37	60 (95.2)	257 (93.5)	62 (91.2)		
Sex of newborn				1.740	0.419
male	30 (47.6)	147 (53.5)	31 (45.6)		
female	33 (52.4)	128 (46.5)	37 (54.4)		
Birth weight (g)				5.505[a]	0.422
<1499	1 (1.6)	2 (0.7)	2 (2.9)		
1500 - 2499	2 (3.2)	9 (3.3)	1 (1.5)		
2500 - 3999	59 (93.7)	249 (90.5)	60 (88.2)		
>4000 -	1 (1.6)	15 (5.5)	5 (7.4)		
Birth length (cm)				3.081[a]	0.542
< 51	10 (15.9)	39 (14.2)	13 (19.1)		
52 - 57	49 (77.8)	219 (79.6)	48 (70.6)		
>58	4 (6.3)	17 (6.2)	7 (10.3)		
Head circumference (cm)				1.623[a]	0.808
< 33.9	3 (4.8)	21 (7.6)	5 (7.4)		
34 – 36.9	45 (71.4)	202 (73.5)	52 (76.5)		
>37	15 (23.8)	52 (18.9)	11 (16.2)		
APGAR 1min				0.283[a]	1.000
0-4	0	0	0		
5-7	1 (1.6)	8 (2.9)	2 (2.9)		
8-10	62 (98.4)	267 (97.1)	66 (97.1)		
APGAR 5min				0.788[a]	0.823
0-4	0	0	0		
5-7	1 (1.6)	3 (1.1)	1 (1.5)		
8-10	62 (98.4)	272 (98.9)	67 (98.5)		
Transfer to neonatology				1.197	0.550
No	40 (63.5)	194 (70.5)	47 (69.1)		
Yes	23 (36.5)	81 (29.5)	21 (30.9)		

[a]Fisher's exact test

Perinatal infection was experienced more often by the newborn babies of fathers younger than 30 years of age. No statistically significant difference was found between paternal age and other analyzed characteristics (Table 3).

DISCUSSION

The average paternal age has increased in countries all around the world. Besides the implications for demographics and public health factors, the direct impact of aging fathers on the health of the fetus and the pregnancy outcome has been studied in detail (1). As men age, their sperm quality is poorer. Besides postponing conception, the effects of aging fathers on the health of their offspring can be significant (5). Our study shows that older partners had older wives, who gave birth to their second child at a more advanced age, which is statistically significant.

Table 3. Course, method and outcome of treatment of newborns, transferred to the Department of Neonatology in relation to paternal age.

	Age of father (years) n (%)			χ^2	p
	20-29 (N=23)	30-39 (N=81)	40+ (N=21)		
Duration of treatment (days)				1.001[a]	0.655
< 7	22 (95.7)	72 (88.9)	20 (95.2)		
7 >	1 (4.3)	9 (11.1)	1 (4.8)		
Referral diagnosis					
Jaundice	8 (12.7)	25 (9.1)	8 (11.8)	0.985	0.611
Perinatal infection	3 (4.8)	2 (0.7)	1 (1.5)	4.260[a]	**0.041**
Preterm infants	4 (6.3)	15 (5.5)	5 (7.4)	0.637[a]	0.769
Other	11 (17.5)	50 (18.2)	14 (20.6)	0.260	0.878
Method of treatment					
Antibiotics	7 (11.1)	15 (5.5)	5 (7.4)	2.861[a]	0.235
Phototherapy	9 (14.3)	27 (9.8)	7 (10.3)	1.088	0.580
Other	1 (1.6)	5 (1.8)	1 (1.5)	0.197[a]	1.000
Mechanical ventilation				0.593[a]	0.803
Yes	3 (13.0)	15 (18.5)	5 (23.8)		
No	20 (87.0)	66 (81.5)	16 (76.2)		
Treatment outcome				1.614[a]	0.402
Recovery	22 (95.7)	78 (96.3)	19 (90.5)		
Lethal	1 (4.3)	3 (3.7)	2 (9.5)		

[a]Fisher's exact test

This contradicts claims of a rising trend of older fathers, who father their first child at a more advanced age. Fathers with university degrees may have postponed starting a family because of their or their partner's career objectives (11). However, this correlation cannot be confirmed in a satisfactory way by our study and remains exclusively speculative, as these factors were not analyzed. According to studies conducted in America, pregnant women with older partners are 28% more likely to develop gestational diabetes (5), which was not shown in our research. Paternal age may increase the odds of spontaneous abortion, independent of selected factors such as demographics, pregnancy intention and maternal age (13), which is also similar to our results. However, we have no data on the age of the fathers when their partners had an abortion, neither can we conclude that the abortions were spontaneous or intentional. The impact of younger fathers on the fetal-labor outcome has been less researched. Our study indicated no direct correlation between the risk of a poor perinatal outcome and a younger paternal age. However, over the past several years, studies have indicated a rising trend of caesarean section incidence (14), and the younger age of a partner has had a protective effect on the occurrence of the same (9), which was not supported by our study. In addition, the influence of any of the paternal age groups on the Apgar index score of the newborn baby was not confirmed in our research, even though studies exist which have found a connection between the two, that is, that older fathers have some impact on lower Apgar index scores (12). In contrast, a younger father may also increase the risk of premature labor, a lower vitality score and a poor perinatal outcome (12, 15), none of which were confirmed by our study. However, our study showed that the newborns of fathers around the age of 30 have the lowest risk of a poor perinatal outcome, which is similar to research conducted in America (8). Paternal age did not significantly affect the frequency of newborn jaundice in any of the groups, which is in accordance with Zhan et al., who also failed to establish a connection between paternal age and the incidence of newborn jaundice (16).

With respect to the effect of paternal age on the anthropomorphic measurements of newborns, this study found that newborn babies with fathers from older age groups deviate from the norm with respect to birth length, however, no other studies exist to date that can confirm these findings. Consequently, further research on these conclusions would be desirable. The future direction of research should include a more encompassing approach, including the physical, social and biological effects of a father (1). The limitations of the study are the short research period, the lack of data relating to the father's age at the time of the partner's abortion and information on the type of abortion.

CONCLUSION

The study showed that maternal age increased in accordance with paternal age, and with it, the possibility of complications in the mother's pregnancy and also in the perinatal outcome of the newborn baby. Although our study did not indicate that a single age range significantly contributed to individual complications, a poorer perinatal outcome was observed in older fathers, which impacted health system costs. This should prompt further research, particularly due to the ever-greater challenges facing older parents and the potential implications for their offspring. Although the results are conservative, as they are limited by the size of the sample and the lack of socio-demographic parameters, there is still irrefutable proof that both maternal and paternal factors have an impact on the lack of reproductive success.

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CONFLICT OF INTEREST
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AUTHORS' CONTRIBUTIONS

MJR: contribution to study conception and design, literature review, supervision, writing of the paper, interpretation of data, critical revision of the paper; AP: acquisition of data, contribution to study conception and design, literature review, critical revision of the paper, assistance in writing the paper; SR: acquisition of data, contribution to study conception and design, literature review, assistance in writing the paper.

ETHICAL BACKGROUND

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee.

Informed consent statement: Informed consent was obtained from all subjects involved in the study.

Data availability statement: We deny any restrictions on the availability of data, materials and associated protocols. Derived data supporting the findings of this study are available from the corresponding author on request.

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